



Technical Assistance Consultant's Report

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Viet Nam: Preparing the Kunming – Haiphong Transport Corridor Project (Supplementary – GMS Hanoi – Lao Cai Railway Upgrading) (Financed by the Japan Special Fund)

Prepared by

Wilbur Smith Associates in association with
Deutsche Eisenbahn-Consulting GmbH and Vietnam Transport Engineering Consultancy Center

For the Viet Nam Railways

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Asian Development Bank

TA No. 4050-VIE

**KUNMING – HAIPHONG TRANSPORT CORRIDOR PROJECT
UPGRADING HANOI – LAO CAI RAILWAY**

Feasibility Study and Preliminary Design

MAIN REPORT (FINAL)

August 2006

(Revised June 2007)

CURRENCY EQUIVALENTS

(21 August 2006)

Currency Unit	–	Vietnamese Dong (VND)
VND 1.00	=	\$ 0.00006245
\$1.00	=	VND 16,013
VND 1.00	=	€ 0.00004829
€1.00	=	VND 20,704
€1,00	=	\$ 1.293
\$1.00	=	€ 0.773

ABBREVIATIONS

ADB	-	Asian Development Bank
AFD	-	Agence Française de Développement
AP	-	Affected People
BCR	-	Benefit cost ratio
CAD	-	Computed Aided Design
CARB	-	Compensation and Resettlement Board
CPC	-	Commune People's Committee
CPI	-	Consumer Price Index
DFR	-	Draft Final Report
DGTPE	-	Direction Générale du Trésor et de la Politique Economique
DMC	-	Developing Country Member (of ADB)
DPC	-	District People's Committee
EA	-	Executing Agency
EIRR	-	Economic internal rate of return
EMSA	-	Ethnic Minority Special Actions
EPMD	-	Environmental Protection and Management Division
FIRR	-	Financial Internal Rate of Return
FYRR	-	First Year Rate of Return
GDP	-	Gross Domestic Product
GOV	-	Government of Vietnam
GSO	-	General Statistical Office
GTZ	-	Gesellschaft für Technische Zusammenarbeit
IBRD	-	International Bank for Reconstruction and Development (World Bank)
ICB	-	International competitive bidding
IEE	-	Initial Environmental Examination
IoL	-	Inventory of Loss
IP	-	Indigenous People
IPDP	-	Indigenous Peoples' Development Plan
IMO	-	Independent Monitoring Organization
IPSA	-	Initial Poverty and Social Analysis
IRR	-	Internal rate of return
ISA	-	Initial Social Assessment
LURC	-	Land Use Rights Certificate
MOF	-	Ministry of Finance
MONRE	-	Ministry of Natural Resources and Environment
MOT	-	Ministry of Transport
MPI	-	Ministry of Planning and Investment
NGO	-	Non Government Organization
NPV	-	Net present value
OCR	-	Ordinary Capital Resources (of ADB)
O-D	-	Origin Destination

ABBREVIATIONS

ODA	-	Official Development Assistance
OSPF	-	Office of the Special Project Facilitator
PIB	-	Project Information Booklet
PPTA	-	Project Preparatory Technical Assistance
PRC	-	People's Republic of China
PSA	-	Participatory Social Appraisal
RALC	-	(Department of) Resettlement and Land Clearance
RoW	-	Right of way
RP	-	Resettlement Plan
RPI	-	Retail Price Index
RPUC	-	Railway Public Utility Company
RPMU	-	Railway Projects Management Unit
RRP	-	Report and Recommendation of the President (to ADB Board of Directors)
RRP	-	Report and Recommendation of the President (to ADB Board of Directors)
SAP	-	Severely Affected People
SES	-	Socio-Economic Survey
SIEE	-	Summary Initial Environmental Examination
TA	-	Technical Assistance
VNR	-	Vietnam Railways
VOC	-	Vehicle operating costs
vpd	-	Vehicles per day
VRA	-	Vietnam Roads Authority

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A	Technical Survey and Prioritization of Interventions
A.1	Operations
A.2	Infrastructure
A.3	Rolling Stock
A.5	Topographical Survey
A.6	Geological Survey
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Executive Summary

Introduction

The Hanoi – Lao Cai railway is part of the Kunming to Haiphong transport corridor, which plays an important role in international and regional trade. An expressway standard road is to be built along the corridor. Very high rail traffic is anticipated, with freight volumes approximately trebling and passenger volumes nearly doubling. The objective of this Study was to determine the investments necessary to enable the railway to carry the expected increase in traffic to 2020, when it is expected that a new standard gauge railway, running on the other side of the Red River, will be built.

The Study encompassed civil engineering, operational and rolling stock studies, as well as environmental, socio-economic and resettlement components, together with economic and financial appraisal. Interventions to increase capacity and ensure the future operation of the line were examined and subjected to economic and financial analysis (as described below).

Technical Surveys and Interventions

Surveys

Detailed topographical and geological surveys have been carried out at the locations where major construction activities were proposed, notably on sections proposed for realignment, at bridge sites and locations with slope protection and drainage problems. A bridge condition survey was carried out. In addition, full use was made of all information on track and structures available from Vietnam Railways (VNR).

Infrastructure

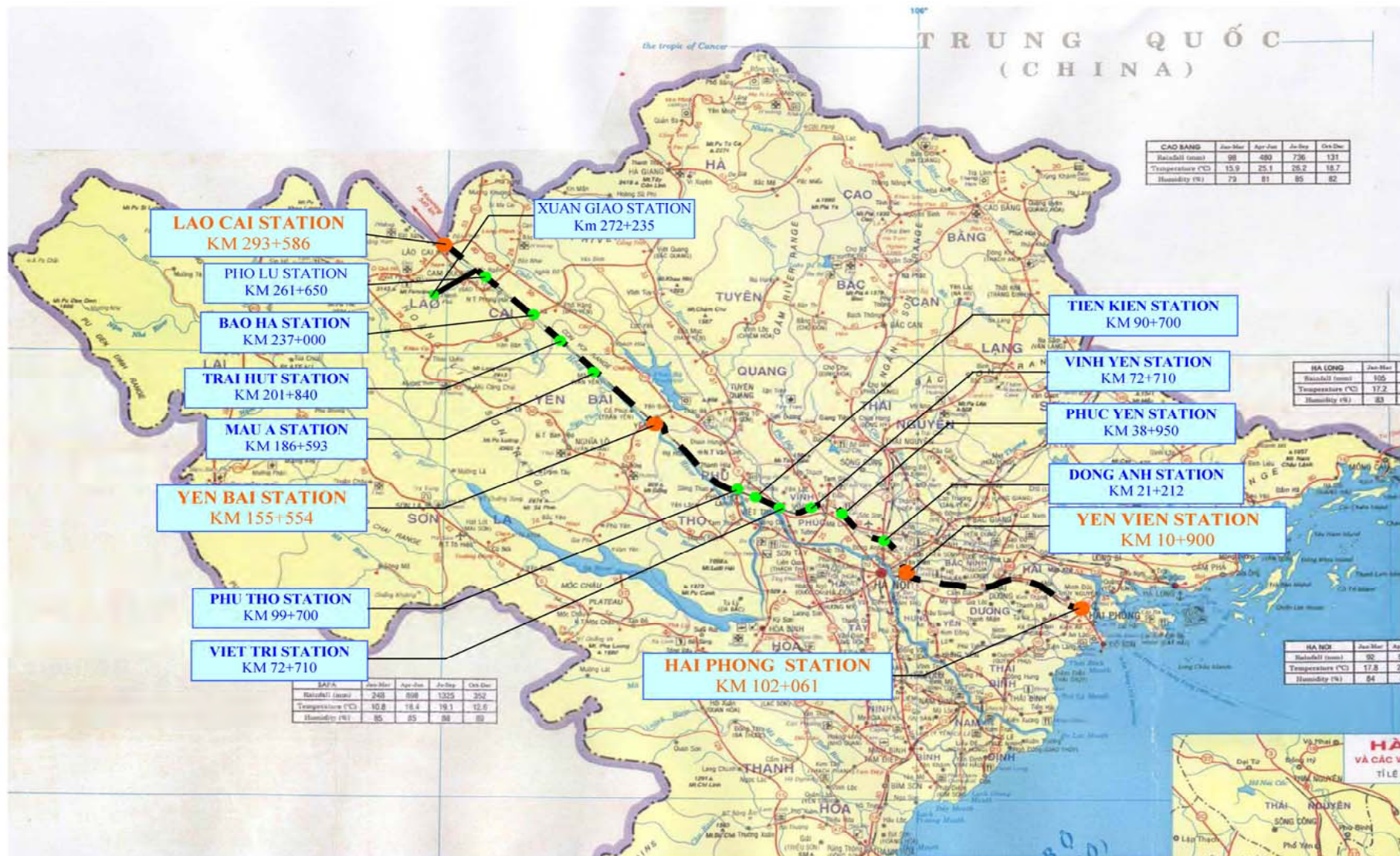
The line under study runs from Yen Vien, just outside Hanoi, to Lao Cai on the border with China, a distance of 283 km. The line is single track, non-electrified, and metre gauge (although there is a short section of dual gauge track near Hanoi). Signalling is about to be modernized, with Chinese assistance, to provide colour light signals, with central traffic control.

The track is generally in poor condition. Most of the rail is now badly worn and out of standard, a large proportion of the sleepers are cracked, and much of the ballast is seriously deteriorated. Many bridges are in need of rehabilitation due to war damage, corrosion or fatigue. Some short sections of line are prone to landslips, which block the line, and in some places, the line runs close to the Red River, which is eroding the embankments.

Operating speeds are limited, in some places by track and bridge limitations, but also due to the large numbers of tight curves.

There are relatively few deaths from accidents (less than 8 per year). However, the track is unfenced through long sections in urban areas, there are large numbers of unofficial crossings and many official crossings remain unprotected. There is continuing and serious potential danger to workers, pedestrians and road users if appropriate safety measures are not implemented.

Figure 1.1 : Haiphong to Lao Cai Railway



Operations

The operational analysis has shown clearly that the forecast traffic cannot be accommodated on the existing line, even with the signal upgrading.

Preliminary Design, Project Costs and Packaging

After an examination of the problems the railway would have to overcome to carry the forecast traffic, a range of improvement proposals were examined. A combination of measures will be required to provide the additional capacity. These include :

- bridges repairs to remove restrictions on train weight and speeds;
- additional passing loops and extension of existing passing loops to permit trains of 400 metre length to operate;
- realignment of some tight curves to permit higher operating speeds and the use of 6-axle locomotives; and
- the introduction of more powerful locomotives to permit longer and heavier trains to be run.

In addition, a substantial programme of rehabilitation works will be required to ensure that the railway remains capable of carrying the traffic offered. The rehabilitation works include renewal of over 200 km of track, major slope protections works along nearly 6.7 km of line, 8.6 km of drainage improvements, approximately 1 kilometre of culvert repair and the rehabilitation of 73 bridges. Table 1.1 summarizes the project scope. Estimated costs for the works are shown in section 6.9

Bridges

Standard solutions have been prepared for the bridges to be rehabilitated, and outline designs prepared for the 6 new bridges required as part of the realignment works.

Stations

Additional tracks are required at 8 stations, passing loops need to be extended to 450 m at a further 8 stations. Lao Cai station requires a major extension. In addition a new station is needed at Mai Tung. Preliminary layout drawings have been prepared.

Realignment

Two sections of realignment have been proposed, with approximately 6 km near Lao Cai and a further 3 km near Co Phuc. The section near Lao Cai will remove all curves with a radius of less than 150m and will move the track away from the banks of the Red River, where the embankment was in danger of erosion, while the realignment near Co Phuc will avoid a section prone to flooding.

Track Renewal

Track renewal will involve replacing existing worn P38 and P43 rail with heavier P50¹ rail, and replacement of cracked sleepers and deteriorated ballast. Where new rail is to be laid, new continuous sleepers will be used to replace the existing two block sleepers, to reduce ballast wear.

¹ 50 kg per metre

Table 1.1 : Summary of Recommended Project Scope of Work

Type of Work	Rationale	Location		Volume of Work			
		Km		Length (km)	Cut (cu.m)	Fill (cu.m)	Land Take (sq m)
Realignment		From	To				
Realignment (1)	Avoidance of flooded area	169.909	173.809	2.973	24,981	40,394	43,605
Realignment (2)	Removal of curves of < 150 m radius & moving line away from river	283.550	292.317	6.073	142,253	97,659	41,053
Totals				9.046	167,234	138,053	84,658
Embankments	Protection of track from subsidence; prevention of closures due to soil & rock falls on line	Various		Length (m)			
Shoulder Protection (SH 01)	Ensures acceptable embankment width			1,200			
Lower Slope Protection (SH 02)	Protects lower slopes against river action			2,300			
Upper Slope Protection (SH 03)	Protects upper slopes against slippage			600			
Additional slope protection requested by VNR & RPUC	Prevention of embankment slippage			2,590			
Surface Drainage (DR 01)	Prevention of soil saturation			6,620			
Embankment Drainage (DR 02)	Prevention of soil saturation			1,500			
Slope Drainage (DR 03)	Slope stabilisation and prevention of soil saturation			500			
Bridges	Replacement of war damaged and weak bridges	Various		No	Total Length (m)		
					Bridges	Girders	
Girder replacement & minor work on substructure				73	1,780	999	
Replacement bridges				6	145	102	
Totals				79	1,925	1,101	
Stations	Increase in line capacity	Km		Loops		Extn	Land (sq m)
				No	(m)	(m)	
New station at Mai Tung		124.2		2			29,641
Additional passing loops at 9 stations		Various		19			28,337
Extension of passing loops at 8 stations		Various		13		1,196	4,408
Totals				34		1,196	62,385

Safety Measures		Km		No	Length (m)		
Overpass at Dong Anh	Reductions in traffic conflict & congestion	21.8			307		2,791
Barriers & gatekeepers at unmanned Railway crossings	Currently unprotected; high crossing traffic volumes			18			
Engineering upgrade at unsafe rail crossings	Crossings currently in poor condition which can obstruct safe passage by road users and pedestrians			13			
Fencing & collector crossings	Reduce the number of unauthorised railway crossings				5,565		
Track Renewal				Units	Length (m)		
New rail (50 kg/m)	Replacement of badly worn rails				415,350		
Ballast	Replacement of crushed ballast				177,234		
Sleepers	Replacement of cracked sleepers; new with new rail			344,202			
Turnouts on the Mainline (P50)	Replacement of badly worn turnouts on mainline			132			
Turnouts off the Mainline (P43)	Replacement of badly worn turnouts at stations, passing loops, sidings etc			123			

Note : A summary of the estimated costs are provided in Tables 6.5 and 6.6. Further details concerning the cost estimate and recommended Scope of Works are provided separately in Technical Appendix A2 - Infrastructure

Construction Methods

Construction, particularly for the realignment work, will require careful planning, if interruptions to services are to be avoided, as road access is very poor and materials will have to be transported to site by rail. In particular close liaison will be required between the Contractor's staff and Vietnam Railways.

Bridge rehabilitation works will involve maximising off-site assembly, as space on-site will be limited.

Costs

The total financial cost of the project is approximately US\$ 140.2 million, including allowances for the difficulty of work, resettlement costs, environmental mitigation, applicable taxes, RPMU project management fees and estimated design and supervision costs. The estimated costs, and to some extent scope of work, have been modified in accordance with numerous comments received concerning the Draft Final Report submission.

Packaging

It is suggested that all the civil works on any given section of line should form part of a single contract. It is further suggested that the works be split into 3 packages of civil works of between US\$ 27 million to US\$ 33 million, with a separate package of approximately US\$ 36 million for rails and fittings. It is anticipated that the rails and mainline switches will be sourced from France using DGTPE financing.

Economic and Financial Evaluation*Economics*

The results of the cost-benefit analysis are shown in Table 1.2. Evaluation of the project gives a positive NPV, and an overall IRR of 13.9%.

Table 1.2 : Cost-Benefit Analysis

Cost and Benefits for:	NPV (US\$ mn)	IRR (%)
Overall Project vs Base (Capacity Increase & Rehabilitation)	26.0	13.9

Table 1.3 shows the NPV and IRR for the project. As can be seen, the IRR is 13.4%, and therefore above the test rate of 12%.

Table 1.3 : Project Evaluation

NPV	IRR
(US\$ million)	(%)
21.0	13.4

The main benefits from the safety component arise from the reductions in traffic congestion by the construction of a flyover at heavily trafficked crossings. The cost of rehabilitation at the overpass site at Dong Anh is so high that the flyover is not economically justified. Design improvements to reduce the amount of resettlement could be expected to change this conclusion. It is clear that road congestion at the crossings will grow very rapidly, and the railway will face increasing problems of security

and safety, if the overpasses are not built. The Consultant therefore recommends that implementation of the flyover proceeds in order to avoid this intersection becoming dangerously congested in the near future.

Financial Analysis and Evaluation

VNR's income statements indicate that the Railway, even with subsidies from Government funds for tariffs and infrastructure upkeep, is only barely able to cover its costs. There are therefore no funds generated for modernisation or renewal of capital. This situation is likely to continue for some time, so that it will take a number of years until VNR is likely to be in a position to compete in a commercially oriented market on equal terms with private companies.

The accounting system requires systematic review and revision, as it does not provide the railway management with the data that is needed to operate in a modern commercial environment. In particular, operating cost data cannot readily be extracted. If these deficiencies are not remedied, the implementation of the new railway law, which proposes the separation of traffic and infrastructure, will prove very difficult. Substantial technical assistance will be required to modernize the accounting procedures.

Environment

The proposed rail improvements present minor environmental problems, but these can be overcome by appropriate mitigation measures. The main problem areas are noise and air pollution, both during construction and operations, the disposal of solid and liquid wastes, and the potential for soil erosion during and after construction.

Resettlement

Inventory of Loss and Socio-Economic Surveys have been carried out at all stations, along the realignment sections and at the proposed flyover site. Total land requirements are modest, at just over 22 hectares. A total of 593 households, comprising 2,378 people, will be affected. Of these, 302 households will be required to relocate. Most of the relocation is required to accommodate the expansion of Lao Cai station, where 122 households will be relocated from the station area and a further 180 households in the relocation area will be relocated (or severely affected) as a result. A Resettlement Plan has been prepared.

Socio-Economic

The population in the project area is significantly poorer than average, particularly in the areas nearer to the border with China, where there are substantial numbers of ethnic minorities. There is a small potential for the spread of HIV through the introduction of workers from outside the area during construction. The Government of Vietnam's HIV/AIDS programs are considered adequate, but will need some local publicity to increase awareness of the risks. There is also a possibility that the railway will facilitate human trafficking, and publicity will be required to ensure that the populace is made aware of the problems.

1 INTRODUCTION

1.1 BACKGROUND

The Hanoi – Lao Cai railway is part of the Kunming to Haiphong transport corridor, which is important for China's transit trade, for international trade between China and Vietnam and for Vietnamese domestic traffic. Investment requirements in the corridor were examined in an earlier phase of this ADB-TA, which examined improvements to both road and rail links. It is now expected that an expressway standard road will be built along the corridor, and this study is designed to examine the needs for improvements to the railway.

The section of the existing railway line considered in this study is single track and not electrified. It runs from Yen Vien, near Hanoi, to Lao Cai on the Chinese border, a distance of 285 km. The southern end of the line runs through flat, rice land areas, but as it approaches the northeastern provinces, the terrain becomes more mountainous. There are large numbers of very tight curves, and many of the bridges require rehabilitation, both of which reduce operating speeds. The railway has also suffered from lack of finance for long-term maintenance and many bridges are in need of rehabilitation and major repair. In addition sections of track are in urgent need of renewal.

Traffic volumes are highest close to Hanoi. Freight traffic ranges from 2.1 million tonnes p.a. between Hanoi and Viet Tri, to just under 1.0 million tonnes between Yen Bai and Lao Cai. Passenger traffic ranges from 1.4 million p.a. between Hanoi and Viet Tri to 0.9 million between Yen Bai and Lao Cai. The timetable makes provision for 38 trains per day, which is close to the capacity of the line.

Substantial increases in traffic have been forecast, with freight volumes expected to increase by a factor of 2.8 to 3.6 by 2020, with the greatest increases being closest to Hanoi. Passenger growth will be more restrained, mainly as a consequence of road competition, but increases of approximately 60% are still expected by 2020.

It is clear that substantial expenditures will be required to meet the traffic demands and to carry out the delayed major maintenance necessary to ensure that the railway continues to operate effectively. The Asian Development Bank (ADB), the Agence Française de Développement (AFD) and the Direction Générale du Trésor et de la Politique Economique (DGTPE) have all expressed their interest in financing the investment programme proposed in this study.

1.2 STUDY OBJECTIVES

The objective of this study is to establish the feasibility of increasing the capacity of the railway line to accommodate the expected growth in traffic, until 2020, when it is expected that a new standard gauge railway line, running on the other side of the Red River, will be built.

The study has examined a range of civil engineering interventions to increase the capacity of the line (through station expansion and realignments), to ensure its continuing operations (through selected rehabilitation works), and to improve safety. The study also encompassed operational and rolling stock analyses, as well as social, environmental and resettlement studies and financial and economic evaluation.

1.3 REPORT STRUCTURE

This Final Report has been structured in accordance with the Terms of Reference (ToR). This volume, the Main Report, provides an overview of all the work carried out. More detailed information has been provided in the Technical Appendices.

The following topics are covered in the Main Report:

Technical Surveys and Interventions

Chapter 2 describes the technical surveys and analyses that were carried out to determine what civil engineering measures would be required. It describes the procedures followed for the topographical, geological and bridge condition surveys and outlines the major engineering and operational problems facing the line.

The survey results are presented separately. Details of the operational analysis are given in Technical Appendix A.1: *Operations*. Further information on the bridge surveys and slope protection work can be found in Technical Appendix A2 : *Infrastructure*.

Environment

An initial environmental examination has been carried out, to establish whether the investment proposals will create any significant environmental problems and what mitigation measures would be required. Chapter 3 provides an overview of the environmental issues, whilst further details can be found in Technical Appendix B.

Resettlement

Extensive surveys have been carried out in all the areas where the project works being examined might require the loss of property, houses or crops. Chapter 4 provides an overview of the findings of the surveys. A detailed Resettlement Plan has also been prepared and can be found in Technical Appendix C.

Socio-Economic Survey

A socio-economic survey has been carried out, using mainly secondary sources, which were supplemented with a small programme of interviews in the project area. This work is reported in Chapter 5, with supplementary data given in Technical Appendix D. The findings in this chapter should be read in conjunction with the resettlement survey results, which include a much more detailed socio-economic survey of those likely to be affected by the project.

Preliminary Design

Chapter 6 describes briefly the nature of the proposed civil engineering works and sets out the costs of the project by component. Further details on design principles are given in Technical Appendix A.2: *Infrastructure* and the preliminary design drawings can be found in Technical Appendix E.1.

Economic Evaluation

The main benefits of the proposed improvements are the savings in transport costs which can be realized because the capacity increases and the rehabilitation enable more traffic to be carried by rail, rather than road. For the purposes of analysis, the project is divided into three components: capacity increases (station expansion and realignment), rehabilitation (bridges, track and slope protection works) and safety (provision of barriers and overpasses). Economic evaluation is carried out on the

overall project and on each component individually. Chapter 7 sets out the economic analysis. The estimation of operating costs (road and rail) is given, together with some detailed tables from the evaluation, in Technical Appendix F.1: Economics.

Financial Analysis

Chapter 8 sets out the analysis of VNR's overall financial position and assesses the company's ability to service any loan that may be taken to implement this project.

Project Packaging

Finally, Chapter 9 sets out the Consultant's proposals for packaging the project. In doing this, due account has been taken of the need to ensure that the works are of a manageable size, while remaining large enough to attract the interest of international contractors. The proposals also take explicit account of the requirements of the various funding partners.

2 TECHNICAL SURVEYS AND INTERVENTIONS

2.1 INTRODUCTION

This section of the Main Report summarizes the technical aspects of the Hanoi-Lao Cai portion of the rail study, and covers both railway operations analysis and civil engineering aspects. The Consultant's key findings and recommendations are detailed. The method which has been adopted in order to prioritize the proposed solutions is explained. Safety recommendations are detailed and a recommended approach to contract packaging is outlined. A summary cost estimate is also provided

Further technical details are provided separately in Technical Appendices A.1: Operations, and A.2: Infrastructure. In addition the preliminary design drawings are provided separately in Technical Appendix E1. These preliminary designs will be developed into detailed drawings by the consultant appointed to carry out the next phase of the project.

The Hanoi–Lao Cao railway connects Vietnam's mountainous border provinces in the West with the midlands and Red River plains towards Hanoi. This railway forms part of an important East-West transport corridor. The existing track alignment is characterised by:

- Tight curves, many without adequate cant or transition curves;
- Sections of steep gradients;
- Poor quality track, in particular:
 - lack of ballast;
 - old and worn rail (typically 38 or 43 kg per meter);
 - insufficient capacity at main stations; and
 - passing loops that are too short to accommodate full length trains.

The current poor condition of the track in certain areas is both reducing speeds and increasing the risk of derailments. Sections of embankment have been subject to landslides and require stabilization works. The poor condition of the bridges and the large numbers of tight turns reduce operating speeds and the lack of passing loops limits capacity.

VNR are already constructing a new station at Cau Nho, and a new signaling system will be installed with Chinese assistance. In order to further improve the technical condition of the existing line and increase capacity, the following engineering interventions have been examined as part of this study:

- Construction of one new station at Mai Tung;
- Extension of existing passing loops;
- Provision of new passing loops and sidings;
- Bridge rehabilitation;
- Selective improvement to horizontal and vertical alignment;
- Stabilisation of slopes and embankments;
- Improvements to track including turnouts;, and
- Improvement of selected at-grade crossings.

2.2 OPERATIONAL ANALYSIS

2.2.1 Current Traffic and Timetable

Timetable

The current timetable allows for 12 passenger and between 11 and 23 freight trains daily, with the heaviest freight loadings (19 to 20 trains daily) being between Yen Vien and Pho Lo (km 262). Most of the freight trains are on regular scheduled services and run daily. There is one through container train every second day. The main freight load is the carriage of minerals between Xuan Giao and Lam Thao and fertilizers from Lam Thao to Hanoi and points further south.

There are four through passenger trains daily in each direction, with a further two trains between Yen Vien and Bac Hong (km 27) to Yen Bai (km 156) and one between Yen Bai and Lao Cai. The passenger trains run mainly at night.

Traffic

The line currently carries about 2.6 million tonnes of freight and nearly 3 million passenger journeys per year. The most heavily trafficked section is between Viet Tri and Yen Bai, which carries nearly 6,000 tonnes of freight per day. Freight traffic at the northern end of the line is significantly lower, at approximately 2,700 tonnes per day. The traffic is heavily imbalanced, with more than three times as much moving towards Hanoi as moves northwards.

Cross-border rail freight volumes have been growing rapidly, from around 200,000 tonnes in 2001 to approximately 700,000 tonnes p.a. in 2003 / 04. Substantial volumes of Chinese export trade also cross the border by road and are trans-shipped to rail at Lao Cai. Rail wagons are handled reasonably expeditiously, with a reported delay of only 12 hours for customs formality and 6 hours for marshalling. However, a substantial proportion of the Chinese export traffic crosses the border by road and is transhipped to rail at Lao Cai, and the average delay for all border crossing traffic is reported to be two days.

Cross-border passenger volumes are still small, reported as 4,000 in 2001. Passenger trains do not cross the border.

The traffic forecasts used in this study are based on a Multimodal Traffic Study² carried out by COWI for ADB. A fuller description is given in Chapter 7 of this Main Report.

2.2.2 Factors Affecting Capacity

There is significant variation in the distance between stations, ranging from 3.4 km between Co Loa and Dong Anh stations, to 14.2 km between Pho Lu and Thai Van. As is well known, it is the length of the longest section that effectively determines the capacity of the line. In addition, the inadequacy of the signaling system between Thach Loi and Lao Cai impedes train operations and safety.

² *Kunming – Haiphong Corridor – Multimodal Transport Demand*, 2005. The passenger volumes for the Yen Bai - Lao Cai section have been adjusted upwards, on the basis of more recent information about current traffic volumes.

The number of passing loops in stations, particularly at Lao Cai and Yen Bai is insufficient to meet the demands of current train operations. Moreover, although the overall limit on train length is 400 m (and 1200 tonnes), the length of the passing loops in eight of the stations is less than 400m, which reduces the length of trains that can be operated.

The condition of bridges and culverts also limits line capacity. Firstly, speed restrictions have been applied and secondly, the more powerful (and heavier) locomotives are not allowed, for safety reasons, to use this infrastructure.

Turnouts (switches) are all manually operated. Further, missing locks mean that the approach speed, particularly when changing tracks, has to be restricted.

As noted above, the tight curves, limit operating speeds, and the large number of uncontrolled crossings pose safety problems, as well as limiting speeds.

2.2.3 Future Train Requirements

Taking due account of traffic composition and the possibility of minor changes to train composition, the number of trains that will need to be accommodated, under current operating practice, in 2020, is 52 close to Hanoi (Yen Vien to Bac Hong) and at the northern end of the line (Pho Lu to Lao Cai). The central sections will need to accommodate 72 to 74 trains per day, with the exception of a short section near Viet Tri, where the load reaches 82 per day. (For more details, see Technical Appendix A1: *Operations*)

It is clear that the line lacks the capacity to carry the forecast volumes of traffic, even when account is taken of committed expenditures on the new station and signaling improvements. Accordingly, the following options (arranged in order of increasing capacity) were evaluated using a computer rail operations simulation model, with the objective of reducing section times, removing current and potential bottlenecks, and facilitating the operation of longer, heavier trains:

Base Case

Current track layout, with a new station at Cau Nho, and the committed improvements to signaling

Option 1

- Replacement or rehabilitation of all bridges with speed restrictions
- Stabilization of embankments
- New station at Mai Tung (km 124), between Phu Tho and Yen Bai
- Upgrading and lengthening of passing loops at 8 stations, to permit operation of trains of 400m length

Option 2

Option 1 plus:

- Realignments near Co Phuc and near Lao Cai station
- Additional passing loops at 5 stations
- Rehabilitation of sections of permanent way (approx. 10 km)

Option 3

Option 2 plus:

- Use of more powerful locomotives, pulling longer and heavier trains (to reduce the number of trains to be run)

Option 4

Option 3 plus

- Double heading for some trains

Table 2.1 shows the anticipated numbers of trains and the capacity of the line under each option. As can be seen, the infrastructure only improvements of Options 1 and 2 do not provide adequate capacity, with the major shortfall being in the section Tien Kien to Cau Nho, where 72 trains are required and only 47 to 60 (depending on Option) can be accommodated. Moving to Option 3, which allows heavier and therefore fewer trains, ensures that all the traffic to be handled, though the section between Lao Cai and Tien Kien has no spare capacity.

Option 4, which involves double-heading did not result in any increase in line capacity and reductions in running time are very small.

Table 2.1: Line Capacity by Option and Section (trains per day)

	Yen Vien - Bac Hong	Bac Hong - Viet Tri	Viet Tri - Tien Kien	Tien Kien - Yen Bai	Yien Bai - Pho Lu	Pho Lu - Lao Cai
Section length (km)	15.9	45.9	18.0	64.9	106.1	31.9
	Line Capacity by Section					
Base	71	71	66	47	47	42
Option 1	73	73	73	53	56	47
2	74	74	71	60	60	48
3	74	74	71	66	66	48
	Train Requirements (Passenger & Freight)					
Current operations	52	74	82	72	72	52
Heavier trains	42	58	62	66	66	48

Notes:

1. Table shows all trains, passenger and freight
2. Table assumes no loss of capacity due to deterioration or failure of infrastructure

2.2.4 Stations

Thirty six (36) stations are located along the Hanoi to Lao Cai rail route. These include:

- 33 existing stations
- Cau Nho station is currently under construction by Vietnam Railways,
- Xuan Giao station is located at the end of the branch line from Pho Lu. This rail branch is used to carry apatite from the mines to the fertilizer factor at Tien Kien.
- The new station at Mai Tung forms part of the Consultant's recommendations for the current feasibility study.

The results of the operational analysis confirmed the need for additional station capacity. As noted above, a key finding was that the stations and passing loops need to be upgraded to enable the operation of train loads of up to 1,200 tonnes and train lengths up to 400 m. Accordingly the minimum length of the new passing loops is 450 metres.

The passing loops at the following nine stations have an effective length of less than 400 metres (Viet tri, Phu Duc, Co Phuc, Mau A, Lam Giang, Thai Van, Thai Nien, Yen Bai and Lao Cai). This results in the operational train length being limited which, in turn, reduces the traffic carrying capacity of the line. In addition a further nine stations along the existing alignment do not have adequate rail siding loops for efficient and future planned traffic operation. (Lao Cai, Yen Bai ,Thach Loi , Huong Canh, Tien Kien, Chi Chu, Vu En, Mau Dong and Lang Thip).

In particular, the operational analysis identified specific needs for major increases in capacity at Lao Cai, where 9 additional loops are to be provided, and at Yen Bai. Expansion at Yen Bai is not possible, as the station is in the middle of an urban area, so the additional capacity will be provided at Van Phu, immediately to the south of Yen Bai. The additional capacity will also serve the needs of a new industrial area to be built alongside the station. (For details, see Technical Appendix A.1)

In addition Vietnam Railways has requested that provision be included for station improvement works including storage facilities, extended platforms and marshalling yards at the following five stations (Dong Anh, Tien Kien, Doan Thuong, Pho Lu and Lao Cai). A budget item has therefore been included for these facilities. Details will be prepared by the Consultant appointed to prepare the Detailed Design drawings.

2.3 ROLLING STOCK

The rolling stock analysis was carried out in support of the operational analysis. Data was assembled on the characteristics of the locomotive, coaches and wagons. The maximum train load and length that could be safely hauled, given the gradients and other restrictions on the line, was then established for each of the Options considered in the operational analysis. Details are given in Technical Appendix A.3: *Rolling Stock*.

2.4 SURVEYS

In order to complete this Feasibility Study and prepare the engineering recommendations a number of surveys have been carried out during the course of the study. These surveys included

- Topographical
- Bridge condition surveys, and
- Geological/materials investigations.

Prior to finalizing the scope of each survey a considerable number of reconnaissance and site visits were carried out by the Consultant. In addition discussions were held with Vietnam Railways (VNR) and the Executing Agency (RPMU) in order to identify their major concerns regarding the existing track condition. Copies of the surveys have been provided to the Executing Agency in order that they can be used by the Consultant appointed to carry out the detailed design, which forms the next stage of this project.

Digital Maps

Digital maps have been obtained covering the whole line between Hanoi and Lao Cai. These documents have been used as a base for creation of working maps for engineering, environmental, social and resettlement studies.

Topographical Surveys

Topographical Surveys were carried out in areas where new or remedial works, such as slope stability, railway realignment or station passing loop were proposed. The topography work was carried out according to the Vietnamese survey standard No. 1105/QD-DS-KHCN.

The survey covered 81.9 kilometres of the mainline including an area 30m each side of the track centreline. The surveys recorded vertical and horizontal data. The results were linked to the network of national and railway benchmarks. A number of new benchmarks were also installed as part of the survey works. Table 2.2 summarises the extent of the topographical survey.

The results of the topography surveys were used by the Consultant in order to prepare more detailed designs and carry out further investigations in order to be able to prioritise the recommended technical interventions such as realignment works or station upgrading. The estimated quantities obtained from the digitized drawings were used in preparing the cost estimates.

Bridge Condition Surveys

Information concerning the condition of the existing bridges was obtained early during the course of this study from Vietnam Railways (VNR). This was supplemented by information obtained as a result of site visits to inspect bridges and sections of alignment concerned. The Bridge Condition Survey was targeted towards structures which were known to be in structural distress or where speed limits were currently in force. In total 65 existing structures were identified as being at risk and in need of surveying and further investigation.

Geological Survey

The Geological Survey works were carried out to assist the Consultant in preparing the preliminary design recommendations for the slope stabilization, bridge rehabilitation and realignment works. Boreholes were drilled at each kilometer along the 82 kilometres initially proposed for realignment works. The investigative boreholes were 7m deep. The length of boreholes was increased to 20 metres where slope stability works were being proposed. Laboratory tests were carried out on samples taken for the planned slope stability and bridge rehabilitation works.

Table 2.2: Summary of Survey Locations.

Topographical Surveys	
Stations	
Station	Location (km)
Thach Loi	33+170
Huong Canh	47+510
Viet Tri	72+710
Tien Kien	90+700
Phu Duc	81+770
Chi Chu	108+150
Vu En	118+170
Cổ Phúc	165+110
Mậu A	186+593
Mậu Đông	194+840
Lâm Giang	210+000
Lạng Thíp	227+803
Thái Văn	247+450
Xuân Giao	272+235
Thái Niên	277+840
Mai Tùng (New station)	124+200
Realignment Sections	
From (km)	To (km)
166+000	174+000
177+800	182+400
184+000	186+000
194+000	206+600
208+000	221+000
221+000	246+016
246+000	247+549
276+200	277+800
278+900	279+400
280+200	280+600
283+700	295+800
Geological	
Bridges	
Bridge	Location (km)
Từ Mậu	168+850
Mậu A	187+910
Vải	192+300
Phúc Ninh	214+810
Quỳnh Sum	286+570
Realignment Sections	
1 borehole at each of 82 kilometres of realignment works being investigated	
Slope Stabilization	
From (km)	To (km)
233+400	233+550
273+900	274+000
Bridge Condition	
65 bridges between km 52+510 (Bridge Đầm Vạc) to km 258+050 (Bridge Trì)	

2.5 PRIORITIZATION CRITERIA

As required in the Terms of Reference, a prioritized approach has been adopted by the Consultant when identifying engineering problems and proposing design solutions³. Three levels of priority were considered, as follows:

Priority 1

Priority 1 works are those which the Consultant recommends are carried out as a matter of urgency and without undue delay. Types of work which have been included within this highest priority are:

- Works which, if not carried out, may affect the safety of the train operations and passengers;
- at locations where serious damage has previously been recorded;
- at locations where periods of long interruption to rail operations have been encountered in the past;
- at locations where repeated events, such as failures, occur regularly; and
- at locations where frequent maintenance is required.

Priority 2

Priority 2 works are not urgently required and are not currently a threat to the safety or reliability of train operations. The works in this category are not recommended to be included within the Scope of the current upgrade project. However the Consultant believes that implementing these works at some stage in the future, perhaps within a five year timeframe, would be beneficial.

Priority 3

Priority 3 works are those which should be carried out by Vietnam Railways as part of their routine maintenance program.

2.6 REALIGNMENT

2.6.1 Introduction

The rail alignment between Haiphong and Lao Cai was opened in three phases at the start of the 1900's. The railway line was originally designed and constructed in accordance with the Technical Standards applicable at that time. This resulted in the original alignment only consisting of simple curves and straight sections without the need for transition curves. Generally the rail (24 kg/m) was mounted on steel sleepers. However in areas close to the sea, such as the Haiphong port area, wooden sleepers were adopted in an attempt to minimize possible corrosion problems caused by salt in the atmosphere.

After the war was over, in order to stimulate economic development of the North-western area, a branch line to the Apatite Mine at Pho Lu Station was developed simultaneously with a general upgrading and realignment of the railway. At this time the vertical profile was improved and extensions were provided to the station siding loops.

³ This was also confirmed during the ADB bank mission and subsequent meetings with RPMU.

However in recent years the condition of the railway has deteriorated. In addition maintenance, in some areas, has been inadequate. As part of this study the Consultant has investigated the existing alignment and prepared prioritized recommendations concerning the sections which should be upgraded in order to improve the safety and efficiency of the railway operations.

The operation and maintenance work on this section of railway is administered by four Rail Public Utility Companies (RPUC). The extent of each Management Unit is illustrated in Figure 2.1 overleaf.

2.6.2 Topography

There is considerable variation in the topography along the railway's alignment. The route varies from broad plains between Hanoi to Viet Tri, narrow valleys in the midlands in Vinh Phuc and Phu Tho provinces, denuded low mountains and hills near Yen Bai, typical loose masses, deeply incised slopes, eroded gullies and high mountainous uplands between Yen Bai and Lao Cai. The main sections of alignment are summarized below :

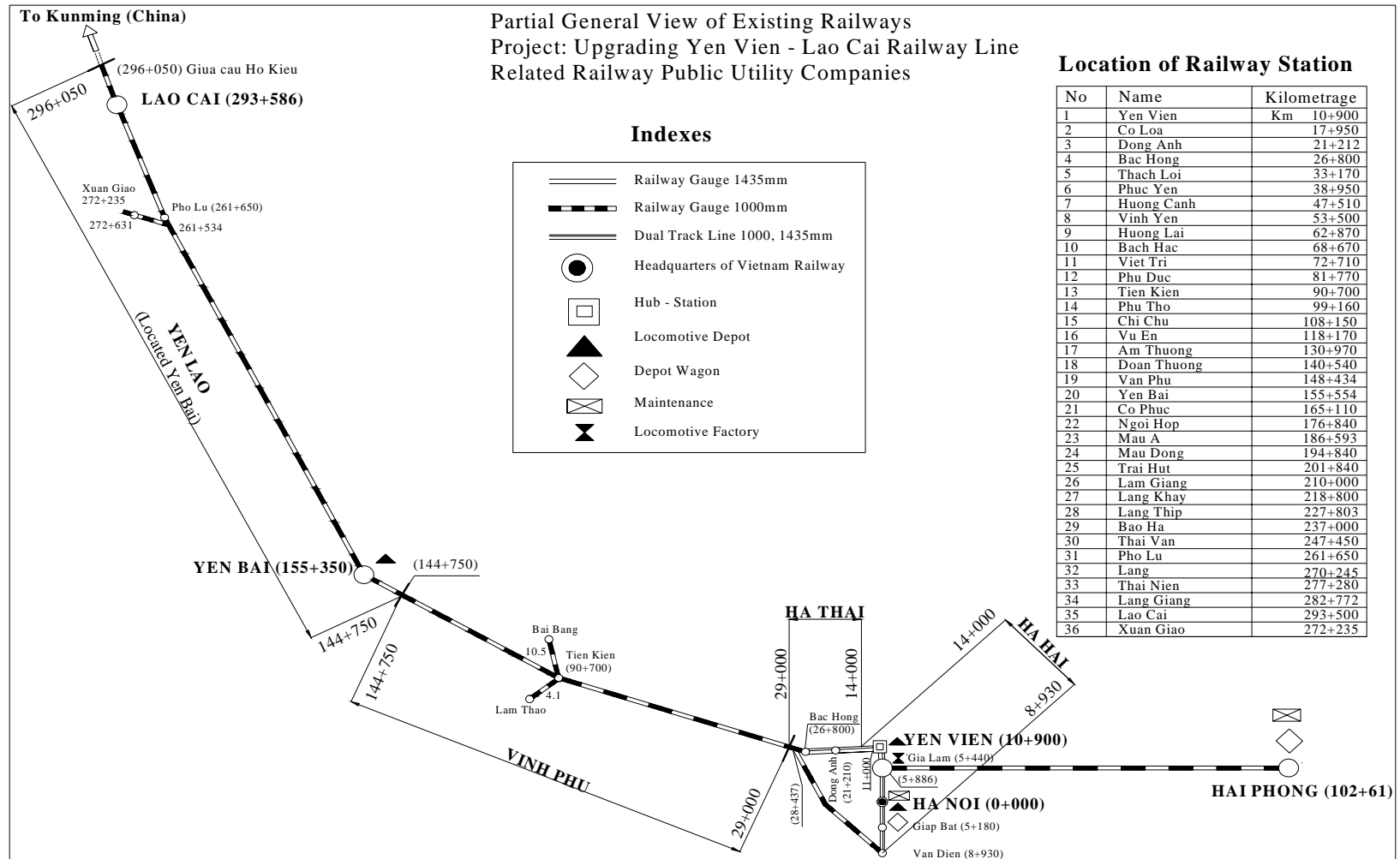
Haiphong to Hanoi (101 km)

The first section of rail line connecting Haiphong to Hanoi was completed and opened in April 1903. The existing topography along this section of the line is generally flat and undulating. As a result the track was built on embankment to avoid flooding, subsidence and collapse during the rainy season. The line crosses the Red River at Hanoi on the significant Long Bien Bridge.

Yen Vien – Viet Tri

The line runs from Yen Vien, alongside the Red River towards Viet Tri. The railway line remains on filled embankment in this area until it leaves the delta area via the Viet Tri Bridge (Length = 295 m) over the Lo River. This railway section was completed and opened in 1904.

Figure 2.1: Railway Public Utility Companies (RPUC) by Section



Yen Bai to Lao Cai (181 km)

The last section to be completed was between Yen Bai and Lao Cai. This section runs along the bank of the Red River with the mountain range on the adjoining side. A large number of very tight turns in this mountainous region. This section includes 11 Stations, several of which are used as sidings.

A summary of the detailed geological and hydrological characteristics are provided separately in Technical Appendix A2.

2.6.3 Existing Alignment

The existing railway line has a poor geometric vertical and horizontal layout. The track contains 943 curves with a combined length of 115.5 km (41% of total length). A considerable amount of the existing ageing infrastructure and facilities are in poor condition. This has the potential to affect the safe operation of the railway.

From Viet Tri to Lao Cai the line runs on the North-eastern side of the Red River. In order to reduce the amount of earth work, the railway track winds its way, closely following the natural landscape. Therefore the line has many curved sections, some with very small radii as low as 100 metres.

Tight curves increase track wear, reduce the safe train operating speed and increase the risk of derailment. As a result of the existing layout, there is frequently inadequate provision of railway cant between two adjacent curves. This affects ride comfort and increases the risk of derailment. This situation is illustrated in Figure 2.2 below where the straight railway segment between inverse curves is only 5 metres which is inadequate.

In order to minimise the risk of derailment, additional guardrails have been installed in high risk areas in order to ensure that the train remains on the track. As a result of the existing cant being non-compliant with the relevant Vietnamese standards, the train speed is limited at the sections concerned.

Figure 2.2: Illustration of Tight Curves and Guard Rails on the Existing Alignment



A number of existing bridges and sections of track along the existing alignment are at risk of flooding, particularly during the rainy season, when excess water flows down from the mountainous areas along the valleys. This meets the raised Red River water levels and causes flooding of the existing alignment and associated bridges. This can significantly affect rail operations and safety.

2.7 BRIDGES

2.7.1 Introduction

In the period since 1992, 54 of the 154 existing bridges along the route have been improved and upgraded. These bridges are in sound condition and able to carry the required train load (T14). The remaining 100 bridges were therefore required to be assessed by the Consultant as part of this study.

The majority of the existing bridges are steel structures. However some of the short span bridges are made from reinforced concrete. The abutments are generally formed of masonry or in situ mass concrete and their foundations are normally of mass concrete. However piling solutions have been adopted at a number of locations.

A large number of the existing bridges and rail facilities have deteriorated for the following reasons:

- War damage,
- the aggressive environment (particularly the high level of humidity),
- steel fatigue,
- flood damage,
- weathering and severe corrosion,
- lack of maintenance,
- scouring and erosion of adjoining river banks endangering the stability of the railway and bridges.

In addition the surrounding environment and ecological conditions have varied recently as a result of flooding and river scour beneath bridges and at curves in the river which endanger the railway line as well as the bridges.

The weakened state of the bridges has required the imposition of speed restrictions. This affects railway capacity and is a safety risk. Speed limits of 35 km/h are imposed on most bridges and 15 km/h in the vicinity of Yen Vien. Further details are provided separately in Technical Appendix A2.

The current poor bridge condition results in cracking and static vertical deflections ("bridge sagging"). When trains pass over these bridges excessive dynamic vertical deflections and horizontal oscillations are observed.

2.7.2 Bridge Condition Survey

The condition survey was targeted towards structures which were known to be in structural distress or where speed limits were in force as a result of the bridge's current poor condition. In total 65 existing structures were identified as being at risk and in need of surveying and further investigation. These were selected based on the findings of numerous site visits which were carried out by our engineering staff. In addition detailed discussions were held with the staff from Vietnamese Railways who are very familiar with existing conditions along the alignment.

Table 2.3: Summary of the Bridge Assessment Exercise

Ref.				RPUC	Bridge Name	Km	Length of		SUPER STRUCTURE	Designed Train Load	Affected by War	Priority		
							Bridge	Girder				1	2	3
	1	1	1	HT	Dục Tú	14+850	29.62	13.60				1		
		2	1	VP	Phỉ Trx	35+140	54.77	31.62	French Truss					3
		3	2	VP	Thịnh kỷ	42+272	102.83	92.00	New Steel Truss					3
		4	3	VP	Hương canh	46+290	55.60	31.70	French Truss					3
	2	5	4	VP	Đàm Vạc	52+510	30.24	9.24	I750 (French)	Mic+4.2T/m		1		
		6	5	VP	Đ á Lạn	54+500	30.21	9.21	I 500 (French)					3
		7	6	VP	Lĩ nh	56+210	31.30	17.30	French Truss					3
	3	8	7	VP	Mạ Giũa	60+152	18.05	9.26	I500 (French)	Mic+4.2T/m		1		
		9	8	VP	Me	67+200	41.16	31.82	French truss					3
		10	9	VP	Việt Trì	71+341	372.88	352.00	HTB Truss - built in 97					3
		11	10	VP	Thanh Miếu	73+900	17.50	7.00	I575 - new concrete girder					3
	4	12	11	VP	Xoan Đào	92+390	14.09	4.84	I 500 (French)	Mic+4.2T/m		1		
	5	13	12	VP	Vạn Thắng	92+990	19.65	9.27	I 750 (French)	Mic+4.2T/m		1		
		14	13	VP	Bê Tông	95+352	5.00	3.32	RC girder					3
	6	15	14	VP	Diên Hồng	95+550	13.84	4.84	I 500 (French)	Mic+4.2T/m		1		
		16	15	VP	Phú Thọ	98+699	29.15	21.7	4I550 - replaced girder					3
	7	17	16	VP	Đồng Minh	99+730	19.16	4.84	I 500 (French)	Mic+4.2T/m		1		
	8	18	17	VP	Đồng Miếu	100+387	18.18	4.84	I 500 (French)	Mic+4.2T/m		1		
	9	19	18	VP	Chùa	108+872	21.70	13.31	I 870 (French)	Mic+4.2T/m		1		
	10	20	19	VP	Sâm	110+900	16.25	7.02	I 580 (French)	Mic+4.2T/m		1		
		21	20	VP	Trầm Bồng	112+900	12.60	2.74	I 300					3
		22	21	VP	Trầm Hương	113+700	14.16	4.84	I 500					3
		23	22	VP	Mạ Lan	115+556	30.74	21.58	6 I 550 - new girder					3
	11	24	23	VP	Vĩnh Chân	120+130	21.08	13.32	I 870 (French)	Mic+4.2T/m		1		
	12	25	24	VP	Mai ô	122+990	22.08	7.02	I 580 (French)	Mic+4.2T/m		1		
		26	25	VP	Mình Hạc	129+075	24.82	17.2	French truss- replaced girder					3
	13	27	26	VP	Âm Thượng	130+500	16.77	4.84	I 500 (French)	Mic+4.2T/m		1		
		28	27	VP	Lửa Việt	132+476	28.48	21.53	4 I550					3
	14	29	28	VP	Ngôi Lanh	134+004	19.1	13.4	4 I550 (War fabrication)	Mic+4.2T/m		1		
	15	30	29	VP	Ngôi Hiền	137+785	24.6	17.3	4 I550 (French)	Mic+4.2T/m		1		
		31	30	VP	Đầm Hà	141+148	14.00	4.84	2I 500					3
	16	32	1	YL	Mấn	145+520	15.40	4.84	I 550 (French)	Mic+4.2T/m		1		
	17	33	2	YL	Ngôi Sen	145+950	26.92	17.3	4I550 (War fabrication)	Mic+4.2T/m		1		
	18	34	3	YL	Văn Phú	148+920	25.9	21.5	6I 550- (War fabrication)	Mic+4.2T/m		1		
		35	4	YL		151+750	4.64	1.74	BTCT					3
	19	36	5	YL	Gia Đa	152+494	21.12	11.25	4 I550 - (War fabrication)	Mic+4.2T/m		1		
	20	37	6	YL	Tuần Quán	152+550	32.68	26.50	T66 (War fabrication)	Mic+4.2T/m		1		
	21	38	7	YL	Trầm	153+450	17.69	9.15	2I 610 (French)	Mic+4.2T/m		1		
		39	8	YL	Lâm Sinh	154+370	11.88	4.90	RC girder replaced					3
	22	40	9	YL	Thủy Lợi	157+341	24.96	16.4	4 I550 (War fabrication)	Mic+4.2T/m		1		
		41	10	YL	Xuân Lan	158+240	14.41	5.14	RC girder replaced					3
		42	11	YL	Nga Quán	162+692	40.7	35.80	VN71 - Truss replaced					3
	23	43	12	YL	Nghĩa Phương	166+550	27.76	17.3	4I550	Mic+4.2T/m		1		
	24	44	13	YL	Từ M ầu	168+850	28.0	28.0	RC Arch bridge			1		
1		45	14	YL	Đào Thịnh	171+414	22.3	13.3	2I 875 (French)	Mic+4.2T/m		1		
2		46	15	YL	Thác Thủ	173+380	12.74	4.78	2I 450(French)	Mic+4.2T/m		1		
	25	47	16	YL	Con Tràn	173+960	13.87	7.07	2I 580			1		
	26	48	17	YL	Móc tôm	174+185	14.17	7.07	2I 580 (French)	Mic+4.2T/m		1		
		49	18	YL	Đầm S ầu	174+430	11.74	2.80	RC girder					3
		50	19	YL		174+960	4.55	1.7	RC girder					3

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		51	20	YL	Ngòi Hóp	176+619	52.40	42.50	VN71+I550 truss reinforced					3
	27	52	21	YL	Sung	177+176	29.95	13.28	2I 890 (French)	Mic+4.2T/m		1		
	28	53	22	YL	Điều	179+304	38.44	17.3	4I 550 (War fabrication)	Mic+4.2T/m		1		
	29	54	23	YL	Tây	181+190	22.70	13.30	2I 890 (French)	Mic+4.2T/m		1		
		55	24	YL		181+473	5.28	1.70	RC girder					3
		56	25	YL	Khe Đồi	182+520	29	17.3	4I 550 (War fabrication)	Mic+4.2T/m				3
	30	57	26	YL	Trang	183+150	35.57	22.70	T66	Mic+4.2T/m		1		
	31	58	27	YL	Máng	183+960	34.02	17.3	4I 550 (War fabrication)	Mic+4.2T/m		1		
	32	59	28	YL	Khe Nhâm	185+265	18.90	9.20	2I 700 (French)	Mic+4.2T/m		1		
	33	60	29	YL	Mẫu A	188+050	32.50	21.50	Pigeaud Truss (French)	Mic+4.2T/m		1		
	34	61	30	YL	Khe Hoi	189+264	13.00	4.95	2I 500			1		
		62	31	YL		189+660	5.10	1.70	RC girder					3
		63	32	YL	Quách	190+020	26.2	20	6I 550					3
		64	33	YL	Vải	192+462	34.35	21.5	4I 550					3
	35	65	34	YL	Muống	194+470	17.89	7.02	2I 670 (French)	Mic+4.2T/m		1		
	36	66	35	YL	Khai	195+394	30.0	21.5	4I 550	Mic+4.2T/m		1		
	37	67	36	YL	Mười	197+850	29.5	21.5	4I 550 - War fabrication	Mic+4.2T/m		1		
		68	37	YL	Lâm	201+216	35.5	21.5	4I 550					3
		69	38	YL		201+503	6.74	2.7	RC girder					3
	38	70	39	YL	Bơm nước	201+635	19.20	9.20	4I 550 (War fabrication)	Mic+4.2T/m		1		
	39	71	40	YL	Trần	203+150	19.63	9.20	2I 700 (French)	Mic+4.2T/m		1		
	40	72	41	YL	Đen	204+064	20.20	9.20	2I 700 (French)	Mic+4.2T/m		1		
	41	73	42	YL	Trở	204+815	35.9	21.5	4I 550	Mic+4.2T/m		1		
		74	43	YL		205+813	6.74	2.80	RC Girder					3
		75	44	YL		206+044	6.74	2.74	RC Girder replaced in 2002					3
	42	76	45	YL	Sau	206+243	16.84	7.02	2I 670 (French)	Mic+4.2T/m		1		
	43	77	46	YL	Nước chảy	206+630	9.62	7.02	2I 670 (French)	Mic+4.2T/m		1		
	44	78	47	YL	Bảy	206+960	24.80	13.38	2I 890 (French)	Mic+4.2T/m		1		
	45	79	48	YL	Trắc	207+572	20.20	9.46	4I 550 (War fabrication)	Mic+4.2T/m		1		
	46	80	49	YL	Mãng	208+210	32.86	21.82	Pratt truss (War fabrica.)	Mic+4.2T/m		1		
		81	50	YL		208+538	6.70	2.80	2I 300					3
	47	82	51	YL	2 M	208+977	10.10	2.74	2I 300 (French)	Mic+4.2T/m		1		
	48	83	52	YL	Khe Sẻ	209+705	26.08	17.3	4I 550 (War fabrication)	Mic+4.2T/m		1		
		84	53	YL		211+522	4.00	1.70	RC girder					3
	49	85	54	YL	Cài	212+540	38.50	28.42	VN64	Mic+4.2T/m		1		
	50	86	55	YL	Phúc minh	214+742	31.0	17.3	4I 550 (War fabrication)	Mic+4.2T/m		1		
		87	56	YL		216+270	6.16	1.70	RC girder					3
	51	88	57	YL	4 M	217+050	7.00	5.00	2I 500 (French)	Mic+4.2T/m		1		
		89	58	YL	Trục	217+736	46.10	38.12	VN64 truss reinforced in 2000					3
		90	59	YL		217+944	6.02	2.80	RC girder					3
	52	91	60	YL	Khe Bút	218+486	22.00	13.30	2I 850 (French)	Mic+4.2T/m		1		
	53	92	61	YL	Lang Khay	220+139	31.5	21.5	4I 550 (War fabrication)	Mic+4.2T/m		1		
	54	93	62	YL	Bầu	221+953	23.50	13.30	2I 850 (French)	Mic+4.2T/m		1		
	55	94	63	YL	Cọp Vồ	222+287	27.30	13.30	2I 850 (French)	Mic+4.2T/m		1		
	56	95	64	YL	Bo	223+220	34.33	13.30	2I 850 (French)	Mic+4.2T/m		1		
	57	96	65	YL	4 M	224+050	11.30	4.94	2I500 Reinforcing girder			1		
	58	97	66	YL	Ly	225+170	33.37	17.8	4I 550 (War fabrication)	Mic+4.2T/m		1		
	59	98	67	YL	Lang Thíp	228+030	34.0	21.6	4I 550 (War fabrication)	Mic+4.2T/m		1		
		99	68	YL		228+560	4.80	1.70	RC girder					3
	60	100	69	YL	Ba mươi	229+980	24.50	7.02	2I 870 (War fabrication)	Mic+4.2T/m		1		
	61	101	70	YL	Khe Den	231+530	18.11	9.2	4I 550 (War fabrication)	Mic+4.2T/m		1		
	62	102	71	YL	Bùn	232+612	55.85	43.2	4I 550 (War fabrication)	Mic+4.2T/m		1		

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		103	72	YL		233+530	12.20	4.94	RC girder					3
		104	73	YL		235+540	6.54	2.80	RC girder					3
		105	74	YL		235+940	8.92	1.70	RC girder					3
	63	106	75	YL	1 M	236+680	4.36	1.74	2I 300	Mic+4.2T/m		1		
	64	107	76	YL	Bảo Hà	237+326	29.5	18.3	4I 550 (War fabrication)	Mic+4.2T/m		1		
		108	77	YL		238+108	8.72	1.7	RC girder					3
	65	109	78	YL	4 M	239+428	7.4	4.94	2I 500			1		
	66	110	79	YL	Khoai	241+710	32.6	17.4	4I 550			1		
		111	80	YL	Kíp	242+735	19.2	13.3	2I 890					3
		112	81	YL		243+203	6.8	2.8	RC girder					3
	67	113	82	YL	Mèo	244+965	32.0	17.2	French Truss	Mic+4.2T/m		1		
		114	83	YL	Vàn	245+735	42.0	26.5	French Truss	Mic+4.2T/m				3
	68	115	84	YL	4 M	247+595	10.5	4.95	2I 500 (French)	Mic+4.2T/m		1		
	69	116	85	YL	Gia	249+004	32	21.4	French Truss	Mic+4.2T/m		1		
	70	117	86	YL	Nhai	250+412	47.5	26.5	Pigeaud Truss (French)	Mic+4.2T/m		1		
	71	118	87	YL	Cháy	252+420	34	21.4	Pigeaud Truss (French)	Mic+4.2T/m		1		
		119	88	YL		253+500	2.6	1.7	RC girder					3
		120	89	YL	Nhò	253+750	44.5	26.5	T66- temporary truss					3
		121	90	YL		257+175	4	1.7	RC girder					3
		122	91	YL		257+410	4	1.7	RC girder					3
	72	123	92	YL	Trì	258+050	26.7	13.3	2I 850 (French)	Mic+4.2T/m		1		
		124	93	YL		260+720	10	10	RC Arch bridge					3
	73	125	94	YL	Ngòi lu	261+040	40.15	21.6	4I 550			1		
		126	95	YL	My	265+775	38.3	21.7	I1480					3
		128	96	YL	Đền	266+007	11.43	7.07	2I 550					3
		127	97	YL		266+537	10.5	5.2	2I 550					3
		129	98	YL	Lạng	269+321	36.2	21.7	I1 480					3
		130	99	YL	Cao	271+296	34.92	9.2	2I 550					3
		131	100	YL	Đo	273+448	38.82	21.7	2I 1480					3
		132	101	YL	Lượt	274+648	31.4	17.5	I1480					3
		133	102	YL		275+733	18.24	18.24	RC Arch bridge					3
		134	103	YL		276+007	22.31	22.31	RC Arch bridge					3
		135	104	YL	Tây	276+265	6.84	1.8	RC girder replaced					3
		136	105	YL	Khe Quan	276+689	20.7	9.2	2I 550					3
		137	106	YL	Khe dưng	279+417	25.7	13.6	2I 910					3
		138	107	YL	Múc	280+742	25.4	13.6	2I 920					3
		139	108	YL	Giàng	282+398	21.35	9.2	2I 550					3
3		140	109	YL	Thất Cổ	284+388	27.1	13.6	2 I1010	Mic+4.2T/m		1		
4		141	110	YL	Quỳnh Sum	286+593	34.8	22.1	VN 71- temporary truss	Mic+4.2T/m		1		
		142	111	YL		286+861	20.3	20.3	RC Arch bridge					3
5		143	112	YL		288+732	15.8	15.8	RC Arch bridge	Mic+4.2T/m		1		
6		144	113	YL		289+953	32.54	32.54	RC Arch bridge	Mic+4.2T/m		1		
		145	114	YL	Son Mãn	291+167	23.48	9.2	2 I 550					3
		146	115	YL	Vườn rau	292+327	18.5	9.2	2 I 550					3
		147	116	YL	Chui	295+329	18.3	9.2	2 I 550					3
		148	117	YL	Hồ Kiều	296+050	70.53	60.67	Steel truss					3
TOTAL							3,823	2,402				79	0	69

KEY



- Bridges surveyed (65No.)
- Additional bridges proposed by the Consultant
- New bridges required by realignment
- Bridges damaged during the war

It has been established that significant temporary bridgeworks were carried out during the war in order to repair significant bomb damage. Temporary procedures, such as installing regular nuts and bolts, were adopted as a result of the difficult war conditions. These structures do not meet current technical standards. For example High Tension Bolts (HTB) with gussets are required to be incorporated in new structures. Standard nuts and bolts are liable to become loose over time.

In addition bomb attacks on bridges often resulted in damaged girders falling into the Red River. Given the difficult war conditions prevailing at the time, and limited availability of materials these girders were usually recovered from the river. Temporary and essential rapid repairs were carried out prior to the girder being reinstalled on the repaired abutments. These girders are obviously at greater risk of corrosion damage.

2.8 SLOPE STABILIZATION

2.8.1 Introduction

The majority of the existing slopes and embankments along the alignment are considered safe and stable. However a number of sections have suffered from instability and landslides.

The Consultant's Engineering staff carried out site visits, in addition to the topographical and geological surveys. The four Railway Public Utility Companies, who are responsible for the maintenance of the infrastructure, were also consulted.

In addition to slope protection measures, drainage improvement works have been proposed in order to reduce the amount of standing water and saturated soil. The presence of excess or standing water frequently leads to slope instability as the ground becomes saturated.

2.8.2 Current Condition

The mountainous sections between Yen Bai and Lao Cai have elevations between 400m and 1,400m and are characterized by steep slopes. These can become unstable and cause landslides or slippages.

A number of the slopes alongside the Red River have suffered from erosion which is mainly due to flooding and river action. In addition abandoned quarry sites and the uncontrolled dumping or disposal of materials from previous projects may also lead to increased slope instability.







Areas most likely to fail have been identified as those with a large angle of dip, and having relatively thick soil layers (ie. exceeding 5 metres). Saturated soil conditions, caused by significant ground water infiltration, can trigger the deep landslides which can be witnessed on site. Vietnam Railways routinely carry out slope stabilisation and improvement works to the areas concerned.



2.9 TRACK

2.9.1 Introduction

The existing railway track between Yen Bai and Lao Cai comprises non electrified, bolted track in 12.5 metre rail lengths of steel Grades 43 or 38. The majority of the alignment is 1000mm gauge. However there are some sections of dual (standard and metre) gauge track near Hanoi.

Figure 2.3: Examples of Slope Conditions

	
Km 233+200	Rail and Ballast Works
	
Kilometre 254	Slope Improvement Works under construction near Km 254
	
Km 273 where significant upper and lower slope stability problems have been encountered	Standing water near Lao Cai station. Drainage upgrade required.

	
Km 233+400 - Rock slope	Km 233 - slope consisting of mixed ground

The railway route is divided into four sections which are managed by four different Railway Public Utility Companies. In the past the quality of the maintenance works carried out, and the quantity of rail which has been replaced has been limited and not consistent. The current poor condition of significant sections of the track limits operating speeds and increases the risk of derailments. Vietnam Railways has installed an additional guide rail in areas where derailment is most likely. These include:

- at the tightest curves;
- on bridges which are in poor condition and subject to excessive vertical movement;
- on sections of rail where the vertical or horizontal wear is excessive.

The amount of lateral wear to the railway track is partly related to the degree of curvature in the alignment. The large number of tight curves, some with radii less than 100m, in the Northern section result in an increased rate of lateral rail wear and a greater risk of train derailment.

In contrast the Southern section of the line from Yen Vien to Lao Cai has fewer curves, apart from the section near Yen Bai. As a result the amount of rail wear in the Southern section is less than the Northern section.

2.9.2 Interaction of the Track Work Elements:

Rail track work consists of the following four elements :

- Rail,
- Sleepers with fastening devices,
- Sub-ballast and Ballast, and
- Sub grade.

These four elements interact closely together. If one of these elements becomes significantly deteriorated (eg rail wear, sleeper damage, fixing breakage or crushed ballast) this will affect the effectiveness of the other elements and jeopardise the safety of the rail operations

The current use of split sleepers results in more rapid deterioration of the ballast. The pressure under each of the blocks as trains pass over them is more concentrated and higher than when compared with single unit sleepers. This accelerates the crushing process within the ballast layer or increases the amount of ballast which is pressed into

the sub grade. As a result additional quantities of ballast are required to be continually added below the track in order to maintain performance. (see photo below).

Figure 2.4: Two Block Sleepers and Ballast Damage



2.10 SAFETY ISSUES

2.10.1 Introduction

There are 78 principle crossings on the Yen Vien - Lao Cai railway line. The following types of crossing can be found.

Manned Crossings (ie with gate-keeper)

The current procedure at manned crossings is that a barrier is manually drawn across the road to prevent vehicles and passengers from crossing the railway track. An audible bell and signal warn the road traffic that the barriers will soon be, or are currently, being drawn across the road. The gatekeeper is in telephone contact with the station officer and is notified when a train is approaching.

Unmanned Crossing (ie without gate-keeper)

At these unmanned crossings a warning sign and direction post are the only facilities provided. A list of the unmanned crossings is provided overleaf.

Automatic Crossings (with no gatekeeper)

Two of the existing crossings (Km 131+230 & km 263+321) are equipped with automatic warning systems which activate automatically when trains approach. These automatic systems have only been installed relatively recently and remain under assessment in Vietnam. Concerns exist regarding the level of traveller observance.

Unauthorised Crossings

A large number of unauthorised crossings have been constructed by individuals living close to the alignment. These crossings are used to transfer bicycles, motorcycles and animals. In addition unauthorised and uncontrolled developments have been constructed which begin to encroach the area directly alongside the track. The unofficial crossings are a significant risk to the safe operation of the railway. For example concrete slabs or gravel fill are placed between the tracks by unauthorised local residents. These objects have the potential to derail a train.

At each type of rail crossing there is a potential risk to train operations, passenger safety and vehicles or individuals attempting to cross the rail tracks. As a result of these known risks, the train's operational speed is reduced to approximately 15 km/hr around the cities or densely populated urban areas such as Yen Vien or Dong Anh.

Table 2.4 : Railway Crossing Locations with no Gate Keeper (18 No.)

Ref.	Location Km	RPUC	Actual Conditions	Width of crossing (m)
1	14+325	Ha Thai	Cummune crossing, no gate keeper, high volume of crossing traffic	12
2	16+250	Ha Thai	Cummune crossing, no gate keeper, high volume of crossing traffic	8
3	18+370	Ha Thai	Cummune crossing, no gate keeper, high volume of crossing traffic	10
4	20+210	Ha Thai	Cummune crossing, no gate keeper, high volume of crossing traffic	19
5	27+950	Ha Thai	Cummune crossing, no gate keeper, high volume of crossing traffic	8
6	28+350	Ha Thai	Cummune crossing, no gate keeper, high volume of crossing traffic	8
7	29+975	Vinh Phuc	Level crossing no gate keeper; crossing road to industrial zone "Quang Minh", high traffic volume	8
8	33+660	Vinh Phuc	Level crossing no gate keeper; crossing road to industrial zone "Quang Minh", high traffic volume	12
9	34+660	Vinh Phuc	Level crossing no gate keeper; crossing road to industrial zone "kim Hoa", high traffic volume	10
10	64+590	Vinh Phuc	Level crossing no gate keeper; connecting road between provinces, high traffic volume	12
11	66+860	Vinh Phuc	Level crossing no gate keeper; connecting road between province, high traffic volume	8
12	74+550	Vinh Phuc	Level crossing in Viet Tri, no gate keeper, high vehicle and pedestrian traffic	16
13	75+480	Vinh Phuc	Level crossing in Viet Tri, no gate keeper, high vehicle and pedestrian traffic	26
14	107+925	Vinh Phuc	cummune crossing, no gate keeper, crossing road to historical monument, high volume of crossing traffic	8
15	108+732	Vinh Phuc	Dense population, high traffic volume crossing	8
16	121+750	Vinh Phuc	Dense population, high traffic volume crossing	10
17	131+200	Vinh Phuc	Level crossing with no gate keeper, crossing road in the Ha Hoa district, high volume of crossing traffic	19
18	186+550	Yen Lao	Level crossing with no gate keeper, high volume of crossing traffic, dangerous condition	15

The accident figures for the line are summarised in the following table.

Table 2.5 : Accident Statistics Hanoi – Lao Cai Railway

Period	Number of human injury	Number of human death
2002 - 2006	103	25

Table Source: Railway Public Utility Company Records

Table 2.6 : Record of Accidents near Dong Anh (km 21.8)

Year	Accident Description
1985	Train collided with cars and truck (Km 20+210)
1995	Train collided with motor bicycle: (1 dead & 2 injured, Km 21+800)
1995	Train hit pupils (1 injured, Km 20+21)
1999	Cars collided with barrier; Rail guard personnel injured (Km 21+800)
2003	Cars hit and demolished signalling tower (Km 21+800)
2003	Cars collided with barrier; Rail guard personnel injured (Km 21+800)
2004	Cars hit and demolished signalling tower (Km 21+800)

Year	Accident Description
2004	Container trucks from station collided with cars on National road No. 3 (Km 21+800)
2004	Train collided with motorbike (1 dead & 2 injured)
2005	Cars collided with barrier (Km 21+800)

Table Source: Railway Public Utility Company Records

Table 2.7 : Existing Crossings (13 No.) where Engineering Upgrading works are required to ensure safety for the travelling public (Required by VNR & RPUC)

Ref	Location (Km)	Existing Condition	Width of crossing (m)
Vinh Phu RPUC			
1	50+950	Damaged sleepers, very poor quality and uneven road surface	26
2	117+400	Damaged sleepers, substandard crossing road surface, railway line intersects provincial road 312	17
3	137+100	Crossing road without gate keeper, railway line intersects with HaHoa town road	12
III Yen Lao RPUC			
4	154+450	Poor quality crossing road surface, damaged guard house, limited sight distance	15
5	155+550	Damaged guard house does not meet current safety requirements	10
6	156+960	Damaged concrete surface, rough road surface, rusty supports, many damaged sleepers	15
7	163+810	Old and damaged guard house, seriously damaged crossing road surface, broken bar, narrow road	15
8	164+530	Walls of guardhouse in poor condition, re-construct guardhouse yard	10
9	176+150	Rough crossing road surface, Narrow road needs widening.	12
10	184+122	Tough and blistered crossing road's surface, road and crossing are narrow, need widening.	12
11	262+050	Reconstruct fence, re-mortar the whole guard house	30
12	294+680	Reconstruct crossing road's surface, drainage system of crossing road is not satisfying	12
13	295+941	Reconstruct road's surface and guard house for crossing road	15

3 ENVIRONMENT

3.1 OVERVIEW

The proposed improvement activities cause risk of pollution, disturbance to water resources and affect various ecosystems. Hence there was a need for an “Initial Environmental Examination (IEE)” of the project activities along the existing alignment based on primary observation and secondary information. The approach and methodology for the IEE study was based on the ADB Guidelines for Environmental Assessment, and is presented in Technical Appendix B.

3.2 DESCRIPTION OF THE ENVIRONMENT

The environmental profile of the project area was studied by observing the salient features of the project components during the two surveys conducted during February and March 2006 along the alignment using the rail car and the road parallel to the track.

Physical Environment

The key features of the project area’s physical environment are:

- hot and humid climate with normal rainfall;
- variable topography, ranging from broad flat plains to mountainous regions;
- uncomplicated geology;
- limited ground water resources;
- the Red River runs parallel to the railway, at times close to the track (within 10-30m);
- severe soil erosion, which is a major environmental issue; and
- air and noise quality ranging from poor to moderate in industrial areas and urban locations.

Ecological Environment

The ecological environment revealed a land use pattern of forestry land (41-43%), agricultural land (45-48%), flora and fauna of normal type with no protected and endangered species, recently grown plantations along the slopes of mountains and no sensitive or protected areas within 5 kilometres on either side of the alignment.

Socio-Economic Environment

The key elements of the socio-economic environment are :

- sporadically distributed ethnic minority habitations;
- agricultural products (eg. bamboo, cassava, tea and rice);
- mineral deposits (eg. iron, lime stone, apatite and coal); and
- a prominent tourist location of Sapa approximately 40 km away from the railway line, the nearest point on the line being Lao Cai.

3.3 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Based on the area's environmental baseline profile, secondary information collected through project documents and discussions with railway officials en route, the project's anticipated impacts during the construction and operations phase of the project were assessed and appropriate mitigation measures were suggested.

Construction Phase

During the project's Construction Phase minor short term negative impacts on various environmental attributes like air quality, solid and hazardous waste, flora, fauna, public health and safety are anticipated. These impacts can be mitigated with the help of measures suggested. However some major long term negative impacts are forecast, with noise and vibration and the danger of soil erosion during the entire construction period. Although with the suggested mitigation measures their impacts could be reduced to a certain extent, a detailed study has to be conducted and site specific mitigation plan needs to be worked out before the commencement of construction. Some induced impacts like increased employment potential for local unskilled workers during construction are 'major positive' impacts.

Operations Phase

During the Operational Phase, no impacts are expected on items such as soil erosion, flora and fauna and environmentally sensitive areas. There may be minor negative impacts on water and air quality, and some induced social and commercial activities, all of which could be easily mitigated with the measures suggested, in particular appropriate planning and regulation. However, there will be major negative impacts from the generation and discharge of waste water from railway stations and workshops, noise and vibration, solid waste from stations and workshops and impacts on public safety and health. These impacts will require to be mitigated with proper planning, regulations and close monitoring of rail operations over the long term.

3.4 INSTITUTIONAL REQUIREMENTS

The project's Executing Agency (EA), the Railway Project Management Unit (RPMU), will have overall responsibility for ensuring that all environmental standards and procedures are followed. The EA will establish an Environmental Protection and Management Division (EPMD) that will ensure implementation of an environmental management and monitoring plan during both phases of the project. The EPMD will prepare a detailed environmental monitoring plan for the project prior to commencement of bidding for construction contracts.

It is clear that RPMU does not currently have the staff or expertise within their organisation to carry out the EPMD duties. As a result it is anticipated that the Detailed Design and Supervision Consultant will second an expatriate and a local expert into the Executing Agency in order to complete the required Environmental management and monitoring duties.

The environmental monitoring plan will be included in all bidding contractor documents and construction contracts. The EPMD will ensure that the environmental monitoring plan is updated, as required, during project construction and operation.

Environmental monitoring will be undertaken by a range of relevant authorities, local Environmental Protection Bureaus (EPB), the forestry department, the relics bureau and others. Though the local EPBs are well qualified to carry out the environmental

monitoring, there is a need to train them in areas such as field monitoring of the environmental attributes, sampling and analysis, and Environmental Assessment studies. For this purpose training courses, seminars and workshops could be arranged by RPMU and the Consultant's staff.

There is also a need to comply with requirements from the Ministry of Natural Resources and Environment (MoNRE), which will require an EIA, before a licence can be granted. The EE studies, which form a chapter of the (Vietnamese) Feasibility Study (preliminary design stage) are sufficient for making an application for a Stage 1 Investment License. At Stage II, while submitting detailed design for obtaining investment license, a detailed EIA (as per the guideline and format stipulated for Transport related projects) is required.

Table 3.1: Anticipated Impacts and Mitigation Measures : Construction Phase

Environmental Parameter/Issue	Anticipated Impacts	Mitigation Measures	Degree of impact
Soil	Disposal of excess earthworks	Use for soil embankments	Significant Negative Impact for short period
	Loss of top soil	Stripping & storing and reuse during rehabilitation works	
	Damage to temporarily acquired land and failure to rehabilitate borrow areas	Appropriate rehabilitation works	
	Soil erosion and saturation	Planting of shrubs and grass, Suitable compaction, placement of geosynthetics, construction of berms and dikes	
	Contamination by fuel and lubricants	Oil separators at washing areas and installing secondary containment at fuel storage areas	
	Improper erosion control and disposal run-off entering the Red river.		
Water	Wash water from workshops	Pass through separator prior to discharge	Minor Negative impact
	Sanitary wastewater effluent from work camps	Use of septic tanks and primary treatment before discharge to nearby watercourse No direct discharge of untreated waste water to surface waterbody like Red River	
Air Quality	Particulate dust from construction vehicles and activities	Cover the stored material with tarpaulin sheets or store in an enclosed area to prevent loss due to wind action. Spray the site working area with water to prevent dust forming.	Minor Negative Impact
Noise and Vibration	Impact of noise on residential areas will be mainly from maintenance workshops, construction vehicles and earthmoving equipment	Within 200 m of the nearest habitation, construction works such as crushing, mechanical compaction, concrete mixing and batching will be stopped between 2200 and 0600 hours	Major Negative Impact for entire construction period
	Impact of vibration to buildings from heavy earthmoving equipment	Use of pneumatic equipment wheels to reduce vibrations. Proper lubrication of vehicle moving parts.	
Solid Waste	Domestic and construction waste from work camps	Regular disposal of the waste to the identified disposal sites. No on-site development of landfills	Minor Negative Impact. Site specific.

Environmental Parameter/Issue	Anticipated Impacts	Mitigation Measures	Degree of impact
	Hazardous waste from work sites	Material collected and stored on-site in approved facilities as per relevant standards. Removed from site to the location approved by MoNRE officials	Short period
	Spoil and excavated material from cuttings	Used for filling embankments and excess quantity stored with containment walls for future use	Minor Negative Impact, site specific.
Hazardous Materials	Lubricating oil and grease will be applied to construction machinery. Accidental spillages affecting soil, groundwater and adjacent water bodies especially in regions close to the Red River.	Installing appropriate and secure hazardous storage facilities wherever required. The used chemicals will be emptied in labelled containers and sold to the identified users, reused or recycled.	Minor Negative Impact
Soil Erosion	Increase in the levels of erosion, particularly in areas where the soil types and topography are susceptible to erosion	Follow the mitigation measures suggested in the Erosion Prevention Plan (ErPP) prepared for the project as part of Pre Feasibility studies	Major Negative Impact during the entire construction period
Seismic Activity	Liquefaction of soils primarily in the mountainous regions between Yen Bai and Lao Cai and subsequent loss of foundation bearing capacity	Extending slopes, widening sub grade surfaces and adding dual-direction geotechnical layer within the crushed layer	Minor Negative Impact
Flora and Fauna	Minimal impact in the plains between Yen Vien to Yen Bai. Some loss of vegetation and plantation areas close to the existing track between kms 277 to 280 near Lao Cai	Development of non-agricultural land and a 30m wide green belt on both sides of the proposed rail track. Additional land will be seeded with grass	Minor Negative Impact becoming positive after green belt is developed
	Loss of a small number of medium sized trees close to the existing track alignment (within 20 metres) which will obstruct the planned construction work. No loss of older and established trees since they are about 50-60 metres away from the existing track	Preventing construction staff from cutting trees for firewood. Loss of trees compensated by planting similar species in the proposed green belt on either side of the new track	Minor Negative impact for short period
	Impact on aquatic ecology during bridge construction, eg pile driving will increase sedimentation in the waterways below	Engineering design to minimise solid storage discharge to the water channel below	Minor Negative Impact, site specific, short term
Environmentally sensitive areas	No impacts	None	Nil

Environmental Parameter/Issue	Anticipated Impacts	Mitigation Measures	Degree of impact
Historical, Cultural and Archeological Sites	No impacts	None	Nil
Public Health & Safety	Increased risk of construction workers spreading sexually transmitted diseases and HIV/AIDS	A public Health officer will regularly inspect work camps and disseminate appropriate information	Minor negative impact, site specific
	The operations of local industrial complexes and petrol storage facilities, as seen near Van Phu station, Viet Tri and Phu Duc stations, may be affected during the construction phase of the project	Keep the businesses concerned regularly and fully informed about the proposed construction activities along with their likely impact and duration	

Table 3.2: Anticipated Impacts and Mitigation Measures : Operations Phase

Environmental Parameter/Issue	Anticipated Impacts	Mitigation Measures	Degrees of Impact
Degree of impact	Spillage of hazardous waste and materials including hydrocarbons	Collection and proper disposal at identified sites	Minor Negative
Water	Waste water from shops, maintenance facilities and stations	Establishing waste water treatment facilities at the largest stations	Minor Negative, site specific
	Major pollutants may be suspended solids, petroleum, COD and BOD	Treatment will include septic tank, oil separators and electro dialysis for heavy metals	
Air Quality	Dust and particulate matter from open and uncovered transportation of ores, coal and ground limestone	Transportation in closed containers. During open transportation they will be fully covered	Minor Negative , site specific
Noise and Vibration	Noise from train movements, stations and switching yards	Installation of sound barriers at noise generating locations and regular noise monitoring at these locations to check compliance to National standards	Major Negative Impact
	Excess levels of vibration result in damage to buildings adjacent to the track	Vibration level monitoring for compliance with National standards	
Solid Waste	Domestic and industrial waste from stations and maintenance facilities	Disposal at identified and approved sites. Sludge from treatment facilities recycled as fertilizer	Minor significant impact
Hazardous materials	Accidental spillage during transportation of chemicals and hazardous materials	Trains conveying toxic or hazardous chemicals shall comply with transportation procedures in accordance with National standards	Minor, but significant impact at specific locations
Soil Erosion	No significant erosion is expected to result from project activities	Regular supervision of the nearby embankments close to the track	No impact
Seismic Activity	Probable liquefaction of soils	Periodic seismic tests and supervision	Minor Negative
Flora and Fauna	Probable impact on aquatic ecology by discharge of untreated waste water	Proper treatment and disposal of waste water	No impact
Environmentally sensitive areas	No impacts are expected to result from project activities	None	No impacts
Historical, Cultural and Archeological sites	None	None	No impacts

Environmental Parameter/Issue	Anticipated Impacts	Mitigation Measures	Degrees of Impact
Public Safety and Health	Increase in sound and vibration levels affecting people living close to the track	Compliance with noise mitigation measures	Major, irreversible negative impact for long time
Induced Impacts	Increase in industrial activity leading to a rise in water and air pollution	Compliance with relevant emission and discharge standards	Minor negative impact
	Excessive commercialization affecting natural tourist locations in the mountainous regions	Planned growth with a focus on natural conservation	
	Major positive benefits such as significant reduction of road traffic, reduced transportation costs, growth in tourism potential especially the Sapa region, upgrading of tourist facilities, enhanced direct and indirect employment opportunities.	Provision of proper infrastructure and its maintenance, carefully planned growth and sound environmental planning etc	Significant Positive Impact

3.5 PUBLIC CONSULTATION AND DISCLOSURE

Pre-IEE informal consultation meetings were held during the initial survey and formal, pre-arranged Post-IEE environmentally focused meetings after the IEE was made available. During the informal consultation and focused meetings about 120 and 35 people were consulted respectively.

Questionnaires, in both English and Vietnamese, were distributed and their responses recorded. Various issues like overall need for the project, salient features of the project, environmental and social concerns were discussed during the meetings. Though more than seventy percent of the respondents supported the proposed project, they expressed concerns regarding :

- a. likely increase in the levels of noise and vibrations during train movements at increased speed and their impact on nearby sensitive receptors such as schools, clinics, hospitals and houses located close to the track,
- b. safety at level crossings,
- c. absence of proper solid waste and waste water management systems at railway stations especially at larger stations; and
- d. seriousness of compliance of the suggested mitigation measures by the contractors during the construction stage and by Viet Nam Railways during the operations phase.

Some of the respondents made additional suggestions such as :

1. banning all illegal and unmanned crossings;
2. placing signs near hospitals and schools and banning trains from sounding their horns near these places; and
3. encouraging or mandating the hiring of local people, especially those from ethnic minorities, to carry out part of the construction work.

The concerns expressed and received suggestions have all been noted and addressed.

3.6 FINDINGS AND RECOMMENDATIONS

The IEE studies showed that the major potential environmental issues resulting from the proposed project are :

- a. soil erosion and disposal during the construction phase,
- b. Impact on water quality of the Red River,
- c. Noise and vibration, and
- d. Waste water and solid waste management at railway stations.

Although there is a requirement to carry out monitoring of these impacts, no major long term significant environmental impacts are anticipated from the proposed project. The IEE study, therefore, at this feasibility study stage, is sufficient, without the requirement of more detailed study or Environmental Impact Assessment (EIA). Nevertheless the environmental issues suggested above will require detailed studies and these could be taken as stand alone projects, independent of this study, by the project proponents (VNR), before implementing the project.

3.7 CONCLUSIONS

The proposed Kunming- Haiphong transport corridor project is a link between Western mountainous provinces, the midland and delta provinces at the north band of the Red

River, reaching Hanoi. The proposed project will (i) improve transport infrastructure in an area rich in natural resources, (ii) augment a vital corridor for the national movement of passengers and freight, (iii) provide a link between the port of Haiphong in Viet Nam and Kunming in Yunnan province of People Republic of China for bilateral trade and (iv) enhance social and economic development and raise the living standard of local inhabitants.

Potential environmental impacts from the proposed project arise from: (i) earth work disposal, (ii) soil erosion, (iii) site specific degradation of surface water quality and (iv) noise pollution and vibration. No sensitive environmental sites were identified in the impact corridor of 5 km on either side of the alignment. Appropriate mitigation measures have been developed to minimize the degree of impacts.

The environmental benefits directly associated with the project include improvements in air pollution and improved energy efficiency. Transporting passengers and freight by trains generates significantly less total air pollution than road transport. In addition rail transport is considerably more energy efficient than equivalent truck transport, particularly for movement of freight. Based on the results of the present IEE, the adverse project environmental impacts can be minimized via the suggested Institutional requirements and Environmental Monitoring Plan resulting in completion of the EIA.

4 RESETTLEMENT AND LAND ACQUISITION

4.1 SCOPE OF RESETTLEMENT AND MINIMIZATION

The Resettlement Plan for the Kunming - Haiphong Transport Corridor Project TA 4050-VIE (hereafter referred to as the “Project”) covers all project components permanently⁴ impacting on land used by Affected Persons. **Affected Persons (AP)** are persons who will lose land, fixed assets or income as a result of land acquisition by the Project. The land area acquired by project components is referred to here as the project’s **Area of Impact**. The Resettlement Plan also covers land acquired for the establishment of resettlement sites for AP relocating from Lao Cai Rail Station. Table 4.1 sets out the main project components requiring land acquisition.

Table 4.1: Project Components Requiring Land Acquisition from Affected Persons

Location	Works	Unit	Amount
HANOI CITY			
Dong Anh District	Fly-over bridge	Item	1
VINH PHUC PROVINCE			
Thach Loi Rail Station	New loop	Item	1
Huong Canh Rail Station	New loop	Item	1
PHU THO PROVINCE			
Viet Tri Rail Station	Extension of 2 passing loops	m	96
Phu Duc Rail Station	Extension of 2 passing loops	m	98
Tien Kien Rail Station	New loop	Item	1
Chi Chu Rail Station	New loop	Item	1
Vu En Rail Station	New loop	Item	1
Mai Tung Commune	New station	Item	2
YEN BAI PROVINCE			
Co Phuc Rail Station	Extension of passing loop	m	56
Mau A Rail Station	Extension of passing loop	m	110
Mau Dong Rail Station	New loop	Item	1
Lam Giang Rail Station	Extension of passing loop	m	100
Lang Thip Rail Station	New loop	Item	1
Van Phu Rail Station	New loops	Item	3
Realignment km169-171	Realignment	m	2,973
LAO CAI PROVINCE			
Thai Van Rail Station	Extension of passing loop	m	93
Thai Nien Rail Station	Extension of passing loop	m	80
Xuan Giao Rail Station	Extension of 4 passing loops	m	563
Lao Cai Rail Station	New loops	Item	9
Realignment km 283-291	Realignment	m	6,073
Pho Moi Ward	Resettlement Site	Sq. m	46,700
Van Hoa Commune	Resettlement Site	Sq. m	61,000

Resettlement impacts were minimized by selecting the engineering options that affected the least number of persons, whilst maximising the line’s operational gains in improved safety and efficiency. For example, track extensions and passing loops were designed on the side of the Rail Station that affected the least number of people. In Huong Canh Rail Station, a protective wall was designed to prevent the line’s embankment from encroaching on a rural road. Also, the Project will generally apply a policy of attrition for clearing the Construction Corridor (7m from edge of embankment) and Safety Corridor

⁴ Temporary impacts will be addressed in the Civil works contracts once the project’s detailed designs have been completed.

(15m from edge of embankment), unless certain structures or land-uses create special risks to safety or line operations. This means that persons and their properties will *not* be evacuated from the corridors by the Project. However, persons will not be allowed to move into the corridor in the future. This approach was deemed appropriate for the national context, as clearing of the Construction and Safety Corridors is inconsistent along the entirety of the railway line. The main exceptions are in the sections of realignment, where clearing the Construction Corridor was deemed necessary for the safety of operations.

4.2 RESETTLEMENT PLANNING PROCESS

The Resettlement Plan is in accordance with the relevant laws and policies of the Socialist Republic of Vietnam and the Asian Development Bank (ADB). It was prepared by one international and one national resettlement specialist, in close collaboration with the Land Clearing Office (*Giai Phong Mat Bang*) of the Railway Project Management Unit (RPMU) and the relevant Railway Public Utility Companies (RPUC). Local authorities at commune, district and provincial levels were also involved in resettlement planning, particularly in identifying Affected Persons, disclosing the Project, and developing compensation and rehabilitation strategies in accordance with local laws and policies.

Resettlement planning was carried out from February to July 2006. Field surveying for the Inventory of Losses (IOL) and Socio-Economic Survey (SES) was carried out by Survey Teams from the RPUC⁵. The Project's resettlement specialists facilitated a half-day in-class training session for the Survey Teams concerning the pre-prepared data collection formats for the IOL and SES (Table 4.2). The training sessions were followed by field-testing, during which the resettlement specialists accompanied the Survey Teams at one or two project sites to give practical guidance on measuring the Area of Impact, identifying Affected Persons, facilitating the first Orientation Meeting (see below), and administering the IOL and SES.

Table 4.2: Schedule of RPUC Trainings

RPUC	Dates	Field-Testing Sites
Vinh Phu	March 16 - 17	Thach Loi, Huong Canh
Yen Lao	March 20 - 21	Co Phuc

The IOL was carried out with 100% of AP households in the project's Area of Impact (n=411) and the resettlement sites (n=180). The primary purpose of the IOL was to assess the quantity and quality of affected lands, fixed assets and income loss; determine severity of impacts on AP; and identify vulnerable groups. The SES was conducted with 21.89% of AP (n=90) in the project's Area of Impact and 21% of AP (n=38) in the resettlement sites. The primary purpose of the SES was to establish baseline data for monitoring resettlement impacts on the AP population, as well as to conduct social analyses for addressing gender and ethnic minority issues.

Data was compiled in a database (MS Excel) and analyzed by the resettlement specialists. Other aspects of the Resettlement Plan that required consultation with local authorities, such as the rehabilitation strategy and resettlement plans, were also carried out by the resettlement specialists together with RPMU. Investment plans for the resettlement sites were already prepared by the Lao Cai City People's Committee, but they were reviewed by the resettlement specialists to ensure concurrence with ADB

⁵ Due to time constraints an independent Consultant was appointed to carry out the required field surveys for the sections of realignment and the flyover bridge in Dong Anh.

policy. The process for public consultation and disclosure of the Resettlement Plan is described overleaf.

The Resettlement Plan will be submitted to the Ministry of Transport and the ADB for final review and approval.

4.3 AFFECTED PERSONS

Two main groups of AP were identified in the Resettlement Plan, (1) AP in the project's Area of Impact and (2) AP in the resettlement sites. A total of 1,772 AP in 411 households were identified in the Area of Impact (Table 4.3), while 606 AP in 180 households were identified in the resettlement sites (Table 4.4). Hence, the total number for the project is 2,378 AP in 591 households. All AP will be equally entitled to cash compensation and other project benefits as defined in the Entitlement Matrix of the Resettlement Plan.

Severely Affected Persons (SAP) are persons that will lose more than 10% of their productive assets or they are required to physically relocate. A total of 208 SAP households were identified in the project's Area of Impact, of which 93 households will lose more than 10% of their productive assets and 122 households will be required to relocate⁶; while all 180 households in the resettlement sites were identified as SAP. Households required to relocate will receive special assistance allowances for income rehabilitation, subsistence in transition, and transport, as detailed below. Households losing more than 10% of productive assets will receive special assistance allowances for income rehabilitation and subsistence in transition.

Vulnerable Groups are persons from a particular social or economic group who face elevated risks of impoverishment as a result of resettlement. The vulnerable groups identified in the project's Area of Impact and resettlement sites were 32 ethnic minority households, 84 single female-headed households with dependents, 25 poor households, eight (8) households whose primary income earner is elderly or physically disabled, and twelve (12) households who are landless or whose current land tenure is unstable. All AP households from a vulnerable group will receive a special assistance allowance for income rehabilitation. Specific actions have also been devised for gender and ethnic minority issues.

⁶ The two categories of SAP are non-exclusive, meaning that one household can belong to both categories. Hence, the total SAP is less than the sum of SAP in the two categories.

Table 4.3: Affected Persons in Area of Impact (No.)

Area of Impact	Persons	House-holds	Vulnerable Groups						SAP	
			Sgl.FHH	Disabled	Elderly	Poor	Landless	EM	>10%	Relocating
HANOI	231	50	3	0	0	0	0	0	2	3
Dong Anh	231	50	3	0	0	0	0	0	2	3
VINH PHUC	20	4	0	0	0	0	0	0	4	0
Thach Loi	11	2	0	0	0	0	0	0	2	0
Huong Canh	9	2	0	0	0	0	0	0	2	0
PHU THO	420	82	2	0	0	4	0	0	49	3
Viet Tri	21	4	1	0	0	1	0	0	3	0
Phu Duc	6	1	0	0	0	0	0	0	0	0
Tien Kien	13	3	0	0	0	0	0	0	0	0
Chi Chu	50	9	0	0	0	0	0	0	5	0
Vu En	45	7	0	0	0	1	0	0	4	0
Mai Tung	285	58	1	0	0	2	0	0	37	3
YEN BAI	518	129	48	1	4	9	4	4	25	26
Co Phuc	39	8	1	0	0	0	1	1	0	0
Mau A	32	8	6	0	0	0	0	3	4	1
Mau Dong	28	7	2	0	0	0	0	0	0	0
Lam Giang	24	6	2	0	0	0	0	0	6	0
Lang Thip	102	21	5	0	1	7	2	0	2	2
Van Phu	69	23	8	1	2	1	1	0	0	17
Realignment km169-	224	56	24	0	1	1	0	0	13	6
LAO CAI	583	146	25	0	2	12	8	23	13	90
Thai Van	11	2	1	0	0	0	0	0	1	0
Thai Nien	11	2	1	0	0	1	0	1	0	0
Xuan Giao	46	7	0	0	0	1	4	5	3	0
Lao Cai	329	92	16	0	0	6	0	10	1	90
Realignment km283-	186	43	7	0	2	4	4	7	8	0
TOTAL	1772	411	78	1	6	25	12	27	93	122

Table 4.4: Affected Persons in Resettlement Sites (No.)

Resettlement Sites	Persons	House-holds	Vulnerable Groups						SAP	
			Sgl.FHH	Disabled	Elderly	Poor	Landless	EM	>10%	Relocating
Pho Moi	155	50	4	0	0	0	0	3	4	50
Van Hoa	451	130	2	0	1	0	0	2	6	130
TOTAL	606	180	6	0	1	0	0	5	10	180

Table 4.5: Land Loss by Affected Person in Area of Impact (No.)

Area of Impact	Agricultural Land			Residential Land			Garden/ Pond	Forest	Common Lands	Renters	Illegal Users
	Marginal	Severe	Total	Reorganize	Relocate	Total					
HANOI	0	0	0	44	3	47	3	0	0	0	0
Dong Anh	0	0	0	44	3	47	3	0	0	0	0
VINH PHUC	0	4	4	0	0	0	0	0	0	0	4
Thach Loi	0	2	2	0	0	0	0	0	0	0	2
Huong Canh	0	2	2	0	0	0	0	0	0	0	2
PHU THO	26	49	75	9	3	12	12	0	0	0	7
Viet Tri	0	3	3	1	0	1	2	0	0	0	2
Phu Duc	1	0	1	0	0	0	0	0	0	0	0
Tien Kien	0	0	0	3	0	3	1	0	0	0	1
Chi Chu	4	5	9	0	0	0	1	0	0	0	3
Vu En	2	4	6	0	0	0	0	0	0	0	0
Mai Tung	19	37	56	5	3	8	8	0	0	0	1
YEN BAI	12	23	35	40	26	66	39	5	2	5	0
Co Phuc	8	0	8	0	0	0	0	0	0	0	0
Mau A	4	4	8	0	1	1	0	0	0	0	0
Mau Dong	0	0	0	2	0	2	5	0	0	2	0
Lam Giang	0	6	6	0	0	0	0	0	0	0	0
Lang Thip	0	0	0	14	2	16	3	0	0	3	0
Van Phu	0	0	0	3	17	20	0	0	2	0	0
Realignment km169-171	0	13	13	21	6	27	31	5	0	0	0
LAO CAI	5	12	17	12	90	102	34	8	0	0	7
Thai Van	1	1	2	1	0	1	1	0	0	0	0
Thai Nien	0	0	0	2	0	2	1	0	0	0	0
Xuan Giao	4	3	7	1	0	1	0	0	0	0	0
Lao Cai	0	0	0	0	90	90	6	0	0	0	7
Realignment km283-291	0	8	8	8	0	8	26	8	0	0	0
TOTAL	43	88	131	105	122	227	88	13	2	5	18

Table 4.6: Land Loss by Affected Person in Resettlement Sites (No.)

Resettlement Sites	Agricultural Land			Residential Land			Garden/ Pond	Forest	Common Lands	Renters	Illegal Users
	Marginal	Severe	Total	Reorganize	Relocate	Total					
Pho Moi	0	0	0	0	50	50	7	0	0	0	0
Van Hao	0	0	0	0	130	130	107	0	0	2	0
TOTAL	0	0	0	0	180	180	114	0	0	2	0

Table 4.7: Area of Land Acquisition in Area of Impact (sq.m)

Area of Impact	Residential	Agricultural						Garden /Pond	Forest	Common Land	Renter	Illegal	TOTAL
		I	/Pond	III	IV	V	TOTAL						
HANOI	2,052	0	0	0	0	0	0	1,071	0	0	0	0	3,123
Dong Anh	2,052	0	0	0	0	0	0	1,071	0	0	0	0	3,123
VINH PHUC	0	0	0	0	0	0	0	0	0	0	0	322	0
Thach Loi	0	0	0	0	0	0	0	0	0	0	0	212	0
Huong Canh	0	0	0	0	0	0	0	0	0	0	0	110	0
PHU THO	1,945	2,775	14,717	191	0	0	17,682	11,932	0	0	0	879	31,559
Viet Tri	0	8	0	0	0	0	8	18	0	0	0	282	26
Phu Duc	0	92	0	0	0	0	92	0	0	0	0	0	92
Tien Kien	31	0	0	0	0	0	0	108	0	0	0	108	139
Chi Chu	0	462	0	191	0	0	653	105	0	0	0	439	758
Vu En	0	519	496	0	0	0	1,015	0	0	0	0	0	1,015
Mai Tung	1,914	1,694	14,22	0	0	0	15,915	11,701	0	0	0	50	29,530
YEN BAI	10,361	12,78	1,160	849	0	0	14,789	24,827	3,200	4,991	91	0	58,169
Co Phuc	0	0	0	849	0	0	849	0	0	0	0	0	849
Mau A	50	0	759	0	0	0	759	0	0	0	0	0	809
Mau Dong	76	0	0	0	0	0	0	841	0	0	75	0	917
Lam Giang	0	80	401	0	0	0	481	0	0	0	0	0	481
Lanq Thip	1,199	0	0	0	0	0	0	716	0	0	16	0	1,915
Van Phu	2,651	0	0	0	0	0	0	0	0	4,991	0	0	7,642
Realign. km169-171	6,385	12,70	0	0	0	0	12,700	23,270	3,200	0	0	0	45,555
LAO CAI	14,918	8,350	906	400	0	26	9,916	21,763	15,44	0	0	753	62,046
Thai Van	165	0	0	0	0	26	260	350	0	0	0	0	775
Thai Nien	119	0	0	0	0	0	0	238	0	0	0	0	357
Xuan Giao	0	0	906	0	0	0	906	0	0	0	0	0	906
Lao Cai	10,704	0	0	0	0	0	0	4,554	0	0	0	753	15,258
Realign. Km283-291	3,930	8,350	0	400	0	0	8,750	16,622	15,44	0	0	0	44,751
TOTAL	29,276	23,90	16,78	1,44	0	26	42,387	59,593	18,64	4,991	91	1,954	154,896

Table 4.8: Area of Land Acquisition in Resettlement Sites (sq.m)

Area of Impact	Residential	Agricultural						Garden /Pond	Forest	Common Land	Renter	Illegal	TOTAL
		I	II	III	IV	V	TOTAL						
Pho Moi	4,017	0	0	0	0	0	0	4,300	0	0	0	0	8,317
Van Hoa	12,234	0	0	0	0	0	0	48,635	0	0	520	0	60,869
TOTAL	16,251	0	0	0	0	0	0	52,935	0	0	520	0	69,186

4.4 SCOPE OF LOSSES

The main types of land loss as a result of the Project are agricultural land, residential land, garden or pond land, forest land and common lands. Under Vietnamese policy, Commercial land is categorized as residential land under Vietnamese law, although the compensation price for residential land in locations with commercial potential is usually higher. All legal and legalizable land-users will receive replacement land of equal value and/or cash compensation at replacement cost in current markets for land acquired by the Project. Renters will receive 30% of the total compensation value of the acquired land area. Illegal land-users will not be compensated for land, but all land-users will be compensated for houses, structures, trees, standing crops or other investments they have made on the land and for losses in income from affected businesses or employment.

In the project's Area of Impact, 131 AP households will lose agricultural land, of which 43 will be marginally affected ($\leq 10\%$ loss) and 88 will be severely affected ($>10\%$ loss) (Table 4.5). A total of 227 AP households will lose residential land, of which 105 will reorganize on their remaining land and 122 will relocate. Of the households required to relocate, 74% are from Lao Cai Rail Station and for whom two resettlement sites in Lao Cai City have been planned. A total of 88 AP households will lose garden land and 13 households will lose forest land. Only 5 households were renting land and 18 households were identified as illegal land-users.

In the resettlement sites, a total of 180 households will lose residential land, all of whom will relocate⁷. Among them, 114 households will also lose garden land.

In the project's Area of Impact, the total area of land acquired from AP households will be approximately 155,000 sq.m, consisting of 29,000 sq.m of residential land, 42,000 sq.m of agricultural land, 60,000 sq.m of garden⁸ or pond land, 19,000 sq.m of forestland and 5,000 sq.m of common land (Table 4.7). In the resettlement sites, the total area of acquired land will be approximately 69,000 sq.m, consisting of 16,000 sq.m of residential land and 53,000 sq.m of garden land.

In the project's Area of Impact, 177 houses will be impacted, of which 49 houses will be partially affected and 128 houses will be left structurally unsound and, hence, entirely affected (Table 4.9). Another 163 houses will be impacted in the resettlement sites, all of which will be entirely affected.

Table 4.9: Impacts on Houses in Area of Impact (No.)

Area of Impact	House Category								
	C3		C4		Temp		TOTAL		
	Pt	En	Pt	En	Pt	En	Pt	En	TT
HANOI	3	4	10	3	0	1	13	8	21
Dong Anh	3	4	10	3	0	1	13	8	21
PHU THO	1	2	0	3	1	1	2	6	8
Tien Kien	1	0	0	0	0	0	1	0	1
Mai Tung	0	2	0	3	1	1	1	6	7
YEN BAI	6	2	20	10	5	0	31	12	43

⁷ AP currently located in the area designated for the resettlement sites will be given first priority for acquiring residential land plots in the resettlements sites (i.e., same general area). However, they are still defined as relocating AP because the resettlement site will require the complete reorganization of current land use in those sites.

⁸ Agricultural land in residential areas is classified as "garden" land under Vietnamese legislation, usually with a higher compensation price than the highest category of agricultural land.

Area of Impact	House Category								
	C3		C4		Temp		TOTAL		
	Pt	En	Pt	En	Pt	En	Pt	En	TT
Lang Thip	0	0	0	10	0	0	0	10	10
Van Phu	5	1	8	0	3	0	16	1	17
Realignment km169-171	1	1	12	0	2	0	15	1	16
LAO CAI	0	6	1	83	2	13	3	102	105
Thai Van	0	1	0	0	0	0	0	1	1
Thai Nien	0	0	1	0	0	0	1	0	1
Lao Cai	0	5	0	82	0	9	0	96	96
Realignment km283-291	0	0	0	1	2	4	2	5	7
TOTAL	10	14	31	99	8	15	49	128	177

Table 4.10: Impacts on Houses in Resettlement Sites (No.)

Resettlement Sites	House Category								
	C3		C4		Temp		TOTAL		
	Pt	En	Pt	En	Pt	En	Pt	En	TT
Pho Moi	0	0	0	39	0	5	0	44	44
Van Hoa	0	6	0	61	0	52	0	119	119
TOTAL	0	6	0	100	0	57	0	163	163

A total of 554 structures will be impacted in the project's Area of Impact and 397 structures in the resettlement sites.

An approximate total area of 45,000 sq.m of annual crops and 8,600 trees will be impacted in the project's Area of Impact and an approximate 6,000 sq.m of annual crops and 2,900 trees in the resettlement sites.

In the project's Area of Impact, 46 businesses will be affected, of which 41 will be able to re-build on the AP's remaining land and 5 will be required to relocate. Of these 46 businesses, eleven (11) are already legally registered. The employment of 40 persons will also be affected as a result of the Project, of which 18 are employees of affected businesses and 22 are sharecroppers. In the resettlement sites, ten (10) businesses will be required to relocate and two (2) employees in these businesses will be affected. None of the businesses in the resettlement sites are legally registered.

Table 4.11: Impacts on Structures in Area of Impact

Area of Impact	Bath-room	Court/Floor		Fence			House Fndtn	Grave	Hut	Kitchen	Kitchen Counter	Roof	Animal Stables	Toilet	Wall	Water Piping	Water Tank	Well	
		Tiled	Concr.	Steel	Living	Concr												Drilled	Ground
		sq.m	sq.m	sq.m	sq.m	Sq.m	cu.m	Item	sq.m	sq.m	sq.m	sq.m	sq.m	sq.m	sq.m	m	cu.m	m	Item
HANOI	0	0	1,135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dong Anh	0	0	1,135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VINH PHUC	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Huong Canh	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PHU THO	18	98	305	16	0	24	0	1	17	425	3	0	179	232	76	445	11	0	5
Tien Kien	2	0	0	16	0	0	0	0	0	7	0	0	0	0	0	0	0	0	1
Vu En	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	375	0	0	0
Mai Tung	14	98	305	0	0	24	0	0	17	419	3	0	179	232	76	70	11	0	4
YEN BAI	56	34	266	0	38	1	60	0	0	465	0	133	127	277	370	0	162	3	19
Lang Thip	4	34	246	0	38	1	60	0	0	8	0	133	64	22	88	0	3	3	1
Van Phu	52	0	0	0	0	0	0	0	0	149	0	0	37	57	282	0	147	0	14
Realign. km169-171	0	0	20	0	0	0	0	0	0	308	0	0	26	199	0	0	12	0	4
LAO CAI	17	0	702	17	12	0	0	0	27	547	0	59	104	377	113	0	19	0	55
Thai Van	0	0	42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Thai Nien	0	0	24	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lao Cai	17	0	616	17	0	0	0	0	27	513	0	59	84	377	113	0	19	0	52
Realign. Km283-291	0	0	20	0	0	0	0	0	0	34	0	0	20	0	0	0	0	0	2
TOTAL	91	132	2,407	58	49	25	60	1	44	1,437	3	192	410	886	559	445	192	3	79

Table 4.12: Impacts on Structures in Resettlement Sites

Resettlement Sites	Bath-room	Court/Floor		Fence			House Fndtn	Grave	Hut	Kitchen	Kitchen Counter	Roof	Animal Stables	Toilet	Wall	Water Piping	Water Tank	Well	
		Tiled	Concr.	Steel	Living	Concr												Drilled	Ground
		sq.m	sq.m	Sq.m	sq.m	sq.m	cu.m	Item	sq.m	sq.m	sq.m	sq.m	sq.m	sq.m	sq.m	m	cu.m	m	Item
Pho Moi	0	0	61	0	0	0	0	0	0	230	0	0	71	168	0	0	9	0	5
Van Hoa	52	0	1,302	0	0	0	0	0	0	1,284	0	192	626	35	0	0	49	0	56
TOTAL	52	0	1,363	0	0	0	0	0	0	1,514	0	192	697	203	0	0	58	0	61

Table 4.13: Impacts on Crops and Trees in Area of Impact

Area of Impact	Annual Crops (sq.m)								Trees			
	Rice	Corn	Sugar Cane	Cas-sava	Sweet Potato	Herbs /Leaves	Gourd /Vines	TOTAL	Fruit	Timber/ Bamboo	Shade/ Décor.	TOTAL
HANOI	0	0	0	0	0	0	0	0	39	70	5	114
Dong Anh	0	0	0	0	0	0	0	0	39	70	5	114
VINH PHUC	212	0	0	0	0	50	0	262	4		0	13
Thach Loi	212	0	0	0	0	0	0	212	0	0	0	0
Huong Canh	0	0	0	0	0	50	0	50	4	9	0	13
PHU THO	15,570	105	0	35	492	1,785	104	18,091	586	826	291	1,703
Viet Tri	0	0	0	0	217	65	0	282	2	0	0	2
Phu Duc	0	0	0	0	0	0	0	0	0	0	0	0
Tien Kien	0	0	0	0	0	0	0	0	3	2	0	5
Chi Chu	621	0	0	0	193	330	0	1,144	2	22	0	24
Vu En	164	0	0	0	0	268	0	432	0	512	0	512
Mai Tung	14,785	105	0	35	82	1,122	104	16,233	579	290	291	1,160
YEN BAI	4,553	300	300	4,102	70	744	100	10,169	931	2,097	6	3,014
Co Phuc	542	0	0	0	0	0	0	542	0	0	0	0
Mau A	719	0	0	0	0	0	0	719	0	0	0	0
Mau Dong	0	0	0	562	0	0	0	562	22	253	0	275
Lam Giang	332	0	0	0	0	0	0	332	15	0	0	15
Lang Thip	0	0	0	20	0	0	0	20	114	13	6	113
Van Phu	0	0	0	0	0	204	0	204	122	0	0	122
Realignment km169-171	2,960	300	300	3,520	70	540	100	7,790	658	1,831	0	2,489
LAO CAI	9,856	150	2	3,531	0	2,638	154	16,330	2,686	1,154	0	3,780
Thai Van	200	0	0	0	0	5	0	205	10	20	0	30
Thai Nien	0	0	2	325	0	0	0	327	8	2	0	10
Xuan Giao	906	0	0	0	0	0	0	906	0	0	0	0
Lao Cai	0	0	0	56	0	543	4	603	410	30	0	440
Realignment km283-291	8,750	150	0	3,150	0	2,090	150	14,290	2,258	1,102	0	3,300
TOTAL	30,190	555	302	7,668	562	5,216	358	44,851	4,246	4,147	302	8,624

Table 4.14: Impacts on Crops and Trees in Resettlement Sites

Resettlement Sites	Annual Crops (sq.m)								Trees			
	Rice	Corn	Sugar Cane	Cassava	Sweet Pot	Herbs/Leaves	Gourd/Vines	TOTAL	Fruit	Timber/Bamboo	Shade/Decor	TOTAL
Pho Moi	0	0	0	0	0	1,300	0	1,300	178	2	13	193
Van Hoa	0	0	0	0	0	4,697	0	4,697	2,534	219	3	2,756
TOTAL	0	0	0	0	0	5,997	0	5,997	2,712	221	16	2,949

Table 4.15: Impacts on Businesses and Employment in Area of Impact

Area of Impact	Businesses (No. AP HH)																								Employment				
	Store /Shop		Hair Salon		Mech- anic		Resta- urant		Guest House		Café/ Karaoke		Phar- macy		Fruit Stand		Phone /Elec.		Other		TOTAL			Lic.		(No. pers.)			
	B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L	tt	B	L	T	P	S	tt
HANOI	6	1	0	0	3	0	0	0	1	0	1	0	1	0	0	0	0	0	18	1	30	2	32	7	0	10	0	0	10
Dong Anh	6	1	0	0	3	0	0	0	1	0	1	0	1	0	0	0	0	0	18	1	30	2	32	7	0	10	0	0	10
PHU THO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	2	2	0	8	0	1	9
Tien Kien	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	2	2	0	8	0	1	9
YEN BAI	3	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	4	0	9	2	11	0	2	0	0	21	21
Mau Dong	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
Lang Thip	3	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4	0	8	2	10	0	2	0	0	21	21
LAO CAI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0
Lao Cai	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0
TOTAL	9	3	0	0	3	0	2	0	1	0	1	0	1	0	0	0	0	0	24	2	41	5	46	9	2	18	0	22	40

Note: B=Rebuild; L=Relocate; T=Temporarily Affected Employees; P=Permanently Affected Employees; S=Sharecroppers; tt=Total

Table 4.16: Impacts on Businesses and Employment in Resettlement Sites

Resettlement Sites	Businesses (No. AP HH)																				Employment								
	Store /Shop		Hair Salon		Mech- anic		Resta- urant		Guest House		Café/ Karaoke		Phar- macy		Fruit Stand		Phone /Elec.		Other		TOTAL			Lic.		(No. pers.)			
	B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L	tt	B	L	T	P	S	tt
Pho Moi	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	0	0	0	0	0	0
Van Hoa	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	5	0	6	6	0	0	2	0	0	2	
TOTAL	0	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	5	0	10	10	0	0	2	0	0	2	

Note: B=Rebuild; L=Relocate; T=Temporarily Affected Employees; P=Permanently Affected Employees; S=Sharecroppers; tt=Total

Special assistance allowances will be provided to SAP and vulnerable groups to help eliminate risks of impoverishment as a result of resettlement. **Income rehabilitation assistance** will be awarded in kind at a value of 3,000,000 VND for one male and one female member in each household that is an SAP or vulnerable group. Income rehabilitation assistance may take the form of training, preferential credit, start-up materials or other technical or material needs, as described below. An allowance for **subsistence** in transition will be awarded in cash or in kind to SAP households at a minimum value of 30 kg rice per household member for six months. A **transport** allowance will be awarded in cash to relocating households at a value ranging from two (2) to five (5) million VND, as determined by the Provincial People's Committee. In the project's Area of Impact, 268 AP households will be entitled to income rehabilitation assistance, 207 of these households will also be entitled to the subsistence allowance and 119 of these households will further be entitled to the transport allowance, while all 180 households in the resettlement sites will be entitled to all three allowances.

Table 4.17: Special Assistance Allowances in Area of Impact (No. AP HH)

Area of Impact	Income Rehab Assistance		
		Subsistence	
			Transport
HANOI	6	3	0
Dong Anh	6	3	0
VINH PHUC	4	4	0
Thach Loi	2	2	0
Huong Canh	2	2	0
PHU THO	52	50	3
Viet Tri	4	3	0
Phu Duc	0	0	0
Tien Kien	0	0	0
Chi Chu	5	5	0
Vu En	4	4	0
Mai Tung	39	38	3
YEN BAI	83	48	26
Co Phuc	3	0	0
Mau A	8	5	1
Mau Dong	2	0	0
Lam Giang	6	6	0
Lang Thip	13	2	2
Van Phu	17	16	17
Realign km169-171	34	19	6
LAO CAI	123	102	90
Thai Van	2	1	0
Thai Nien	2	0	0
Xuan Giao	6	3	0
Lao Cai	90	90	90
Realign km283-291	23	8	0
TOTAL	268	207	119

Table 4.18: Special Assistance Allowances in Resettlement Sites (No. AP HH)

Resettlement Sites	Income Rehab Assistance		
		Subsistence	
			Transport
Pho Moi	50	50	50
Van Hoa	130	130	130
TOTAL	180	180	180

4.5 REHABILITATION STRATEGY AND RESETTLEMENT SITES

The primary strategy for ensuring that AP are able to maintain or improve pre-project living standards and production levels is replacement value compensation in cash or in kind (e.g. replacement land) for all losses in land, fixed assets and income. In addition, special assistance allowances will be awarded to Severely Affected Persons (SAP) and vulnerable groups (as defined above) to support them in re-establishing their income sources and production bases. The specific application of funds designated for income rehabilitation assistance will be decided together with the relevant People's Committee and the eligible AP households, depending on the income opportunities available in the locality and the specific needs and interests of the AP. Examples of uses for these funds are training, micro-credit funds and start-up materials and equipment for new businesses. Because nearly all project sites counted less than five (5) SAP, the specific strategy for their rehabilitation will be determined on a case-by-case basis together with local authorities during implementation of the Resettlement Plan. However, a more elaborate rehabilitation strategy has been developed for project components with more than 20 SAP, namely the new Rail Station at Mai Tung and Lao Cai Rail Station, as well as at both resettlement sites.

Based on consultations with local authorities, RPMU and RPUC, the rehabilitation strategies in Mai Tung and Lao Cai emphasize replacement land where available, notably at Mai Tung; finding new employment, such as by assisting AP to secure jobs at the new Rail Station in Mai Tung or Industrial Zones currently being developed in Lao Cai; developing non-land based businesses, such as by reserving land spaces at the Rail Station for AP to build small service sector businesses; and integrating rehabilitation efforts with the social and economic development programs and policies of local government and NGOs present in the area, such as the Vocational Training and Support Centres in Lao Cai City.

The Lao Cai City People's Committee has also planned Resettlement Sites to accommodate the 90 AP households who will relocate from Lao Cai Rail Station. The People's Committee is currently preparing several different resettlement sites in and around Lao Cai City to accommodate displaced persons from various economic development projects, such as the upgrading of the Lao Cai Rail Station. The particular resettlement sites that will be used by the Project are located in Pho Moi Ward and Van Hoa Commune⁹ in Lao Cai City. The resettlement site in Pho Moi Ward will comprise an area of approximately 40,800 sq.m and it will be able to accommodate 110 households. The resettlement site in Van Hao Commune will comprise an area of 40,500 sq.m and 220 households. The resettlement sites will provide each incoming household with a residential land plot of 80-100 sq.m, as well as make investments in road access, residential electricity, residential water supply and drainage. AP will be required to purchase the residential plots with their compensation money, if they so wish. The Lao Cai City People's Committee will engage in amortization schemes with households who may not have money to purchase a plot in the resettlement sites, whereby the AP would pay-off the purchase price over a period of time determined together with the People's Committee.

4.6 PUBLIC CONSULTATION AND DISCLOSURE

Because the project's Area of Impact can be generally described as many project sites with few AP households in each site, the first Orientation Meeting was carried out simultaneously with the IOL and SES and facilitated by the Survey Teams in each

⁹ Note that Lao Cai City People's Committee is currently preparing two resettlement sites in Van Hao Commune. The one that is proposed for use by the Project is located along Road M12.

project site. The resettlement specialists trained the Survey Teams on basic information for the Meeting during the data collection training and provided a standard checklist of main points to be covered at each meeting. This checklist was then signed by the Head of the Survey Team, commune official and at least one AP household, as the Meeting Minutes. The checklist also provided space to detail other topics covered at the Meeting and any comments or questions arising from the AP. Participants were also asked to sign an attendance sheet, where further space was reserved for individual comments. The primary purpose of the first Orientation Meeting was to familiarize AP with basic information on the Project, the Project's principles for resettlement, and the process for developing the Resettlement Plan.

After the draft Resettlement Plan was complete, the Project convened the second Orientation Workshop. The Orientation Workshop was co-facilitated by the national resettlement specialist and RPMU. One workshop was held in Lao Cai Rail Station covering all project components within the Yen-Lao RPUC; and another workshop was held at the Vinh Phu RPUC for all project component within its jurisdiction, as well as the fly-over bridge in Dong Anh under the Thai Ha RPUC. The primary purpose of the Orientation Workshop was to present and explain the Resettlement Plan and gain feedback from local authorities, AP representatives and other relevant stakeholders. The Project Information Booklet and the ADB's Information Guide on public consultation and the ADB accountability mechanism were also circulated at the Orientation Workshop, as well as copies delivered to each of the project sites for circulation to all AP.

Comments and concerns raised at the Orientation Workshops were incorporated into the final Resettlement Plan. Once the Resettlement Plan is approved, copies will be distributed to each RPUC and Provincial, District and Commune People's Committees with project components. AP will be entitled to consult the Resettlement Plan at any time, in coordination with the RPUC or the relevant People's Committee. A copy of the final Resettlement Plan will also be posted on the ADB's website.

4.7 GENDER AND ETHNIC MINORITY ISSUES

In accordance with ADB policy, special provisions have been made to hinder discrimination against women and ethnic minorities in the implementation of the Resettlement Plan. Women and girls comprised exactly 50% (878 AP) of the AP population, while single female-headed households comprised 15% (58 households) of AP households. To ensure sensitivity to gender issues, the following actions will be taken during implementation of the Resettlement Plan:

- Engage an international specialist in Gender and Social Development to help ensure that gender sensitivity in the implementation of the Resettlement Plan issues;
- Allocate any awarded replacement land in the names of both the male and female heads of the AP households;
- Provide funds for Income Rehabilitation Assistance for one male and one female labourer in each of the eligible AP households;
- Involve the local Women's Union in helping to organize programs for administering funds for Income Rehabilitation Assistance for groups of AP households, notably in Mai Tung and Lao Cai City.
- Ensure that women have equal access to project information by ensuring that at least 30% of participants in Resettlement Training are women;

- Ensure that Resettlement Training for project authorities and AP representatives adequately addresses gender issues;
- Disaggregate social and economic monitoring data according to gender, as it has already been done for the baseline data collected in the Socio-Economic Survey (see above)
- Require that a gender specialist is part of the Independent Monitoring Unit (see below)

Ethnic minorities were under-represented in the AP population, comprising only 5% (32 households) of AP households compared to the 14% that ethnic minorities comprise in the national population. Furthermore, no large groups of more than 10 (ten) AP households were found living together as a single community in the project's Area of Impact or the resettlement sites. Rather, socio-economic data collected by the Project indicated that ethnic minority AP exhibited similar levels of social and economic attainment as their Kinh counterparts. Hence, an Ethnic Minority Development was deemed unnecessary for this Project. However, the following Ethnic Minority Specific Actions will be taken during implementation of the Resettlement Plan:

- Require that the international and national specialists have expertise and background in addressing Ethnic Minority issues
- Provide funds for Income Rehabilitation Assistance for all Ethnic Minority AP households
- Involve the local Committees for Ethnic Minorities and Mountainous Affairs (CEMMA) in helping to organize Income Rehabilitation Assistance for groups of AP households, notably in Mai Tung and Lao Cai City.
- Ensure that Ethnic Minorities have equal access to project information, particularly by ensuring that at least one ethnic minority AP representative for each project site with Ethnic Minority AP attends Resettlement Training
- Ensure that Resettlement Training for project authorities and AP representatives adequately addresses ethnic minority issues
- Disaggregate social and economic indicators in monitoring data for AP according to ethnic minority households, as it has already been done for the baseline data collected in the Socio-Economic Survey (see above)
- Require that specialists of the Independent Monitoring Unit have expertise and background in ethnic minority issues
- Monitor the distribution of compensation payments and other project awards to ensure that no discrimination is exercised against Ethnic Minority AP households

4.8 GRIEVANCES AND COMPLAINTS

AP may file complaints about implementation of the Resettlement Plan through the national system for addressing grievances and complaints or the ADB's accountability mechanism. In the national system, the AP should first file the complaint with the Commune or District People's Committee. The AP may also address the RPUC or RPMU for assistance in filing the complaint. If the AP is dissatisfied with the resolution by the Commune People's Committee, the AP may then appeal to the District People's Committee and again, if necessary, to the Provincial People's Committee. If the AP remains dissatisfied, then the AP may seek to redress grievances through the national

court system. All administrative or legal fees for AP's complaints will be waived, excluding costs incurred for processing the complaint through the national court system.

The AP may also file complaints directly to the ADB through the ADB's Accountability Mechanism. The AP will be first encouraged to resolve their complaints at the local level or through the national system. However, the AP may also file the complaint directly to ADB's Office of the Special Project Facilitator in Manila, Philippines. The procedures for seeking to redress grievances through the Office of the Special Project Facilitator are described in the ADB Information Guide circulated to AP (see above).

4.9 INSTITUTIONAL ORGANIZATION AND IMPLEMENTATION SCHEDULE

The main institution responsible for executing the Resettlement Plan will be the RPMU, under the supervision of Vietnam Railways and the Ministry of Transport and in close coordination with the relevant Provincial People's Committees. The Provincial People's Committees will establish the Compensation and Resettlement Boards at the provincial and district levels for updating and implementation of the Resettlement Plan. The Project will also hire one international and one national Resettlement Specialist with expertise in ethnic minority issues, as well as one international Gender and Social Development specialist.

The envisioned timeframe for implementing the Resettlement Plan is 10 months, as illustrated in Table 4.19.

Table 4.19: Implementation Schedule

ACTIVITY	IMPL. UNIT	MONTH										
		First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth	Tenth	...until end
Establishment of CARB	CARB											
Resettlement training for implementing units and relevant institutions (e.g., Women's Union, Farmers' Union, CEMMA)	RPMU, PPC											
Resettlement training for Affected Persons and local authorities (e.g., Commune officials) and related organizations (e.g., NGO)	RPMU, PPC											
Public consultation and information dissemination with AP on implementation of Resettlement Plan	CARB											
Revised list of AP & updated Detailed Measurement Survey for Resettlement Plan	CARB											
Establishment of compensation rates and prices	CARB											
Disclosure of Compensation Plan to AP & Review of Special Rehabilitation Assistance Programs	RPMU & CARB											
Submit updated Resettlement Plan to GoV and ADB for review and approval	GOV & ADB											
Compensation payments and establishment of timeframe for land clearing and relocation	RPMU											
Independent monitoring of Resettlement Plan and Compensation Payments	IMO											
Land clearing and relocation from Project Area	AP & RPMU											
Award construction contracts and execute civil works	RPMU											
Plan and implement Special Rehabilitation Assistance Programs	PPC											
Supervision and internal monitoring	RPMU											
External monitoring and evaluation	IMO											

4.10 BUDGET

All costs for resettlement will be financed by the Government of Vietnam, except for the costs of consulting services, which will be included in the loan. The total cost for implementing the Resettlement Plan is estimated at 76.9 billion VND (approx. 4.8 million USD), of which 37.5 billion VND (approx. 2.4 million USD) is for compensation costs in the project's Area of Impact, 9.5 billion VND (approx. 0.6 million USD) for compensation costs in the resettlement sites, and 5.4 million VND (0.3 million USD) is for surveying and consulting costs (Table 4.20).

Table 4.20: Total Estimated Cost for Project

No.	CATEGORY	QUANTITY	COST	
			1000d	USD
AREA OF IMPACT				
1	COMPENSATION COSTS		37,516,686	2,352,143
a.	LAND	154,987	26,492,410	1,660,966
b.	HOUSES	6,180	5,596,679	350,889
c.	STRUCTURES	554	465,522	29,186
d.	CROPS (ANNUAL)	44,851	82,873	5,196
e.	TREES (PERENNIAL)	8,704	1,294,102	81,135
f.	BUSINESSES	46	546,000	34,232
g.	EMPLOYMENT	40	121,500	7,618
h.	ALLOWANCES	621	2,917,600	182,922
RESETTLEMENT SITES				
2	COMPENSATION COSTS		9,459,265	593,057
a.	LAND	69,706	2,240,004	140,439
b.	HOUSES	6,139	4,277,200	268,163
c.	STRUCTURES	379	162,650	10,197
d.	CROPS (ANNUAL)	5,977	23,988	1,504
e.	TREES (PERENNIAL)	2,949	240,523	15,080
f.	BUSINESSES	10	36,900	2,313
g.	EMPLOYMENT	2	12,000	752
h.	ALLOWANCES	540	2,466,000	154,608
3	INVESTMENT COSTS**		11,965,699	750,201
TECHNICAL				
4	SURVEYS AND TRAINING		671,000	42,069
5	SUB-TOTAL (1+2+3+4)		59,612,650	3,737,470
6	MANAGEMENT, ETC.		17,287,669	1,083,866
	Management (7%)		4,172,886	261,623
	Monitoring and Evaluation (7%)		4,172,886	261,623
	Contingency (15%)		8,941,898	560,621
7	TOTAL (5+6)		76,900,319	4,821,337

Table 4.21: Compensation Costs in Area of Impact

Area of Impact	Land	Houses	Structures	Crops	Trees	Bus&Emp	Allowances	TOTAL 1000 VND	TOTAL USD
HANOI	22,706,946	1,093,574	56,750	0	27,289	550,200	44,100	24,478,859	1,529,929
Dong Anh	22,706,946	1,093,574	56,750	0	27,289	550,200	44,100	24,478,859	1,529,929
VINH PHUC	0	0	125	962	1,962	0	34,800	37,849	2,366
Thach Loi	0	0	0	212	423	0	17,400	18,035	1,127
Huong Canh	0	0	125	750	1,539	0	17,400	19,814	1,238
PHU THO	481,665	590,845	133,130	40,209	300,592	70,200	462,000	2,078,640	129,915
Viet Tri	1,886	0	0	911	2,481	0	32,100	37,377	2,336
Phu Duc	2,944	0	0	0	0	0	0	2,944	184
Tien Kien	15,870	1,989	822	0	887	70,200	0	89,768	5,611
Chi Chu	9,716	0	0	3,141	7,796	0	43,500	64,153	4,010
Vu En	12,203	0	3,075	1,400	9,456	0	34,800	60,934	3,808
Mai Tung	439,047	588,856	129,233	34,757	279,973	0	351,600	1,823,465	113,967
YEN BAI	1,688,657	1,853,319	198,018	10,670	600,014	29,700	757,600	5,137,977	321,124
Co Phuc	12,735	0	0	650	1,301	0	18,000	32,686	2,043
Mau A	12,641	0	0	863	1,725	0	66,500	81,729	5,108
Mau Dong	14,515	0	0	281	67,507	2,100	12,000	96,403	6,025
Lam Giang	7,455	0	0	398	18,842	0	52,200	78,895	4,931
Lang Thip	40,719	258,747	54,053	10	48,553	27,600	93,400	523,081	32,693
Van Phu	733,632	751,852	88,164	816	24,074	0	230,200	1,828,738	114,296
Realign. km169-171	866,960	842,720	55,801	7,652	438,012	0	285,300	2,496,445	156,028
LAO CAI	1,502,567	2,058,942	77,500	31,032	364,245	2,100	1,463,400	5,499,786	343,737
Thai Van	1,300	105,222	65	420	3,130	0	14,700	124,837	7,802
Thai Nien	0	5,440	23	1	1,413	0	12,000	18,878	1,180
Xuan Giao	18,110	0	0	1,811	3,622	0	44,100	67,643	4,228
Lao Cai	861,757	1,845,080	74,302	2,190	38,675	2,100	1,233,000	4,057,103	253,569
Realign. km283-291	621,400	103,200	3,110	26,610	317,405	0	159,600	1,231,325	76,958
TOTAL	26,379,834	5,596,680	465,522	82,873	1,294,102	652,200	2,744,500	37,233,111	2,327,069

Table 4.22: Compensation Costs in Resettlement Sites

Resettlement Sites	Land	Houses	Structures	Crops	Trees	Bus&Emp	Allowances	TOTAL 1000 VND	TOTAL USD
Pho Moi	375,224	1,124,660	24,945	5,200	28,949	8,400	685,000	2,252,378	140,774
Van Hoa	1,853,548	3,152,200	137,705	18,788	211,334	30,600	1,781,000	7,185,175	449,073
TOTAL	2,228,772	4,276,860	162,650	23,988	240,283	39,000	2,466,000	9,437,553	589,847

Note 1 USD = 16,000 VND

4.11 MONITORING AND EVALUATION

Monitoring for the Resettlement Plan will be both internal and external. The RPMU will be responsible for Internal Monitoring together with the Provincial People's Committees through regular supervision of the Compensation and Resettlement Boards. The RPMU will also prepare quarterly and bi-annual Progress Report for submission to Vietnam Railways and the Ministry of Transport. Internal monitoring will be ongoing throughout the period of project implementation.

4.11.1 External Monitoring and Evaluation

External monitoring will be carried out by an Independent Monitoring Organization (IMO) contracted to the RPMU. An IMO can be a university, research institution, non-governmental organization (NGO) or other organization that is legally and administratively independent from government. The IMO will be primarily responsible for assessing whether AP have been able to maintain their pre-project living standards and productive levels, as well as whether resettlement activities have been implemented in quality, quantity and timeliness according to the Resettlement Plan. The IMO will report directly to the Ministry of Transport and the ADB. External monitoring will be carried out every six (6) months during the first two years of implementation of the Resettlement Plan and then every year until all AP have been relocated. The IMO will conduct further evaluations at the first, second and fifth years after land acquisition and relocation of AP. The IMO should also organization evaluation missions to coincide with the finalization of the updated Resettlement Plan, the period between payment of compensation and evacuation, and within three months of the AP's relocation to the resettlement sites.

5 SOCIO-ECONOMIC

5.1 POPULATION AND ETHNICITY

The railway spans five provinces: Hanoi, Vinh Phuc, in the Red River delta, and Phu Tho, Yen Bai and Lao Cai in the Northeast Region. The total population of these five provinces is 6.8 million, of which Hanoi accounts for 45%. The population density ranges from 33 people per hectare in Hanoi to less than 1 person per hectare in the mountainous provinces of Yen Bai and Lao Cai.

Approximately 14% of the population are classed as ethnic minorities, mainly Tay, H'mong, Muong, Dao and Thai, most of whom live in the mountainous areas of the Northeast.

5.2 ECONOMY AND EMPLOYMENT

The local economies are predominantly agricultural, except in Hanoi, with over 70% of the populations of the other four provinces employed in the sector, with about 15% in the service sector and a further 10% in industry and construction. The situation in Hanoi is markedly different, with 50% in services, 30% in industry and only 20% in agriculture.

5.2.1 Income

Average monthly income per head (in 2002) ranged from VND 206,000 (\$13) in Lao Cai to VND 621,000 (\$39) in Hanoi. Average income in the highest quintile (top 20% of the population) was between 5 and 6 times higher than that in the lowest quintile. Poverty is particularly evident in Lao Cai, where the average monthly income in the lowest quintile is VND 78,000 (\$4.90). Poverty is acute among indigenous peoples (IP), particularly the H'mong and Thai people.

Table 5.1: Average Income Per Head by Quintile (000 VND per month)

	Q1	Q2	Q3	Q4	Q5	Average
Ha Noi	204.6	368.4	499.8	672.8	1,360.5	621.0
Vinh Phuc	106.4	162.6	220.0	293.1	543.2	265.0
Lao Cai	78.8	106.4	147.4	222.9	475.2	205.9
Yen Bai	100.8	142.6	195.2	292.6	532.7	252.8
Phu Tho	102.7	148.1	198.4	271.7	560.6	256.2
Viet Nam	107.7	178.3	251.0	370.5	872.9	356.1

Source: GSO: Household survey 2002

Lower income is clearly associated with larger family sizes, as can be seen from Table 5.2 below. Notably, in Lao Cai, the average household size in the lowest quintile is nearly 6, while average size of household in the richest quintile in Hanoi is less than 4.

Table 5.2: Household Size by Income Quintile 2002

	Q1	Q2	Q3	Q4	Q5	Average
Ha Noi	4.47	4.26	4.48	4.12	3.86	4.03
Vinh Phuc	5.06	4.93	4.68	4.49	3.85	4.69
Lao Cai	5.75	5.05	4.38	3.97	3.57	4.95
Yen Bai	5.43	4.87	4.43	3.97	3.54	4.58
Phu Tho	4.87	4.53	3.34	3.95	3.68	4.39
Viet Nam	4.92	4.69	4.46	4.25	3.98	4.44

Source: GSO Household survey 2002

5.3 SOCIO-ECONOMIC CHARACTERISTICS OF POPULATION IN PROJECT AREA

A very limited program of rapid socio-economic assessment was carried out, as limits on funds and professional time did not permit more formal surveys.

The main population groups along the line are the Kinh (majority population group) and the Tay, with the Tay being concentrated in the Lao Cai area. Housing, mainly of brick and concrete, is built close to the railway line, with frontages of 4 to 5 metres and areas of 30 to 40 sq. m. In the more rural areas, houses close to the railway line also have vegetable gardens and areas for livestock.

Those living near the railway line in the urban areas are frequently involved in micro-enterprises, while outside the towns, agriculture is the main occupation, with rice, corn and tea being widely cultivated.

The major social services (hospital, clinic, primary school, secondary school, public market and government offices) are readily accessible to over 80% of the population interviewed. Schools were rated as being of the highest importance, followed by access to health care.

5.4 TRANSPORTATION AND MOBILITY

As in most parts of Vietnam, bicycles and motorcycles are the most common form of personal transport. The railway is used for long-distance travel, particularly between Hanoi and the Northeastern provinces, while buses are used for medium distance journeys between the districts and the province capital. However, although many of those interviewed reported use of the train, it is reasonable, given the very low levels of income in the area, to assume that, for most people, rail travel is a rare event.

5.5 SOCIO-ECONOMIC ROLE OF THE RAILWAY

The railway carries significant volumes of freight, including trade with China and minerals and petroleum products. These goods are not consumed directly by most of the local people, but they benefit from the income generation from industrial, agricultural and distribution activities made possible by the railway.

More importantly, the rail passenger services help sustain the local economy, as large numbers of domestic and foreign tourists visit the area by rail. They spend substantial amounts of money in local hotels and restaurants, and also with the large numbers of vendors who ply their trade in and around the railway stations.

5.6 POTENTIAL SOCIAL IMPACTS

Three forms of potential social impact were identified. The first, the small numbers of people requiring resettlement, has been discussed in Section 4 of this report. The other two are the potential spread of HIV/AIDS, particularly during construction and the potential for human trafficking.

5.6.1 HIV/AIDS

HIV has been known to be present in Vietnam since the early 1990s, but has spread quite slowly compared to other countries (particularly in Africa) and is now believed to affect approximately 200,000 people, or 0.24% of the population. The disease is still concentrated in the high risk populations of drug users and sex workers, and in urban areas. The number of known cases in the project area is very small.

The Government of Vietnam is very conscious of the potential danger of the spread of HIV/AIDS and is currently implementing a 5-year program, with World Bank assistance, to increase awareness and help reduce the incidence of HIV.

There is always potential for transmission along the major communications axes, as truck drivers and other travelers may carry the disease and then spread it through casual sexual contacts. Similar concerns arise when construction camps are set up, bringing in workers from outside the area, some of whom may be infected. However, it is normal practice in Vietnam to hire workers locally, so the chances of transmission are thereby reduced.

It will nevertheless be necessary to build in an HIV/AIDS awareness component into the construction contracts, so that the workers and those in the vicinity of construction camps will be aware of the potential dangers. Such a campaign can be carried at low cost and could involve the use of railway station loudspeakers to transmit the messages.

5.6.2 Human Trafficking

There has been some discussion concerning human trafficking along the rail corridor. It is alleged that women are being smuggled into China via Lao Cai. It is possible, though there is no direct evidence, that the rail services may be used in this trade. It is also fair to comment that nothing in the proposed upgrading of the rail line will, in itself, increase the likelihood of trafficking.

The GOV has formulated an action plan and is actively cooperating with neighbouring countries to suppress the trade. This may be judged adequate at national level, but a local area campaign by VNR to increase awareness of the problem should also be undertaken.

6 PRELIMINARY PROJECT DESIGN

6.1 INTRODUCTION

Design Standards

This chapter outlines the proposed improvements, which are intended to resolve the problems identified in the technical surveys described in Chapter 2. All preliminary designs have been drawn up in accordance with the relevant Vietnamese standards, which are listed in Annex A, of Technical Appendix A.2

Prioritization Procedures

All the interventions considered were prioritized in accordance with the principles set out in Chapter 2. The works proposed for this project are all priority 1. The recommended Scope of Work has been increased since the issuance of the Draft Final Report following numerous comments and requests received from VNR and the RPUCs.

Track Access during Upgrading Works

The railway line between Yen Vien and Lao Cai operates on a single track. The majority of the rehabilitation and upgrading works will be required to be carried out whilst the railway remains operational and without disruption to the existing services. Further, road access to the railway is difficult on many sections, and work sites will have to be supplied and accessed by rail.

The engineering proposals have been drawn up with these constraints in mind, and the costs reflect the additional difficulties of working under these circumstances.

6.2 REALIGNMENT

6.2.1 Introduction

During the course of this study the possibility of realigning over 60 kilometres of track was investigated. The sections considered for realignment were those containing the tightest bends and those with significant sections with technical parameters which are not compliant with the current standards applicable in Vietnam. In addition sections of track where train safety could be affected, reliability of operations are threatened by flooding or where frequent heavy maintenance was required.

Short and isolated lengths of track realignment produce only very small gains in train speed (and hence track capacity). Rather than considering individual sharp bends, the Consultant considered sections which are several kilometres long in order to provide significant improvements.

In making the final decision on which sections to propose for realignment, the following issues were also considered:

- The feasibility of constructing the realigned sections, bearing in mind that the railway must remain largely operational whilst the works are carried out.
- Ensuring that the engineering scope of realignments (eg volume of earthworks, number of bridges to be reconstructed) and thus the estimated costs of the realignment work were not excessive.
- Minimise the land acquisition requirements or possible resettlement requirements in order to reduce possible project implementation difficulties.

The selected realignments have been designed in accordance with VNR standards (MOT Standard 1976 & VNR Regulation 364 of 1999).

The typical cross sectional width for existing sections of track and embankment is 4.4 metres, or narrower. This does not comply with current Vietnamese standards. As part of the improvement works the newly realigned track will have a typical 5.0 m wide embankment. Typical cross sections are provided in Technical Appendix A2.

6.3 SECTIONS CONSIDERED FOR POSSIBLE REALIGNMENT

Preliminary designs for the realignment of five sections of track were prepared. (Details can be found in Technical Appendix A.2) The costs of realigning all 5 sections were very high and the potential benefits, in terms of increased track capacity or higher speeds, were quite limited. However, two sections of track were assigned Priority 1. The realignment between km 165.1 and km 176.4 will avoid an area prone to flooding, while the realignment near Lao Cai, between km 282.8 and km 293.6, both moves the line away from a site where the embankment is being eroded by the Red River, and eliminates a series of tight bends, with radii of less than 150 m.

The Consultant recommends that these Priority 1 works are carried out as soon as possible. The realignment will provide safety benefits and improve operating speeds. The Consultant considers that the realignment works identified as Priority 2 works do not need to be carried out immediately. However Vietnam Railways may wish to consider implementing these works at some stage in the future, perhaps in five years time.

The Consultant has prepared vertical and horizontal realignment drawings for the works identified as Priority 1. These drawings are provided separately in Technical Appendix E1.

Lang Giang – Lao Cai (km 282+772 - km 293+586).

This section has been identified as Priority 1 for the following reasons :

- The existing alignment runs alongside and close to the North-eastern bank of the Red River. There is risk of erosion, track collapse and frequent disruptions currently occur to operations, particularly during the rainy season.
- The current alignment follows the mountainous ground topography very closely which results in a large number of relatively sharp curves being required.
- Landslides in this section are a frequent occurrence which endanger train and passenger safety in addition to potentially blocking the line.
- An additional advantage of carrying out the realignment works in this section is that at some point in the future, perhaps around the year 2020, a new double track alignment may be required. This may be constructed on the South-western side of the Red River. It is understood that parts of this section new alignment will be incorporated into the proposed new standard gauge railway alignment in the section towards Lao Cai.

The length of the existing alignment in this section 10.814 kilometres. The length of the realigned section is 10.638 km. Four new bridges are also required to be constructed.

The new and smoother alignment will improve the potential operating speeds and reduce the risk of derailment. The track is also relocated away from the Red River which reduces the risk of erosion and disruption due to flooding.

Co Phuc – Ngoi Hop (km 170+110 to km 171+409)

This realignment section has been identified as Priority 1 due to frequent flooding problems, particularly during the rainy season. This is a particular problem between Km170+600 and Km171+300. This delays train services and potentially affects safety of operations. Once the track and related rail facilities become submerged their engineering properties and performance are adversely affected. The actual length of track to be realigned within this section is 1.299km. The alignment will be raised by up to 80 centimetres. In addition two bridges will be reconstructed to match the new route.

6.4 BRIDGES

The Consultant's recommended technical interventions have been prepared based on the following activities:

- numerous site visits and visual inspections by our engineering experts,
- review of the bridge survey results including information provided in design drawings, and
- information provided from RPMU and VNR staff who are familiar with the current condition of the railway line.

It should be noted that detailed modeling and computerized structural assessment of individual bridges was not carried out as this was beyond the scope of this preliminary study. The three categories which have been adopted are as follows :

Priority 1

Priority 1 includes:

- Rehabilitation works that the Consultant recommends to be carried out urgently to ensure safety and minimize disruptions to train services.
- Construction of 6 new bridges, required as part of the realignment project

Priority 2

Priority 2 consists of remedial works which should be carried out at some stage in the future. A five year timeframe is recommended.

Priority 3

Priority 3 indicates that the bridges in this category are in a satisfactory condition and not currently giving cause for concern. Generally these bridges have had remedial works carried out on them during recent years. Future works should therefore be carried out during the routine maintenance cycles.

Following requests and comments from VNR and RPUC, a number of the bridges which were initially assessed to be Priority 2, have been included in the Priority 1 works. The rehabilitation of 73 existing bridges is therefore recommended as Priority 1. In addition 6 new bridges are required to be constructed as a result of the required realignment works, detailed in Section 2 of this report.

Loading Requirements

The upgraded bridges are required to withstand the following train loads. Further details concerning the current design standards, codes and principles which should be adopted for this upgrade project are provided separately in Technical Appendix A2.

Table 6.1: Bridge Load Requirements

Design Train Load	T14
Train speed	Max 80 km/h
Train load	Up to 1200T
Train length	Up to 400m

The majority of the existing bridges are steel with Pigeaud type trusses (French built), VN64-71, T66 or “I section” steel girders using riveted connections. These steel structures were originally designed to withstand with the equivalent train load of Micado+4.2 T/m or T13. This is a reduced capacity when compared with the Project design train load of T14.

Remedial Works

The majority of the remedial work involves replacement of the girders or trusses. Repair of girders was initially considered. However replacement is currently recommended as the quality of the materials and the repairs can be ensured. The planned scope of bridge rehabilitation works is outlined in Technical Appendix A2.

Bridges which are known to have suffered significant war damage have been recommended as Priority 1. Particularly if significant remedial works have not been carried out on these bridges since the Vietnamese army implemented their temporary repairs. In particular the age of these structures, the humid environment and the large number of train load cycles which have passed over the bridge have resulted in the poor current condition of the bridges.

New Bridges

Standard designs have been prepared for the new bridges, based on typical spans and structure. Details are given in Technical Appendix A.2: Infrastructure, Annex E, and Technical Appendix E.1: Drawings.

Construction Methods

Access to a number of the bridge locations where remedial works are recommended, will be restricted and challenging. This is as a result of the existing railway line running alongside the Red River with the mountain range on the other side.

The majority of the upgrade works will be required to be carried out without disruption to the existing train services. The permitted working “window” is generally four hours long. If the planned bridgeworks cannot be carried out safely whilst the train services remain operational the Contractors will be required to request track possessions from Vietnam Railway.

The safety of rail traffic, passengers and construction workers is of paramount importance at all times and safety considerations must take precedence over any and all other considerations. Where temporary works are required to be constructed the

Contractor will ensure the quality of these temporary works so that the safety of trains and passengers is not affected.

Given the limited working space available at the majority of the bridge locations, The Consultant recommends that fabrication of the replacement steel girder be carried out in factory conditions rather than at the bridge location. This should ensure that the as-built quality of the structure is improved when compared with works which are fabricated under site conditions at remote locations.

Once assembly is complete, the girders can be transported to the site by train. The girder will then be installed on temporary supports alongside the existing bridge. When all the required preparations are completed, and the necessary possession arrangements have been agreed with the railway authorities, the existing girder can be removed and the new girder can be slid sideways and installed in its permanent location. The required modifications to the bridge bearings can then be completed.

6.5 STATIONS

6.5.1 Recommended Technical Interventions

In order to improve operational flexibility and capacity the Consultant recommends that the following upgrade works are implemented. Railway Station Design is subject to Article 24~50 incorporated in the Railway Design with a 1000mm gauge.

New Station at Mai Tung

Once the new station at Cau Nho (between Pho Lu and Thai Van) is built, the longest section will be that between Vu En and Am Thuong (12.8 km). The operational analysis has shown a clear need for an intermediate station on this section and the Consultant recommends the construction of a new station at Mai Tung (km 124.2).

Yen Bai / Van Phu Station Upgrade

Yen Bai station requires additional loops to maintain operational capacity. However providing an extension to Yen Bai station is difficult due to the presence of an adjacent residential area which will likely result in land acquisition and resettlement problems.

It has therefore been decided that the recommended solution is to upgrade Van Phu station (which is 7 kilometres from Yen Bai station) to become a freight station including marshalling yards. These two stations will coordinate closely. It is anticipated that the volume of freight and industrial material to be imported and exported from this station will increase significantly as a result of the new Industrial Park which has been constructed close to Van Phu Station.

Additional Siding Loops at Lao Cai Station

Lao Cai serves as a major distribution station for trains to and from China. During peak hours, freight trains arriving at Lao Cai station may have to be diverted to Lang Giang Station, which is approximately 11 kilometres away, for shunting or to await train assembly. This causes numerous operational difficulties for train dispatching control at Lao Cai Station. Improving station capacity by increasing the number of siding loops at Lao Cai station will ameliorate this situation.

In addition, as part of the recommended upgrade works, facilities will be provided such as stores, platform extensions, goods yard, a longitudinal drainage tunnel, extension to the horizontal culvert, fence and access to the goods yard.

Finally, the extension of the sidings will make it impractical to use the existing triangular track to turn locomotives, so a turntable will be installed.

Extending Existing Loops and the Provision of Additional Loops

The Consultant recommends that siding loops (480m length) should be added at the following 9 stations:

- Thach Loi, Huong Canh, Tien Kien, Chi Chu, Vu En, Mau Dong and Lang Thip stations : 1 additional siding loop,
- Van Phu station : 3 additional siding loops
- Lao Cai station : 9 siding loops (as explained above).

The existing siding loops at the following 8 stations should be extended in order to ensure an effective length of at least 450 metres :

- Viet Tri, Phu Duc, Co Phuc, Mau A, Lam Giang, Thai Van and Thai Nien stations – 1 loop should be extended at each station,
- Xuan Giao – 4 loops should be extended.

The new station at Mai Tung station (Km 124+20) will incorporate 3 siding loops each of 500m length.

The station upgrade works will include the required modifications to local signalling, rail, sleepers, telecommunication and other related railway facilities.

The Consultant has prepared preliminary design and layout drawings concerning these upgrade works. These drawings are presented separately in Appendix E1.

Table 6.2 : Summary of the Recommended Station Passing Loop improvements

Km	Station	Works	Existing Tracks	Additional Loops	Additional length (m)	Land Reqmt (sq m)
33.2	Thach Loi	New loop	3	1		212
47.5	Huong Canh	New loop	3	1		110
72.7	Viet Tri	Extension of passing loop (2 No.)	5		96	308
81.8	Phu Duc	Extension of passing loop (2 No.)	4		98	92
90.7	Tien Kien	New loop	6	1		139
108.2	Chi Chu	New loop	3	1		1,197
118.2	Vu En	New loop	3	1		935
124.2	Mai Tung	New station	1	2		29,641
148.4	Van Phu	New loops	4	3		7,042
165.1	Co Phuc	Extension of passing loop (1 No.)	3		56	849
186.3	Mau A	Extension of passing loop (1 No.)	3		110	769
194.8	Mau Dong	New loop	2	1		992
210.0	Lam Giang	Extension of passing loop (1 No.)	3		100	412
227.8	Lang Thip	New loop	2	1		1,957
247.5	Thai Van	Extension of passing loop (1 No.)	3		93	715
272.2	Xuan Giao	Extension of passing loop (4 No.)	4		563	906
277.3	Thai Nien	Extension of passing loop (1 No.)	3		80	357
293.0	Lao Cai	9 new loops				15,754
Totals			55	12	1196	62,385

6.6 SLOPE STABILIZATION

6.6.1 Criteria for Prioritization

The following criteria have been adopted for the Consultant's prioritised recommendations.

- Priority No. 1 works are those where urgent slope stabilisation works are required due to the current poor slope condition which has a potential impact on safety or may affect train operations. Locations where frequent sliding or slippage are known to occur have been included within this category.
- Priority No. 2 works are those which are not urgent and do not currently cause a safety risk or disturb train services. However works may need to be carried out at these locations in the future. Works in this category will not be carried out under this phase of the project.
- Priority No. 3 works are minor works which should be carried out a part of Vietnam Railways' routine maintenance works. The majority of the existing slopes along the alignment are included in this category.

6.6.2 Proposed Types of Slope and Drainage Improvement Works

A series of different typical standard slope and embankment stabilisation works have been recommended by the Consultant. These solutions have been modified in accordance with local conditions and requirements. Some of the technical solutions proposed by the Consultant have been adopted from standard solutions which are already applied at similar locations in Vietnam.

A key requirement is to minimise the disturbance and excavation works to the existing slopes. The carrying out of excessive excavation works can lead to further instability. The solutions proposed can be implemented relatively rapidly which is an important requirement as disruption to train services is required to be minimised.

Table 6.3 : Summary of Recommended Slope Stabilisation and Drainage Works

NO			EMBANKMENT CHARACTERISTICS	PRIORITY 1						COMMENTS
				Treatment	Length (m)					
	From	To			Section	DR02	DR03	SH02	SH03	
25	200.000	200.800	Underground water, drainage ditches are not operational	500 (DR02)	500	500				Deep drainage
38	221.000	222.100	Embankment is close to river, land slide on both cut and fill slopes, slope protector is unstable	300 (SH02+SH03)	300			300	300	Flood protection to lower slope +upper slope
45	233.200	233.500	Embankment settlement, rock fall, underground water, drainage ditches are stagnant	300 (DR02+DR03+SH03)	300	300	300		300	Deep and extensive sliding
49	242.200	243.300	Embankment is close to river, landslide on cut and fill slopes	200 (SH02)	200			200		Temporary protection, 200m: flood protection -lower slope; 900 upper slope
50	245.000	245.700	Embankment is close to river, landslide on cut and fill slopes, underground water, drainage ditches are inadequate	700 (SH02)	700			700		Lower slope flood protection + upper slope
60	263.900	264.100	Embankment is close to river, land slide on fill slope, temporary slope protection is unstable, drainage ditches are ineffective	400 (SH02)	400			400		400m flood protection
67	273.900	274.100	Embankment is close to river, large scale landslide on fill slope, temporary slope protection is unstable	200 (DR02+DR03+SH02)	200	200	200	200		Already affected by flooding; temporary surface protection; need additional 200m flood protection
77	294.600	295.100	Weak embankment ,no drainage, underground water	500 (DR02)	500	500				Deep drainage needed
						1,500	500	2,350	600	

Note : VNR and the RPUCs have requested that additional provision for 2.59 kilometres of slope protection and 6.62 kilometres of drainage (Type DR01) are included in the budget estimate. The location and application of these items will be clarified during the detailed design exercise.

The types of slope and drainage improvement works proposed are shown separately in Technical Appendix A2. In addition Preliminary Design Drawings are provided in Technical Appendix E1.

A summary of the type and quantity of slope stabilisation and drainage improvement works proposed under Priority 1 are summarized in Table 6.3. In addition VNR and the RPUCs have requested that additional provision for slope drainage is included within the recommendations.

6.7 TRACK

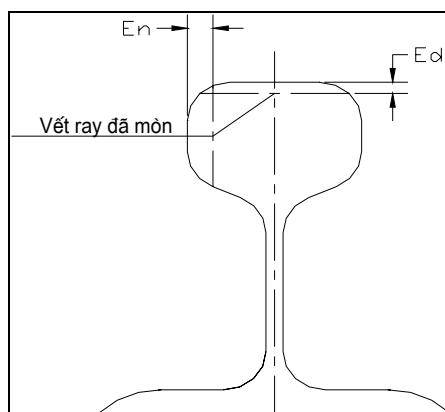
6.7.1 Criteria for Upgrade Works

Rails

According to Vietnamese standards, rail should be replaced when the amount of rail wear exceeds either or both of the following parameters:

- if the rail's vertical wear (E_d) exceeds 9 mm and/or,
- if the rail's lateral wear (E_n) exceeds 11 mm

Figure 6.1: Typical Rail Cross Section



Should the lateral rail wear exceed 11 mm there is a considerable increase in the risk of train derailment, particularly on winding track. In addition the existing track components, including transition length and cant, are below the current design standards. These non-standard sections accelerate the rate of rail wear.

6.7.2 Consultant Recommendations

Track Replacement

The Consultant has prioritised the recommended track replacement and upgrade works. These recommendations have been prepared using the results of existing trackwork condition survey records provided by the relevant Railway Public Utility Companies (RPUC). In addition this data has been supplemented by information obtained during site visits.

Priority No. 1

If the level of wear, and condition of the existing rails, does not comply with the Vietnamese standards listed above (vertical wear >9mm and lateral wear >11mm) the Consultant has identified this as an urgent priority for replacement.

Priority No. 2

The Consultant has categorised the rail as Priority No.2 if the level of wear is currently within the Vietnamese standards, but may be exceeded in the next 5 years. In addition the replacement of sections of non-mainline rail within stations, such as passing loops and sidings, are treated as priority No. 2.

The following tables summarise the Consultant's recommendations concerning the amount of trackwork to be replaced.

The majority of the rails required to be replaced are located in the Northern section of the route where more curves are included in the alignment so rail wear is greatest. In addition numerous sections near Hanoi require replacement of the track (rail, sleepers, fixings and ballast) due to the high frequency of train operation near the Capital. However the track condition in the southern section is generally better than in the northern mountainous areas.

It should be noted that the sections of realignment which the Consultant is recommending will result in the number of curves being reduced and the minimum curve radius increasing. As a result the rate of future rail wear will decrease, and thus delay the need for future replacement.

Grade of Steel for Rail and Switches

The existing rails are formed from steel type P43 or P38. The Consultant recommends that the new rails and switches should be formed from type P50 steel which is harder wearing and will result in reduced maintenance costs.

In addition a significant amount of wear occurs at the bolted joint connection of the existing rails. This causes :

- ride comfort to be reduced as the train passes over each connection,
- more wear and tear to the rolling stock, and
- more noise is produced as the train passes over the joints. This noise disrupts the passengers and also the people living alongside the railway in urban areas.

Rail Length

The existing rails are 12.5 metre in length. The Consultant recommends that, wherever possible, the new rails should be 25 metre lengths. This will reduce the number of bolted joints and, as a consequence, produce the following benefits :

- reduced wear at the bolted joints and thus reduce maintenance costs and disruption to train services,
- reduce the noise levels produced as the train passes over the joint,
- reduced wear and tear to the rolling stock, and
- improved rider comfort.

Table 6.4: Summary of the Rail, Turnouts, Sleepers and Ballast Requirements (Priority 1) on the Yen Vien - Lao Cai line including the PhoLu-Xuan Giao link

From		To	Sec Len	Percent Replacement			Priority One Activities					Comments	Sleeper/km
	(km)	(km)	(km)	Rail	Sleepers	Ballast	Rail	Sleepers	Ballast	Turnouts	Turnouts		
							m	units	m	No - P50	No - P43		
Yen Vien	11.000	14.000	3.0	100	100	61	9,000	4,350	1,825			Dual gauge section	1450
	14.000	21.800	7.8	100	100	100	23,400	13,728	7,800		36	Dual gauge section	1760
	21.800	29.000	7.2	100	100	100	14,400	12,672	7,200				1760
	29.000	107.600	78.6	0	0	0	0	0	0				1454
	107.600	141.000	33.4	90	99	25	60,120	48,078	8,271		39		1454
	141.000	144.750	3.8	80	0	25	6,000	0	923				1454
	144.750	296.500	151.8	98	98	98	297,430	261,738	148,715		48	Turnouts inc. PL - XG	1760
Pho Lu	261.650	272.235	10.6	24	24	24	5,000	3,635	2,500			Pho Lu - Xuan Giao	1454
		Totals	296.1				415,350	344,202	177,234	132	123		

Re-use of Track in the Passing Loops

As outlined above, it is recommended that a significant length of the existing grade 38 and 43 track is to be replaced. In order to minimize the investment cost the Consultant recommends that the rail sections which are in the least worn and damaged condition, be retained for re-use in the new or extended passing loops within the stations. Train safety and operational efficiency will not be compromised due to the reduced operating train speeds around the stations. In addition the track alignment in the station areas is generally straight, or on high radius bends, which minimises the risk of train derailment.

Ballast

The Consultant recommends that ballast replacement works are carried out as Priority 1 works if the ballast crushing process has resulted in the loss of more than 50% of the required volume of ballast.

The works are classified as Priority No. 2 if the amount of ballast remaining exceeds 50% of the Vietnamese standards.

Replacement of the Existing Two Block Sleepers

The majority of the existing sleepers installed along the alignment are concrete two block sleepers.

The use of two block sleepers accelerates the deterioration of ballast. The Consultant therefore recommends that where the existing rail condition is poor and requires replacement, the existing two block sleepers and the fixings should be simultaneously replaced with single unit prestressed sleepers. The load transmission from the rail track to the single sleepers and ballast is more uniform reducing future maintenance requirements will be reduced. This will provide the following benefits :

- Increased operational time for the railway with less disruption on the rail line,
- Reduced amount of construction work on the track therefore less safety risk to the train (driver, passengers and maintenance workers), and
- Reduced maintenance costs (material, labour etc)

In addition where cracking in the existing two-block sleepers exceeds 35% the Consultant recommends that these sleepers be replaced by new single unit pre-stressed concrete sleepers.

6.7.3 Preliminary Design

The minimum required width of the existing rail embankments is 4.40 metres. For the planned track upgrade works, this minimum dimension will remain unchanged. However the sections which are planned to be realigned will incorporate the current Vietnamese standard cross section (ie embankment width = 5.0m). Typical cross-sectional drawings are provided separately in Technical Appendix A2.

6.8 SAFETY ISSUES

The Consultant recommends the following actions in order to improve the current safety situation. Preliminary Design drawings have been prepared and are presented in Technical Appendix E1.

Flyover Construction at Dong Anh¹⁰

It has been noted that the volume of crossing traffic (cars, motorbikes, bicycles, trucks etc) is high at a number of the crossings along the route. This is particularly true at rapidly developing and busy urban centres such as Ha Noi and Vinh Phu. The existing rail crossings are therefore overloaded and need to be upgraded. The crossing traffic is delayed for approximately five minutes each time a train passes a particular crossing and the barriers are closed.

In order to improve the safety situation, and reduce the delays to traffic on the crossing road, the Consultant has investigated the possibility of installing flyovers at three crossings with high crossing traffic levels. The details of this evaluation are given in Chapter 7. In summary, the Consultant recommends that a flyover is constructed over the railway at Dong Anh. This will avoid the junction becoming dangerous, unmanageable and overloaded in the near future.

Provision of Manned Barriers (18 No.)

The Consultant recommends that all currently unmanned crossings should be provided with barriers and gatekeepers. The manually operated barrier should be installed along with the necessary guideway. In addition improvement works will be carried out to the road surfacing within the crossing to ensure smooth transit by all types of vehicles from motorbikes to heavy trucks.

Engineering Upgrade at Crossings (18 No.)

In addition to the provision of the manned crossings and facilities outlined above, the condition of thirteen of the existing crossings has deteriorated and has the potential to disrupt the smooth and safe passage of vehicles and pedestrians. It is therefore recommended that engineering improvement works are carried out to improve the condition of the crossings.

Collecting Road to Replace Unauthorised crossings

In order to reduce the high number of dangerous and illegal crossings, it is recommended that collector roads (Total length = 5.565 km) are constructed at several of the existing legitimate crossing points. The road and fence provided will serve to minimise unauthorised access to the track by channelling the traffic towards the official crossing. Technical Appendix E.1 contains the outline design.

Public Education Program

Given the planned and likely increase in the number of train operations, with a corresponding increase in speeds, it is recommended that a Public Education Program be prepared. This could form part of a National Road Safety Campaign in schools. In addition a leaflet distribution campaign could be targeted towards residents living adjacent to the line.

¹⁰ The provision of a flyover at Gia Cam was also considered (see Chapter 7), but is not recommended, as the local authorities plan to move the railway line, thus rendering the proposal redundant.

6.9 COST ESTIMATION

6.9.1 Introduction

The cost estimates presented by the Consultant have been prepared by a local Senior costing specialist with considerable relevant experience. Ministry of Construction procedures have been followed whilst preparing the applicable rates.

In order to ensure that the estimated rates are realistic and comply with Vietnamese procedures, staff from the Executing Agency (RPMU) have been consulted and assisted with the Consultant's costing exercise using data and rates from recent Vietnam Railway projects. In addition the Consultant has compared the estimated rates with those for similar activities on relevant projects in Europe and the region. Items such as taxes, transport, site installation and labour costs have been considered during the Consultant's costing exercise.

It should be noted that the cost data presented are estimated values based on the preliminary design prepared as part of this feasibility study. These estimates will be developed further during the next phase of this project once detailed designs are completed.

In addition to the Consultant's assumptions outlined elsewhere in this report, the following principles have been adopted whilst preparing the cost estimates.

- The standard rates have been increased by 30% to reflect the difficult access conditions to some of the project locations, and the requirements to ensure that the railway remains operational. This factor complies with Vietnamese regulations concerning the type and location of the work involved. The difficulty factor is only applied to items of work involving input of labour. The price escalation factor is not applied to procurement of materials, such as rails and bridge girders.
- Decree No. 1651/QD-DS dated 20/12/2005 by Vietnam Railway specifies the material transportation price carried by railway.
- The price of mainline rail and turnouts (Type P50) assumes that these items are imported from overseas (France). It is recommended that the rail fastenings are procured via International Competitive Bidding (ICB).
- Unit rates for locally sourced materials such as soil, sand, gravel, cement and machine rates are based on the unit price issued by Lao Cai province in accordance with Decision No. 369/2006/QD-UBND dated 16/2/2006.
- A large amount of new rail is planned to be installed along the line. It has been assumed that the old rail will be recycled and this scrap value will be treated as a credit towards the cost of the works.
- A cost contingency of 10% has been applied.

Environmental Issues

The Contractor is required to implement numerous environmental mitigation measures during the Construction phase. The standard costing procedure adopted in Vietnam is that environmental mitigation measures are estimated to represent 1.5% of estimated rates. The mitigation measures concerned include :

- Proper disposal of solid and liquid wastes and excavated materials in order to avoid contamination to water sources,
- Protection of local flora and fauna,
- Rehabilitation of temporarily acquired lands and borrow areas,
- Maintain air quality by minimizing dust from construction activities,
- Minimize noise pollution, and
- Control works which are likely to cause vibrations, particularly near built-up areas.

6.9.2 Summary of Preliminary Costs

A summary of the estimated costs for the major elements of new and rehabilitation works recommended for implementation are summarized below. Estimated cost breakdowns for each proposed work element are provided in Technical Appendix A2. These cost estimates have been revised following comments received concerning the Draft Final Report.

Table 6.5 - Summary of all Project Costs

No	CIVIL WORKS	Rate%	COST	VAT %	TOTAL COST	
			without TAX		VND	USD
I	Construction Cost		1,148,436,919,210		1,263,280,611,131	79,202,546
1	Construction Net Cost		1,093,749,446,866	10	1,203,124,391,553	75,430,996
2	Construction Supplementary Cost	5	54,687,472,343	10	60,156,219,578	3,771,550
II	Equipment Cost		24,776,112,000		27,253,723,200	1,708,697
1	Signal And Telecommunication Procurement		24,776,112,000	10	27,253,723,200	1,708,697
III	Other Cost		51,152,088,161		254,586,990,977	15,961,567
1	Project management	1.86	21,821,762,381	10	24,003,938,619	1,504,949
2	Detailed Design and Supervision Services				121,419,375,000	7,612,500
3	Land Acquisition and Resettlement				76,900,319,000	4,821,337
4	Environment works	1.5	17,598,195,468	10	19,358,015,015	1,213,669
5	Explosive Obstacle Clearance	1	11,732,130,312	10	12,905,343,343	809,112
	Total I + II + III				1,545,121,325,308	96,872,810
IV	Contingencies	10			154,512,132,531	9,687,281
	Total Cost				1,699,633,457,838	106,560,091
V	Procurement of French Rail + French turnout (132 units-P50) for mainline with transportation to Site				572,224,005,329	35,876,113
1	French Rail (860 Euros Ton)				370,328,136,750	23,218,065
2	Bolted Joints for Rail				5,379,771,781	337,290
3	French Turnout (67,000 Euros each)				183,380,340,000	11,497,200
4	Transportation				4,679,244,404	293,370
5	Contingency for rail procurement	1.5			8,456,512,394	530,189
VI	Turnout Procurement (P43 - 123 units) in sidings (not on mainline)				48,663,574,708	3,051,008
VII	Fees Received from Recycling Old and Worn Rail				-83,704,280,000	-5,247,917
	Total Cost including Tax				2,236,816,757,875	140,239,295

EUROS

27,597,010

17,860,050

259,454

8,844,000

225,669

407,838

Table 6.6: Summary of Construction Related Costs

No	Items	Unit	Quantity	Unit Prices	Total Cost (VND)	Total Cost (USD)
I	Permanent Track				633,473,619,097	39,716,214
1	Upgrading Existing Railway Sections					
	- Gauge 1.000 m	Km				
	+ Excavation, additional earthwork, adding ballast, replacing ballast	Km	191.475	2,308,758,474	442,069,528,893	27,715,958
	+ Embankment Strengthening	Km	21.230	3,285,521,131	69,751,613,616	4,373,142
	- Gauge:1.435 m	Km	10.800	3,565,165,740	38,503,789,995	2,414,031
2	Sections to be Realigned	Km	9.046	2,433,405,778	22,012,588,664	1,380,100
3	Drainage Improvement Works	Km	20	1,500,000,000	30,000,000,000	1,880,878
4	Installation of turnout (P50 tg 1/10) on main line (1m gauge)	unit	132	110,272,093	14,555,916,270	912,597
5	Installation of turnout (P43 tg 1/10) at siding loops	unit	30	108,116,858	3,243,505,750	203,355
6	Installation of Mixed Gauge Turnout (P43 tg 1/10) at stations which are not due to be upgraded	unit	38	194,480,229	7,390,248,701	463,338
7	Signal & Telecoms modification works	Lump sum			5,946,427,208	372,817
II	Earth work and slope protection				157,401,625,447	9,868,440
1	Realignment	Km	9.046	2,132,584,751	19,291,361,662	1,209,490
2	Shoulder Protection SH01	m	1,200	1,603,528	1,924,233,600	120,642
	Lower Slope Protection SH02	m	2,300	12,635,079	29,060,681,753	1,821,986
	Upper Slope Protection SH03	m	600	19,430,095	11,658,057,000	730,913
	Additional slope protection requested by VNR & RPUC	m	2,590	15,755,692	40,807,242,280	2,558,448
3	Surface Drainage DR01	m	6,620	1,500,000	9,930,000,000	622,571
	Embankment Drainage DR02	m	1,500	2,374,609	3,561,913,500	223,317
	Slope Drainage DR03	m	500	45,573,425	22,786,712,500	1,428,634
4	Culvert Rehabilitation	m	1,000	18,381,423	18,381,423,152	1,152,440
III	Bridges				192,431,909,920	12,064,697
1	New Bridge Construction	unit	6		32,400,043,768	2,031,351
2	Bridge Rehabilitation	unit	73		160,031,866,152	10,033,346
IV	Station (1+2+3+4)				95,024,519,760	5,957,650
1	New building station (Mai Tùng)	station	1	8,659,331,942	8,659,331,942	542,905
2	Adding siding loops and support facilities.	station	9		62,469,507,574	3,916,584
	Station Thạch Lỗi		1	3,173,663,188	3,173,663,188	198,976
	Station Hương Canh		1	4,066,814,983	4,066,814,983	254,973
	Station Tiên Kiên		1	1,965,268,353	1,965,268,353	123,214
	Station Chí chủ		1	3,939,965,999	3,939,965,999	247,020
	Station Vũ Ân		1	4,558,285,817	4,558,285,817	285,786
	Station Mậu Đông		1	4,848,798,237	4,848,798,237	304,000
	Station Lang Thíp		1	2,600,259,157	2,600,259,157	163,026
	Station Lào Cai		1	26,398,029,443	26,398,029,443	1,655,049
	Station Văn phú		1	10,918,422,397	10,918,422,397	684,541
3	Siding loop extensions		8		14,022,466,884	879,152
	Station Việt tri	Station	1	4,382,172,837	4,382,172,837	274,744
	Station Phú Đức	Station	1	1,475,825,767	1,475,825,767	92,528
	Station Cổ Phúc	Station	1	842,717,690	842,717,690	52,835
	Station Mậu A	Station	1	897,364,335	897,364,335	56,261
	Station Lâm Giang	Station	1	809,105,842	809,105,842	50,728
	Station Thái Văn	Station	1	842,684,061	842,684,061	52,833
	Station Thái Nien	Station	1	847,385,271	847,385,271	53,128
	Station Xuân Giao	Station	1	3,925,211,082	3,925,211,082	246,095
4	Improvement of station house, storage, platform, marshalling yards	Station	5		9,873,213,360	619,010
4.1	Station Đông Anh	Station	1	3,217,550,000	3,217,550,000	201,727
4.2	Station Tiên Kiên	Station	1	2,550,000,000	2,550,000,000	159,875
4.3	Station Đoàn Thượng	Station	1	1,115,000,000	1,115,000,000	69,906
4.4	Station Phố Lu	Station	1	450,095,360	450,095,360	28,219
4.5	Station Lào Cai	Station	1	2,540,568,000	2,540,568,000	159,283
V	Safety Improvement works (Level Crossing Upgrade + Collector Road)				124,792,717,329	7,823,995
1	Flyover bridge (Km 21+800)	Bridge	1	30,996,545,758	30,996,545,758	1,943,357
2	Collector road with fencing	m	5,565	821,739	4,572,977,535	286,707
3	Manned level crossing	unit	18	2,500,000,000	45,000,000,000	2,821,317
4	Engineering upgrades at crossing	unit	13	1,561,399,541	20,298,194,036	1,272,614
5	Remedial works to level crossings after new rail installation (approx 1000 crossings)	Lump sum			23,925,000,000	1,500,000
	Grand total				1,203,124,391,553	75,430,996

7 ECONOMIC EVALUATION

7.1 PROJECT DESCRIPTION

The project consists of six components, which taken together serve to increase the capacity of the line, improve security and safety and will help preserve the asset. The table below sets out the elements and indicates their contribution to the overall project purpose.

Table 7.1: Project Components

Component	Capacity Increase	Safety and Security	Asset Preservation
Station improvements	Main source of capacity increases	~	~
Realignments	Minor contribution	Reduces chances of: derailments, delays from flooding, track collapse	~
Bridge Rehabilitation	Minor contribution – facilitates heavier trains	Minor contribution	Required in short-medium term to ensure continuing operation
Slope stabilization	~	Reduces chances of delays from land-slips	Required in short-medium term to ensure continuing operation
Track Renewal	~	Minor contribution	Required in short-medium term to ensure continuing operation
Safety Measures Crossing improvements Overpasses	~	Will reduce traffic conflict & accident potential; savings in vehicle time at overpasses	~

Project costs are set out in Table 7.2 below. Domestic financial costs have been converted to economic using the normal Standard Conversion Factor (SCF) for Vietnam of 0.85¹¹, while imported materials (mainly rail and fittings) are costed c.i.f.

Table 7.2: Breakdown of Project Costs : Financial and Economic (US\$ million)

	Financial	Economic
Capacity Expansion	20.8	18.0
Realignment	7.7	6.7
Stations	13.2	11.2
Rehabilitation	111.2	101.2
Bridge Rehabilitation	12.5	10.6
Track (net of rail recycling fees)	87.9	81.5
Slope Protection	10.8	9.1
Safety Improvement	11.1	9.4
Manned level crossing	5.1	4.3
Collector road with fencing	0.4	0.3
Flyover bridge (Km 21+800)	3.0	2.5
Resettlement (Dong Anh)	2.7	2.6
Total	143.0	128.6

Note: Costs include pro-rata allowances for environmental protection, contingencies and detailed design and supervision.

¹¹ This is the value used in recent World Bank studies in the transport sector in Vietnam, e.g. *Network Preservation Program*, BCEOM 2006, and is consistent with the proportion of indirect taxes (VAT and import duties) levied on traded goods.

7.2 TRAFFIC AND CAPACITY

7.2.1 Current Traffic Volumes

The latest year for which traffic data is available is 2003, when the Hanoi – Lao Cai line generated approximately 2.6 million tonnes of freight and 2.9 million passenger journeys. The traffic is generally long-distance, with average hauls of 244 km for freight and average journey of 150 km for passengers.

Major sources of traffic are the Chinese cross-border trade (both direct trade with Vietnam and transit traffic to and from Haiphong) and apatite, which moves from the mines on the Xuan Giao (km 272.2) branch line to the fertilizer factory at Tien Kien (km 90.7). Cross-border traffic is around 700,000 tonnes, though it appears to have fallen slightly between 2003 and 2004. The apatite traffic is in excess of 1 million tonnes p.a.

Table 7.3: Cross-Border Traffic

	2003			2004		
	Exports	Imports	Total	Exports	Imports	Total
Wagons	8,116	16,849	24,965	7,699	15,240	22,939
Load (000 tonne)	243.3	508.6	751.9	229.4	459.8	689.2

Source: VNR

The most heavily trafficked section of line is between Viet Tri (km 72.7) and Yen Bai (km 155.4), with approximately 4,500 tonnes per day in 2003. The traffic is predominately in the direction towards Hanoi, with up traffic being three times larger than that moving towards Lao Cai.

Table 7.4: Freight Density: 2003 (tonnes / day)

Section	Up	Down	Total	Section Length (km)
Hanoi - Gia Lam	2,087	2,057	4,144	5.9
Gia Lam - Yen Vien	3,385	3,327	6,712	5.0
Yen Vien - Dong Anh	3,333	3,344	6,677	10.3
Dong Anh - Viet Tri	3,571	2,035	5,606	51.5
Viet Tri - Yen Bai	4,492	1,214	5,706	82.6
Yen Bai - Lang Giang	3,854	964	4,818	127.4
Lang Giang - Lao Cai	1,820	881	2,701	10.8
Average	3,847	1,365	5,212	

There is, unfortunately, no data concerning the density of passenger traffic.

7.2.2 Forecast Traffic Volumes

The traffic forecasts used in this study are based on a multi-modal study carried out by COWI¹², which looked at the development of traffic in the Kunming to Haiphong corridor, taking account of competition from ports in China for transit traffic. Several scenarios for transport improvements were considered, including the construction of an

¹² *Kunming – Haiphong Transport Corridor: Multimodal Transport Study*, Oct 2005, COWI A/S

expressway between Lao Cai and Hanoi and improvements to the railway. The basic assumption of this study is that the expressway will be built, and the resulting traffic volumes are shown below.

Table 7.5: Forecast Traffic Volumes: Hanoi – Lao Cai

	Yen Vien - Bac Hong	Bac Hong - Viet Tri	Viet Tri - Tien Kien	Tien Kien - Yen Bai	Yien Bai - Pho Lu	Pho Lu - Lao Cai
Km	15.9	45.9	18.0	64.9	106.1	31.9
	Freight Volume (000 tonnes pa)					
2010	3,784	3,784	2,178	2,178	1,586	1,586
2015	5,371	5,371	2,922	2,922	2,096	2,096
2020	7,623	7,623	3,921	3,921	2,771	2,771
2030	12,535	12,535	8,576	8,576	4,261	4,261
	Passengers (000 p.a.)					
2010	1,823	1,823	1,694	1,694	1,120	1,120
2015	2,303	2,303	2,122	2,122	1,370	1,370
2020	2,909	2,909	2,657	2,657	1,677	1,677
2030	4,642	4,642	4,167	4,167	2,512	2,512

Source: COWI Multi-modal Traffic Study: estimates for 2010, 2015, and 2030 obtained by interpolation and extrapolation, as appropriate

Note: Traffic for scenario of expressway & rail improvements

Table 7.6: Cross-Border Traffic Forecasts (000 tonnes p.a.)

Year	Rail	Road	Total
2010	1,368	1,818	3,186
2025	2,820	3,852	6,672

Source: COWI Multi-modal Traffic Study

Note: Traffic for scenario of expressway & rail improvements

Freight traffic is expected to grow by a factor of four between 2005 and 2020 and by a further 65% by 2030. The current capacity of the line is not adequate to handle this increase and the proposed improvements to stations, bridges and alignment will permit:

- Longer and heavier trains (up to 400m long and 1,200 tonnes gross weight),
- Increase in capacity in bottleneck section (new station at Mai Tung), and
- Small increase in running speeds on realigned sections.

The operational analysis has shown that these investments will permit the line to carry all the forecast traffic until the mid 2020s. However, it will not be possible to accommodate any traffic growth after this date, without additional investment (possibly requiring double tracking in the heavily trafficked sections south of Viet Tri).

7.3 SAFETY AND SECURITY

The safety measures will ensure that all official crossings are fitted with automatic warning and manned barriers. In addition, overpasses are proposed at two locations (Dong Anh, near Hanoi, and Gia Cam, in Viet Tri).

These measures will help ensure better segregation of road and rail traffic and reduce the risks of accidents¹³. The overpasses will generate direct economic benefits in the form of vehicle and passenger time savings, as both the selected sites are on heavily trafficked roads.

It should be noted that the Vietnam Roads Authority (VRA) would have to be involved in any final decision on the construction of an overpass.

7.4 ASSET PRESERVATION

The rehabilitation of bridges, the slope stabilization and the track renewal components are required to ensure that the railway can continue to operate. The bridges selected for rehabilitation are badly corroded and girders require replacement in the short to medium term. Approximately two thirds of the track is now so worn that it is out of standard; if left unattended, rail failure and derailments can be expected to occur with increasing frequency. Similarly, the slope stabilization work has been identified as necessary to prevent interruptions to operations from landslips onto the line or from the undermining and slippage of the track.

If the rehabilitation work is not undertaken, the railway operations will become progressively more difficult to manage, and increasing volumes of traffic will transfer from rail to road. For the purposes of the economic evaluation, it has been assumed that the failure to rehabilitate the line will result in an effective loss of capacity of 2.5% p.a. mainly as a result of slower running speeds¹⁴. In addition, lower rates of rolling stock utilization will increase operating costs by around 1% p.a.¹⁵.

7.5 COST-BENEFIT ANALYSIS

7.5.1 Base and Project Cases

Base Case

The Base Case is based on the following assumptions:

- The Lao Cai – Hanoi expressway is built,
- A new station is built at Cau Nho,
- The Chinese signaling project is implemented,
- Routine maintenance is carried out on the line, but no rehabilitation, with a consequent gradual loss of capacity,
- Traffic potential grows in accordance with the COWI assumptions, subject to the following provisos:
 - The passenger traffic volumes assumed for this study are significantly higher than those used by COWI. The COWI estimates for 2005 were far lower than the actual volume of traffic and the potential diversion to road was considered unrealistically high. In addition, the COWI study did not explicitly consider the potential for tourism (both domestic and international); it therefore seemed prudent to increase the provision of passenger trains.

¹³ It should be noted that, despite the obvious lack of normal safeguards, there are relatively few accidents, with only 25 deaths along the line between Jan 2002 and May 2006.

¹⁴ There is little documentation on the question of the rate at which capacity might be lost in these circumstances, but the estimate can be compared with the more extreme case of Cambodia, where an absence of maintenance and rehabilitation led to an annual loss of capacity and average speed reduction of approximately 5% p.a.

¹⁵ This rate is consistent with the reduced utilization implied by 2.5% p.a. capacity reduction.

- VNR gives priority to passenger traffic, so all the forecast passenger traffic is carried by the railway; the balance of line capacity is then available for freight.
- Freight traffic carried by the railway is limited by line capacity, and the traffic which cannot be accommodated on the railway is carried by road

Project Components

Capacity Increase

The capacity increase component includes the following investments, which directly affect line capacity:

- New station at Mai Tung
- Extensions to passing loops in 8 stations
- Additional passing loops in 9 stations
- Realignments at:
 - km 169.9 to 173.8 to raise the line, and avoid flooding
 - km 283.6 to 292.1, to remove curves of less than 150 m radius and to move the line away from the Red River
- 6 new bridges, which are required as consequence of the realignments

The project will permit the use of longer and heavier trains. This will increase capacity sufficiently to permit all the COWI forecast traffic for the mid 2020s to be carried. It will also reduce average operating costs by approximately 10%.

Rehabilitation

The rehabilitation component consists:

- slope stabilization works on 3.7 km of line
- rehabilitation of 40 bridges – mainly replacement of old and corroded girders
- approximately 200 km of track renewal

The slope stabilization will reduce the possibility of line closures from landslips onto the railway, or damage to the track from embankment failure. Bridge rehabilitation will avoid the future imposition of speed restrictions, while track renewal will reduce the potential for accidents from derailments (due to out of gauge track) and rail failure. Taken as a whole, the rehabilitation component will secure the future capacity of the railway line.

Safety Component

The safety component consists of:

- construction of an overpass at Dong Anh (km 21.8),
- provision of manned barriers at 60 currently unprotected crossings,
- Fencing of the railway line in urban areas (where practicable), thus closing off unofficial crossing, and the provision of “collector” crossing

The overpass will provide effective segregation of road and rail traffic at a very heavily trafficked crossing, thus reducing the potential for accidents, and bring about a very significant reduction in traffic congestion. The manned barriers and the track fencing will reduce the potential for accidents both at the level crossings, and along the line.

7.5.2 Costs and Benefits

Capacity Increase and Rehabilitation

The costs of the capacity and rehabilitation components of the project are the investment cost of the station improvements, realignments and bridge repairs, and the associated maintenance costs.

The benefits are:

- Savings in freight transport costs, arising from the avoidance of a forced transfer from road to rail.
- Reductions in operating costs (for the base traffic), arising from the use of longer, heavier trains.
- Avoidance of the increases in operating costs and loss of capacity that will arise if the rehabilitation is not undertaken

The benefits from the capacity expansion project stabilize in 2020, as the traffic demand then matches the line capacity, and no additional traffic can be accommodated. In the absence of the rehabilitation project, however, the line will continue to deteriorate, and increasing volume of traffic will have to divert to road.

Safety Component

The costs of the safety component are the construction costs of the overpasses, manned barriers and fencing, together with the associated maintenance costs.

There are relatively few accidents on the railway line, with only 25 deaths and 100 injuries recorded in the three and a half years between Jan 2002 and May 2006. The cost of a road death has recently been estimated by the ADB-Asean Regional Road Safety Program to be VND 175.4 million or approximately US\$ 11,000, while an injury accident was calculated to cost VND 51.7 million (US\$ 3,250). Eliminating all accidents on the line would save 7.3 deaths and 28.6 injury accidents per year at a total economic saving of approximately US\$ 175,000 p.a.

The project proposal offers some potential savings in accident costs, though they are difficult to quantify for particular safety measures. However, the main benefits are the time savings to road traffic at the overpass site.

Savings in Road and Rail Operating Costs

Road operating costs have been estimated using data from recent studies in Vietnam, supplemented as necessary by information from other countries and trial runs of HDM-4. The general format of the COWI estimates, splitting costs into time and distance costs has been preserved.

Rail costs have been based on COWI unit costs combined with data from other sources on international prices). Operating practice assumptions have been based on an analysis of VNR statistics.

Full details of the operating cost estimates can be found in Technical Appendix F.1: Operating Cost Estimates.

Freight Transport Costs

Table 7.6 summarizes the operating cost estimates for road and rail freight transport. At current fuel prices, road costs average US cents 5.9 per tonne-km, against US cents 2.1 for rail (with current operating practices), giving a net saving of approximately US cents 3.9 for every tonne-km transferred from road to rail. The operating costs from running longer trains are rather lower, at US cents 1.9 per tonne-km, giving a saving of US cents 4.1 for every tonne-km diverted back from road, and US cents 0.19 for every tonne-km of undiverted rail traffic.

Time Costs for Road Vehicles

The costs of vehicle time, taking due account of the proportion of business use and the value of passenger time, have been estimated following the same general principles as the freight transport costs. Vehicles have been grouped to correspond to the categories identified in the traffic counts. The values used in the economic evaluation of the overpasses is shown in Table 7.7, below.

Table 7.6: Road and Rail Operating Costs – Freight (US\$)

Road Cost				Rail Costs		
	Heavy Truck	Articulated Truck	Average		Current	Project
Cost per vehicle-hour	6.76	7.45	7.11	Time cost per train-hour	31.87	34.31
Average speed (km/h)	30	30	30	Average speed (km/h)	30	30
Time cost per veh-km	0.2254	0.2484	0.2369	Time cost per train-km	1.06	1.14
Distance cost per veh-km	0.3719	0.4696	0.4208	Distance cost per train-km	4.37	5.13
Average load	9.0	13.8	11.4	Payload	320	400
Time cost per tonne-km	0.0250	0.0181	0.0216	Time cost per tonne-km	0.0033	0.0029
Distance cost per tonne-km	0.0413	0.0342	0.0377	Distance cost per tonne-km	0.0174	0.0160
Total cost per tonne-km	0.0664	0.0522	0.0593	Total cost per tonne-km	0.0207	0.0188
Saving: Rail vs Road Current Operations Improved Operations			0.0386 0.0405	Saving in Rail Operating Costs: Project vs Current		0.0019

Table 7.7: Road Vehicle Time Costs – Overpass Evaluation (US\$ per hour)

	Motor-cycle	Light Vehicles		Buses		Trucks		
		Cars	Pickups / LGV	Mini	Large	Medium	Heavy	Articulated
Proportion in traffic group		0.35	0.65	0.65	0.35	0.60	0.30	0.10
Cost per hour (inc passenger time) (\$)	0.38	2.53	3.41	5.25	10.32	3.67	6.76	7.45
Average cost per hour by group (\$)	0.38	3.10		7.03		4.98		

7.5.3 Evaluation of Capacity and Rehabilitation Options

Procedures

Capacity Analysis

The operations analysis (see Technical Appendix A.1: Railway Operations) determined the maximum number of trains that can be accommodated on the line, both with and without the project. As noted above, the capacity of the project corresponded to the traffic demand in the mid 2020s, so no further traffic growth can be accommodated after that.

The operations analysis also determined how many trains would be needed (both with and without the improvements) in 2020. It was assumed that VNR would ensure that all passenger demand was met, and that the balance of the capacity would be used for freight. Any freight that could not be carried on the railway would have to divert to road, at additional transport cost.

There is significant variation in line capacity between sections, and the volumes of freight that will have to divert also vary substantially. It is clearly not plausible that traffic will switch from rail to road and then back again to match line capacity, and it was assumed that the volume of freight diverted would equal that on the section, that had the maximum shortfall between capacity and demand. It is further assumed that the average haul of the diverted traffic would equal that of freight traffic on the line at present, at 244 km.

The number of trains required in 2020 is shown in Table 7.9¹⁶. The number of trains in 2010 and 2015 was obtained by scaling the 2020 requirement by the ratio of traffic in the intermediate year to that in 2020. Line capacity by section is shown, both with and without rehabilitation, is shown in Table 7.10.

Table 7.9: Train Requirements by Section

Section	Yen Vien - Bac Hong	Bac Hong - Viet Tri	Viet Tri - Tien Kien	Tien Kien - Yen Bai	Yien Bai - Pho Lu	Pho Lu - Lao Cai
Km	15.9	45.9	18.0	64.9	106.1	31.9
Current Operating Practice						
2030						
Freight	35	55	84	71	50	32
Passenger	29	32	31	31	30	27
Total	64	87	115	102	80	59
2020						
Freight	21	33	38	32	32	21
Passenger	18	20	20	20	20	18
Total	39	53	58	52	52	39
2010						
Freight	10	17	21	18	18	12
Passenger	11	13	13	13	13	12
Total	21	30	34	31	31	24

¹⁶ The initial simulation model, based on the COWI study, showed a need to increase train provisions by 3 to 4 times, depending on the section. Subsequent review showed that the COWI data had underestimated the 2005 traffic volumes and thus overestimated the increase in provision required. The estimated train requirements have been scaled down proportionately.

Section	Yen Vien - Bac Hong	Bac Hong - Viet Tri	Viet Tri - Tien Kien	Tien Kien - Yen Bai	Yien Bai - Pho Lu	Pho Lu - Lao Cai
Km	15.9	45.9	18.0	64.9	106.1	31.9
Project Operations - Heavier Trains						
Heavier Trains	2030					
Freight	27	41	60	65	48	32
Passenger	26	29	28	28	24	21
Total	53	60	88	93	72	53
	2020					
Freight	21	33	38	32	32	21
Passenger	16	18	18	18	16	14
Total	35	51	56	50	48	35
	2010					
Freight	10	17	21	18	18	12
Passenger	10	11	11	11	11	9
Total	20	28	32	29	29	21

Train requirements were then compared with the available capacity. The results of this exercise are shown in Table 7.11. It can be seen that, with the project, all the freight demand in 2020 can be accommodated. In the base case, (without rehabilitation or capacity improvements) only 22% of freight traffic can be carried in 2030. In all cases, the sections with the largest percentage shortfall are between Yen Bai (km 155) and Phu Lo (km 262)

Table 7.10: Percentage of Freight Demand Met: (including Rehabilitation)

	Yen Vien - Bac Hong	Bac Hong - Viet Tri	Viet Tri - Tien Kien	Tien Kien - Yen Bai	Yien Bai - Pho Lu	Pho Lu - Lao Cai	Totals
With Rehabilitation							
2030							
Base	100	71	41	22	34	46	49
Project	100	100	72	58	88	83	83
2020							
Base	100	100	100	84	84	100	92
Project	100	100	100	100	100	100	100
2015							
Base	100	100	100	100	100	100	100
Project	100	100	100	100	100	100	0

Note: Base ~ No capacity increase & current operating practice
Project ~ Capacity increase & longer, heavier trains

Table 7.11: Line Capacity with Rehabilitation (Trains per Day)

	Capacity - with Rehabilitation					
	Yen Vien - Bac Hong	Bac Hong - Viet Tri	Viet Tri - Tien Kien	Tien Kien - Yen Bai	Yien Bai - Pho Lu	Pho Lu - Lao Cai
	Current Operating Practice					
	2030					
Total	71	71	66	47	47	42
Passenger	29	32	31	31	30	27
Freight	42	39	35	16	17	15
	2020					
Total	71	71	66	47	47	42
Passenger	18	20	20	20	20	18
Freight	53	51	46	27	27	24
	2015					
Total	71	71	66	47	47	42
Passenger	14	16	16	16	16	15
Freight	57	55	50	31	31	27
	2010					
Total	71	71	66	47	47	42
Passenger	11	13	13	13	13	12
Freight	60	58	53	34	34	30
	Project Operations - Heavier Trains					
	2030					
Total	74	74	71	66	66	48
Passenger	26	29	28	28	24	21
Freight	48	45	43	38	42	27
	2020					
Total	74	74	71	66	66	48
Passenger	16	18	18	18	16	14
Freight	58	56	53	48	50	34
	2015					
Total	74	74	71	66	66	48
Passenger	13	14	14	14	13	11
Freight	61	60	57	52	53	37
	2010					
Total	74	74	71	66	66	48
Passenger	10	11	11	11	11	9
Freight	64	63	60	55	55	39

The capacity shortfall, expressed as tonnes per annum (p.a). was estimated by applying the percentages in Table 7.11 to the demand on each section. The results are shown in Table 7.12. The volume of traffic that has to divert to road is, as noted above, the maximum shortfall multiplied by the average haul of 244 km. In the base case, in 2020, nearly 800 million tonne-km has to divert. Implementation of the project allows the railway to meet all the traffic demand, and there is no diversion to road.

Table 7.12: Freight Capacity Shortfall and Diversion to Road (000 tonnes p.a.)

	Yen Vien - Bac Hong	Bac Hong - Viet Tri	Viet Tri - Tien Kien	Tien Kien - Yen Bai	Yien Bai - Pho Lu	Pho Lu - Lao Cai	Diversion
	000 tonnes p.a.						t-km (mn)
	With Rehabilitation						
	2020						
Base	0	3,636	5,043	6,674	2,796	2,284	1,628
Project	0	0	2,428	3,599	504	708	878
	2020						
Base	0	0	0	637	450	0	155
Project	0	0	0	0	0	0	0
	2015						
Base	0	0	0	0	0	0	0
Project	0	0	0	0	0	0	0

Note: Base ~ No capacity increase & current practice

Project ~ Capacity increases & longer, heavier trains

Transport Cost Savings

The road and rail transport costs for each option are shown below.

Table 7.13: Transport Costs

	Diversion	Transport Costs (\$ mn pa)		
	t-km (mn)	Road	Rail	Total
	With Rehabilitation			
	2030			
No Capacity Increase & Current Practice	1,628	96.6	29.6	126.2
Inc Capacity & Heavier Trains	878	52.1	45.1	97.2
	2020			
No Capacity Increase & Current Practice	155	9.2	35.3	44.5
Inc Capacity & Heavier Trains	0	0.0	35.0	35.0
	2015			
No Capacity Increase & Current Practice	0	0.0	27.1	27.1
Inc Capacity & Heavier Trains	0	0.0	24.6	24.6

Finally, the incremental benefits of each project component are shown in Table 7.14 below.

Table 7.14: Total Transport Costs and Incremental Benefits of Project Components (US\$ million p.a)

	Rehabilitation		Incremental Benefits
	Without	With	
Capacity Increase	2030		
Without	167.1	N/A	40.9
with	N/A	97.2	52.7
Incremental Benefits	17.2	29.0	69.8
	2020		
Without	63.4	N/A	18.9
with	N/A	35.0	5.5
Incremental Benefits	22.9	9.5	28.4
	2015		
Without	31.2	N/A	4.1
with	N/A	24.6	2.0
Incremental Benefits	4.5	2.5	6.6

Implementing the project will give benefits of US\$ 6.6 million in 2015, rising to over US\$ 69 million in 2030.

Rehabilitation alone also generates substantial benefits (though at much higher cost than the capacity increases), giving US\$ 18.9 millions in 2020 and US\$ 40.9 million in 2030. Further, if the capacity increases are put in place, the incremental benefits of rehabilitation in 2030 increase significantly to US\$ 52.7 million. However, the capacity increases in the earlier years compensate for losses in carrying capacity due to deterioration of the infrastructure, and there are no additional benefits from rehabilitation (given that the capacity increases have been implemented) are relatively small, at US\$ 2.0 million in 2015 and US\$ 5.5 million in 2020.

Treatment of Project Costs

It was assumed that the project would take three years to implement, with construction taking from 2008 to 2010. It was further assumed that construction expenditures would be the same in all three years.

Maintenance costs were estimated to be 1% of capital costs, in line with experience elsewhere. However, for the rehabilitation component, it was recognized that the poor condition of the existing track, bridges and embankments is imposing additional maintenance costs on VNR, although the exact amount is not available from VNR management accounts; it was assumed that maintenance costs would increase by a factor of two. Accordingly, the rehabilitation should result in a reduction in costs, equivalent to 1% of capital expenditure.

Project Appraisal Period

The appraisal period was taken as 25 years, with 2011 being the first year of operation. All costs and benefits were discounted back to 2007 at the standard rate of discount of 12%.

Treatment of Residuals

The appraisal procedure has to take account of any benefits the project may reasonably be expected to generate after 2034. The following approach was used.

The investments for capacity expansion have a life expectancy of around 50 years, so on the assumption that the railway is still in use, the benefits of the capacity expansion would continue indefinitely. Similarly, the life of the slope protection works and bridge rehabilitation investments is around 50 years, so they too could be expected to generate benefits indefinitely. The future cost and benefits attributable to these components were therefore capitalized and added into the final year's cash flow.

The position with the rail and track improvements is rather different, as their life expectancy is around 25 years and a major track renewal programme would be required in or around 2035. It follows that benefits from the track component will not extend beyond the project appraisal period. It is difficult to distinguish effectively between the benefits attributable to track and those attributable to slope protection and bridge rehabilitation, but it seemed reasonable, when capitalizing the final year's cash flow, to reduce the benefits in proportion to the capital costs of the components.

Results of Cost-Benefit Analysis: Central Case

The results of the cost-benefit analysis are shown in Table 7.15. Evaluation of the project gives a positive NPV, and an overall IRR of 13.9%.

Table 7.15: Cost-Benefit Analysis

Cost and Benefits for:	NPV (US\$ mn)	IRR (%)
Overall Project vs Base (Capacity Increase & Rehabilitation)	26.0	13.9

Sensitivity and Switch Analysis

Changes in Costs and Benefits

The project is sensitive to changes in costs and benefits. A 20% increase in benefits, combined with a 20% drop in costs will raise the IRR to 17.1%. Conversely, a 20% increase in costs combined with a 20% decrease in benefits, reduces the IRR to 10.9%.

Table 7.16: Sensitivity Test – Reduced Costs & Increased Benefits

20% reduction in costs; 20% increase in benefits		
Cost and Benefits for:	NPV (US\$ mn)	IRR (%)
Overall Project vs Base (Capacity Increase & Rehabilitation)	67.5	17.1

Table 7.17: Sensitivity Test – Increased Costs and Reduced Benefits

20% increase in costs; 20% reduction in benefits		
Cost and Benefits for:	NPV (US\$ mn)	IRR (%)
Overall Project vs Base (Capacity Increase & Rehabilitation)	-15.6	10.9

Sensitivity to Key Input Parameters

A series of sensitivity tests were run to assess the impact of changes in the following key variables:

- Traffic volumes in 2020
- Rate of reduction in capacity due to deterioration of the track
- Changes in road and rail operating costs
- Changes in the assumed length of average haul, which affects both the costs of road transport and the potential saving in rail transport costs that arise from the use of heavier trains.

Table 7.18 overleaf summarizes the results for the overall project.

Table 7.18: Sensitivity of the Project to Changes in Key Parameters

Parameter Change	NPV (US\$ mn)	IRR (%)
Traffic (passenger & freight)		
Increase 20%	75.4	17.2
Decrease 20%	-10.6	11.2
Capacity Loss		
Slower Deterioration: (1.5% p.a.)	0.9	12.1
Faster Deterioration: (3.5%)	47.5	15.3
Operating Cost Increase		
Slower (0.5% p.a.)	19.7	13.4
Faster (1.5%)	32.5	14.3
Road Costs		
Increase of 20% (7.2 cents per tonne-km)	53.9	15.5
Decrease of 20% (4.7 cents per tonne-km)	-2.0	11.8
Rail Operating Costs		
Increase of 20% (2.5 & 2.3 cents / tonne-km)	21.3	13.6
Decrease of 20% (1.7 & 1.5 cents / tonne-km)	30.5	14.1
Average Haul		
Decrease 20% (195 km)	2.5	12.2
Increase 20% (293 km)	49.4	15.3
Project Rail Operating Cost (heavier trains)		
Increase of 20% (2.3 cents / tonne-km)	-0.4	12.0
Decrease of 20% (2.7 cents / tonne-km)	52.8	15.8

As can be seen, the NPV of the overall project is relatively insensitive to changes in key parameters. It is however, sensitive to changes in road costs, with a 20% reduction in VOC being sufficient to produce a negative NPV. Economic viability is also affected by reductions in forecast traffic volumes and changes in the operating cost of the railway. An overall reduction in traffic volumes of 20% would reduce the overall rate of return to just over 11%. Similarly, a substantial proportion of overall benefits arise from the approximately 10% reduction in rail operating costs which should arise from the use of longer, heavier trains. If these are not realized, then the project becomes marginal, with an NPV slightly lower than zero (as can be seen in the last line of Table 7.18)

Finally, the effects of the proposed construction of a new railway between Hanoi and Lao Cai on the viability of the project were explored. If the railway opens in 2025, which VNR considers the earliest a new line realistically can be in operation, the EIRR of the project is reduced but the project remains economically viable.

Switch Analysis

Finally, the values of key parameters at which the NPV of the project changes sign were identified, as shown in Table 7.19.

Table 7.19 : Switch Values for the Project

Parameter	Value
Traffic reduction (% passenger & freight in 2020)	15.0
Capacity loss (% p.a.)	1.5
Increase in operating costs (% p.a.)	nsv
Road Costs (cents per tonne-km)	4.8

Rail Operating Costs (cent per tonne-km)	nsv
Average Haul (km)	190
Project Rail Operating Cost (heavier trains) (cents per tonne-km)	2.25

nsv – no switch value found

The switch value analysis for the project shows that only relatively small changes in key variables are required to make bring the NPV below zero. Notably, the traffic would only need to fall by 15%, or road vehicle operating costs by 20% to make it unviable.

7.5.4 Evaluation of Overpasses

The principal benefits of the construction of overpasses are the savings in road vehicle times from the elimination of delays from barrier closing. This, in turn, depends on the average barrier closing time, the time taken for traffic flows to return to normal and the volume of traffic on the affected road.

Traffic surveys were carried out at three candidate sites: Dong Anh (km 21.8), Gia Cam¹⁷ in Viet Tri (km 76.5) and Yen Bai (km 155.9), each for one day. The surveys included 18 hour classified traffic counts and a record of the time the barriers were closed and opened. The traffic volumes and average closure times are shown below.

Table 7.20: Traffic Volumes

	Vehicle per Day - Both Directions					
Location	Moto	Car	Bus	Truck	Other	Total
Dong Anh	21,070	2,987	1,531	3,921	1,208	30,717
Gia Cam	43,236	3,177	1,010	529	6,455	54,407
Yen Bai	10,960	656	50	318	2,512	14,496
	Percent of Total Flow					
Dong Anh	69	10	5	13	4	100
Gia Cam	79	6	2	1	12	100
Yen Bai	76	5	0	2	17	100

Traffic volumes at Gia Cam are very high, nearly 55,000 vehicles per day (vpd), approximately 80% of which are motorcycles. Traffic volumes at Dong Anh are also substantial, at nearly 31,000 vpd, with much higher levels of heavy traffic (buses and trucks) than at Gia Cam. Traffic at Yen Bai is modest, with less than 14,500 vpd.

Table 7.21: Barrier Closure Times (minutes)

	Dong Anh	Gia Cam	Yen Bai
Barrier Closure	4.1	4.9	2.6
Time to normal flow resumption	4 to 5	4 to 5	2 to 3

The barrier closure times appear to be related to traffic volumes, with the longest closures being found in Gia Cam, where traffic volumes were greatest. The average of the two more heavily trafficked sites was 4.6 minutes, which was the value used in the economic analysis. It was further assumed, on the basis of limited observations, that a similar time would elapse before normal traffic flows resumed.

¹⁷ The consultants have since been informed that the railway line at Viet Tri is to be moved out of the city, so that the flyover at Gia Cam will not be required. It has therefore been removed from the project.

There are two components to the delays to traffic; delays from the closure and delays from the slow movement of traffic as the jam clears. Traffic arriving as the barrier closes will be delayed by the full period of closure, while traffic arriving as it opens will suffer no delay on this account. The average delay on account of closure will therefore be half the closure time. Conversely, all traffic will suffer some delay on account of jam clearing, (as will traffic arriving in the period immediately after the barrier opens). It has been assumed that the average delay will be equal to that arising from barrier closure.

Future traffic volumes were estimated using the growth rates currently in use by the Vietnam Roads Authority for evaluation of national road projects. These rates are arguably conservative for the crossing sites, which are also subject to rapid urbanization. The traffic growth rates are shown in Table 7.22, while the forecast traffic volumes are shown in Table 7.23:

Table 7.22: Growth Rates and Time Values by Vehicle Type

	Moto	Car	Bus	Truck	Other	Total
Value of Time (\$ / hr)	0.38	3.10	7.03	4.98	1.61	1.61
Av. Closure time (min)			4.6			
Av. Clearance time (min)			4.6			
Annual growth rate (%)						
2006 – 13	8	8	5	6	5	
2014 onwards	4	5	3	3	4	

Source for growth: BCEOM

Table 7.23: Forecast Traffic Volumes by Location (vpd)

	Moto	Car	Bus	Truck	Other	Total
Dong Anh						
2006	21,070	2,987	1,531	3,921	1,208	30,717
2010	28,666	4,064	1,861	4,950	1,468	41,009
2015	39,057	5,644	2,285	6,255	1,838	55,080
2020	47,519	7,203	2,649	7,251	2,237	66,859
2030	70,339	11,733	3,561	9,745	3,311	98,689
Gia Cam						
2006	43,236	3,177	1,010	529	6,455	54,407
2010	58,822	4,322	1,228	668	7,846	72,886
2015	80,145	6,003	1,508	844	9,824	98,324
2020	97,509	7,661	1,748	978	11,952	119,849
2030	144,337	12,480	2,349	1,315	17,692	178,173
Yen Bai						
2006	10,960	656	50	318	2,512	14,496
2010	14,911	892	61	401	3,053	19,319
2015	20,316	1,240	75	507	3,823	25,961
2020	24,718	1,582	87	588	4,651	31,626
2030	36,588	2,577	116	790	6,885	46,957

The number of barrier closures per day at present is known from the timetable, while number of daily closures in the future was assessed using the operational analysis. The calculated hours of closure are shown in Table 7.24 overleaf, together with the estimated hours of vehicle time lost each day.

Table 7.24: Estimated Delays at Barriers (vehicle-hours per day)

Year	Daily Closures		Moto	Car	Bus	Truck	Other	Total
	No.	Hours						
			Dong Anh					
2006	24	1.84	165	23	12	31	9	241
2010	29	2.23	273	39	18	47	14	390
2015	36	2.73	454	66	27	73	21	640
2020	42	3.22	652	99	36	99	31	917
2030	42	3.22	965	161	49	134	45	1,354
			Gia Cam					
2006	37	2.84	522	38	12	6	78	657
2010	43	3.30	826	61	17	9	110	1,023
2011	45	3.41	923	68	19	10	120	1,140
2015	51	3.87	1,322	99	25	14	162	1,621
2020	58	4.45	1,847	145	33	19	226	2,270
2030	58	4.45	2,734	236	44	25	335	3,375
			Yen Bai					
2006	32	1.39	37	2	0	1	8	48
2010	42	1.81	65	4	0	2	13	84
2015	54	2.33	114	7	0	3	21	146
2020	66	2.86	170	11	1	4	32	218
2030	66	2.86	252	18	1	5	47	323

Finally, the value of time delays is estimated, using the delays shown in Table 7.24 above, and the values of time given in Table 7.22.

Table 7.25: Annual Value of Time Delays (US\$ 000 p.a.)

Year	Moto	Car	Bus	Truck	Other	Total
Dong Anh						
2010	34.2	39.6	41.1	77.4	7.4	199.7
2015	56.9	67.1	61.6	119.4	11.4	316.3
2020	81.7	101.1	84.3	163.4	16.3	446.8
2030	121.0	164.6	113.3	219.6	24.1	642.7
Gia Cam						
2010	103.6	62.1	40.0	15.4	27.3	248.4
2015	165.7	101.3	57.7	22.9	40.2	387.7
2020	231.6	148.4	76.8	30.4	56.1	543.4
2030	342.8	241.8	103.2	40.9	83.0	811.8
Yen Bai						
2010	8.1	4.0	0.6	2.9	3.0	18.6
2015	14.3	7.1	1.0	4.7	4.8	31.9
2020	21.3	11.1	1.4	6.7	7.2	47.7
2030	31.6	18.2	1.9	8.9	10.6	71.2

Treatment of Project Costs

It was assumed that the project would take two years to implement, with construction starting in 2008, and the first year of operation being 2010. It was further assumed that construction expenditures would be the same in both years. Maintenance costs were assumed to be 1% of capital costs. Project costs include resettlement, which at Dong Anh costs US\$ 1.5 million, almost as much as the construction work, which cost US\$ 1.9 million. The costs also include a pro-rated allowance for design and supervision, administration, environmental protection, etc.

Project Appraisal Period

The appraisal period was taken as 25 years, with 2010 being the first year of operation. All costs and benefits were discounted back to 2007 at the standard rate of discount of 12%.

Treatment of Residuals

The future cost and benefit streams after the end of the appraisal period were capitalized in 2034 and added into the final year's cash flow.

Results of the Cost-Benefit Analysis: Central Case

The NPV and IRR of each of the flyovers is set out in Table 7.26 below. As can be seen, only the flyover at Gia Cam is viable at 12%. The results for Dong Anh are heavily dependent on the costs of resettlement. If resettlement costs are excluded, the project becomes viable, giving an IRR of 14.9%. The volumes of traffic at Yen Bai are too low to justify construction of the flyover, and the IRR is very low at -3.8%.

Table 7.26: Flyover Cost-Benefit Analysis

Location	NPV (US\$ million)	IRR (%)
Dong Anh	-0.8	9.2
Gia Cam	7.3	15.3
Yen Bai	-17.7	-3.8

Sensitivity and Switch Analysis*Variations in Costs and Benefits*

The NPV of the overpass at Dong Anh is not sensitive to changes in the overall level of costs and benefits. Neither an increase in costs of 20%, or a decrease in benefits of 20%, is sufficient to change the sign of the NPV, and make it economically unviable. Similarly, the conclusions for Yen Bai (unviable) and Gia Cam (viable) are unaffected by 20% variations.

Table 7.27 : Sensitivity to 20% Change in Costs and Benefits

Costs	+ 20%	- 20%	0%	0%
Benefits	0%	0%	- 20%	+ 20%
	IRR (%)			
Dong Anh	7.7	11.2	7.3	10.8
Gia Cam	13.3	18.0	12.8	17.4
Yen Bai	2.7	5.6	2.4	5.3

Variations in Key Parameters

The effect of variations in the key parameters of the value of vehicle time, the length of time traffic is delayed, and the rate of traffic growth, was also investigated, and showed that all the overpass proposals are very sensitive to changes in traffic delays (barrier closure and resumption of flow). A 20% reduction in delays is enough to make Gia Cam economically unviable, while a 20% increase is enough to make Dong Anh economically feasible.

All sites show substantial variations in NPV in response to changes in the value of time and in the rate of traffic growth. However, even Increases of 20% in these parameters are not sufficient to make Dong Anh viable.

Table 7.28 : Sensitivity of IRR to Variations in Key Parameters

Parameter	Value of Time		Delays		Traffic Growth	
Variation (%)	+ 20	- 20	+ 20	- 20	+ 20	- 20
	IRR (%)					
Dong Anh	10.8	7.3	12.6	5.6	10.5	7.9
Gia Cam	17.4	12.8	19.9	10.7	16.8	13.7
Yen Bai	6.7	3.7	8.1	2.1	6.6	3.9

Yen Bai is not sensitive to this level of variation in key parameters.

Switch Values of Key Parameters

The values of the key parameters at which the NPV of the proposed projects changes sign are shown below. As can be seen, very large changes are required before Yen Bai and Dong Anh become economically viable, while Gia Cam is relatively robust to variations in these parameters.

Table 7.29 : Switch Values of Key Parameters

	Value of Time	Delays	Traffic Growth
	Percentage Change Required to Switch		
Dong Anh	+36	+16	+43
Gia Cam	-25	-15	-40
Yen Bai	+125	+ 50	+100

7.6 CONCLUSION

Table 7.30 below shows the NPV and IRR for the project. As can be seen, the IRR is 13.4%, and therefore above the test rate of 12%.

Table 7.30 : Project Evaluation

NPV	IRR
(US\$ million)	(%)
21.0	13.4

The cost of rehabilitation at the overpass site at Dong Anh is so high that the flyover is not economically justified. Design improvements to reduce the amount of resettlement could be expected to change this conclusion. It is clear that road congestion at these crossings will grow very rapidly, and the railway will face increasing problems of security and safety, if the overpasses are not built. Table 7.31 overleaf summarises the annual project cashflow.

Table 7.31 : Project Cashflow – Costs and Benefits

US\$ million			
Year	Project Costs	Project Benefits	Net Benefits
	Total	Total	Total
2008	44.0	0.0	-44.0
2009	44.0	0.0	-44.0
2010	39.8	0.2	-39.6
2011	-0.8	3.2	4.0
2012	-0.8	3.9	4.7
2013	-0.8	4.8	5.6
2014	-0.8	5.8	6.6
2015	-0.8	6.9	7.7
2016	-0.8	9.9	10.7
2017	-0.8	13.4	14.2
2018	-0.8	17.7	18.5
2019	-0.8	22.8	23.6
2020	-0.8	28.8	29.6
2021	-0.8	31.5	32.3
2022	-0.8	34.5	35.3
2023	-0.8	37.7	38.5
2024	-0.8	41.3	42.0
2025	-0.8	45.1	45.9
2026	-0.8	49.3	50.1
2027	-0.8	53.9	54.7
2028	-0.8	59.0	59.8
2029	-0.8	64.5	65.3
2030	-0.8	70.5	71.3
2031	-0.8	70.5	71.3
2032	-0.8	70.5	71.3
2033	-0.8	70.6	71.4
2034	0.2	234.7	234.5

8 FINANCIAL ANALYSIS AND EVALUATION

8.1 FINANCIAL MANAGEMENT ASSESSMENT¹⁸

The terms of reference require that an assessment be made of those parts of VNR which will be involved with the construction and subsequent operation of the project. However, the organisation of VNR is such that the debt repayment will be covered out of the total consolidated income rather than those parts concerned with infrastructure and transport.

VNR is presently in the very early stages of a restructuring from being a department of the Ministry of Transport into a commercially organised corporation which can operate independently and react to the situations with which it will be confronted in a market oriented economy. To this end a Railway Law has been promulgated which now must be brought into effect. The law calls for the splitting of Infrastructure from Operations as well as the introduction of private companies on to the network which will be competing for business with the newly formed subsidiaries of VNR.

The fact that the restructuring is still in progress means that the subsidiaries are not yet fully organised and are still in fact a part of the VNR structure. On the other hand much of the accounting data, for example fixed asset information and depreciation costs, are kept at the subsidiary level whereas it could be consolidated. There is therefore a need for a modern accounting system which should be computer based.

VNR has only once been audited by external auditors, in 2004, and then only partially. As a result it is difficult to obtain impartial financial information. Moreover, the organisation of the accounting function is not such that information can be obtained in a way that provides the type of data required for the assessments needed.

Nonetheless, the sections below provide an appraisal of VNR management information, based on the information available at the time of writing.

8.1.1 Corporate Planning and Budgetary Control

There is presently no corporate planning and budgetary control in the sense that it is normally carried out in modern accounting practice. This must however be introduced as quickly as possible in order to make the restructuring of VNR a success and in order to comply with the requirements of the Railway Law.

At present there is still considerable state control over VNR which includes the directing of the future course of the Railway as well as determining the annual budgets. The latter are based primarily on past experience and do not involve any zero-based compilation and justification process. As a result there is also little monitoring of costs or comparisons of actual results against budgeted figures, nor is there any evaluation of the performance of individual units of the Railway.

The procedure is to provide the Railway with the necessary financial means to carry out its approved budget allocated by the Ministry of Transport. As a general rule no significant additional budget is approved in the course of a financial period, so that VNR

¹⁸ VNR was very reluctant to provide the financial data needed for this analysis (and which would normally be in the public domain). Moreover, the data provided was in many respects incomplete. It has therefore been difficult to comply with all the requirements of the ToR for financial analysis.

is constrained to operate within the limits of the budget allocated at the beginning of the financial period.

Any profit gained is retained by the Railway but taken into account when preparing the next annual budget. In reviewing the statements however, it is clear that the Railway basically only covers its costs.

The budget provided includes subsidies which are given for the infrastructure maintenance and for tariff shortfalls. The 10% of transport revenues charged by the infrastructure to the transport companies as user charges is therefore insufficient.

Long-term planning is not given much emphasis as far as the accounting is concerned and budgeting still seems to be on a VNR total basis rather than the individual companies being given the opportunity to act independently.

In the course of our review we were assured by the external auditors; VACO, who examined the figures for 2004, that all financial movements were reflected in the consolidated figures. Nonetheless, due to the relationship between VNR and the Ministry of Transport which has existed up to the passing of the Railway Law, some transactions made by the Ministry have not been appropriately recorded in the books. The payments to the infrastructure mentioned above for example, are apparently recorded as revenues by the infrastructure companies and there are amounts in the equity section which are recorded as reserves for fixed assets which represent amounts received from Government sources. See 8.3.2 Capital Structure below.

In future therefore, the separation of VNR from the Ministry must be assured and subsidies obtained from Government sources should be recorded as such rather than as revenues.

8.1.2 Financial and Management Accounting

Under the Railway Law VNR is to be split up into an infrastructure company and operating companies. There are presently 21 companies involved in infrastructure maintenance, three in transport and numerous other companies, including several in the construction and logistic sectors and others in the field of education and training. These make up a total of 59 subsidiaries of VNR.

The reorganisation is presently in the approved stage and needs to be implemented. The various companies have not yet been fully set up and there will be a requirement for each one to be further broken down into Business Units, Profit Centres and Cost Centres once the companies themselves have become fully established. This cannot be expected to be completed until well into the period of construction of the project if it should start as intended in 2007.

In reviewing the chart of accounts and in discussions with financial personnel, including the external auditors, there appears to be confusion between entities which should be considered as subsidiaries and those which are normally only departments. There is an obvious need for outside help in the whole area of restructuring of VNR, including the reporting lines and organisation of the various activities.

There are in fact 59 subsidiary companies listed on the accounts but it is questionable whether separate entities should be set up in every case. For instance the Infrastructure has 21 different wholly owned subsidiaries which could probably be grouped into fewer companies with business units established for what are presently foreseen as separate independent subsidiaries.

There is a level of consolidation missing in that the subsidiaries have detailed accounting information on their books which is consolidated into the parent company in summarised form. The detail therefore does not exist at corporate level, which is acceptable. However, what is missing is summarised information at subsidiary level. This is particularly the case with regard to fixed assets and depreciation, where it is difficult to get summarised information appertaining to different types of assets and their depreciation costs. This is an area where more detailed investigation is required, as much information seems to be at hand but it is not channelled into meaningful summarised reports.

The Railway does not have a system of control accounts and registers for such items as fixed assets and inventories. Here again much detail is to be found at local level but it is not condensed in such a way that inconsistencies can be highlighted for review at a higher management level. The fixed assets are partly financed out of the state budget which means that the values on the books may not reflect the proper cost of the assets. Moreover, the records are decentralised as far as detailed costs are concerned. Any future audit or assessment of the accounting system will therefore necessarily involve analyses at the subsidiary level as well as at the parent company.

As part of the reorganisation process the assets of each company will need to be re-valued and the books adjusted accordingly.

8.1.3 Cost Accounting

A cost accounting system is presently in the process of being set up with the help of the German technical assistance company GTZ. It consists of gathering costs and other data relating to operations. The present activities are centered around consolidating the elements which have so far been introduced, further development is not programmed for this year.

The system provides information on commodities carried by the freight company, along with their costs of transport, but in this area also there is an urgent need for further development, consisting of the introduction of a cost accounting system which will provide basis information relating to rolling stock running costs and infrastructure costs. The latter are especially important as they will be needed in order to determine realistic user charges for operators, including potential private operators.

There is presently no use made of information relating to rolling stock running costs, such as fuel usage or maintenance costs per kilometre travelled, and therefore no comparisons to determine efficiency.

As part of the restructuring, the infrastructure is to be financed from user charges made to those operators using it. At present the infrastructure companies receive ten percent of the revenues of the operating companies, which apparently is not sufficient to cover the costs of maintaining the infrastructure. In fact the Government provides additional funds to cover the upkeep. These revenues are intended to be used for the maintenance of the assets belonging to the infrastructure and it is questionable whether they may be sufficient to cover replacement of the assets when needed. There is therefore a need for a more sophisticated cost accounting system which will provide data allowing for the total costs of the maintenance and replacement of the infrastructure to be calculated and passed on accordingly.

In the appendices the income figures for the transport activities have been calculated separately from the total VNR. The figures show that the transport activities generate a

net income of approximately 12 %. However there is no attempt to allocate indirect charges to the transport activities. Many subsidiaries, such as the administrative departments and medical services are directly connected to the transport activities and therefore in introducing a new system a key should be establish to allocate costs for these support functions to the transport companies.

8.1.4 Internal Control and Audit System

Although there is an element of internal control in that as part of normal procedures payments and similar transactions are independently verified by a person other than the one preparing the entry, there is no internal audit group to control transactions or monitor that established procedures are being adhered to.

There appears to be no present plan to introduce an internal audit group. This will however, be necessary for control purposes in the future if VNR is to become competitive and should be formed preferably before the introduction of any new management accounting system.

An external audit was performed by five different auditing firms on the financial statements for the year 2004. However, the extent of the audit did not include all the subsidiaries. Under Vietnamese law there was no requirement for the statements relating to previous years to be audited. Accordingly, in these previous years the control was exercised through audits made by state auditors. For future years external auditors should be engaged to perform independent audits and comment on the financial statements.

Even in 2004 most of the subsidiaries, including the Infrastructure, were not subjected to an independent audit. These were audited by the state auditors and the figures approved by the Ministry of Transport.

For 2005 no external auditors have been engaged, the auditing activities will be taken over by the state auditors. This is apparently within existing Vietnamese regulations. Nonetheless, from 2006 onwards it will be necessary to engage external auditors if VNR is to become commercially oriented.

8.1.5 Data Processing

The system is organised on a departmental basis, at which level data is input and reports as well as other outputs produced. The data thus obtained is manually entered into the centralised system to produce consolidated figures. There is therefore no network of on-line link-ups at this stage.

Automation is an on-going project within the Railway, which will need to be accelerated to provide for the introduction of a state of the art management accounting system. As previously mentioned, it is particularly desirable to develop the costing system to such an extent that unit costs for such items as infrastructure maintenance, rolling stock running costs and similar information can be generated.

The future needs apart from a costing system are for on-line accounting in the areas of accounts receivable, accounts payable and fixed assets and inventory controls. Any accounting package should also provide for the possibility to produce financial statements by computer.

8.1.6 Project Management

It is recommended that separate accounting be made for the execution of the project, as agreed under Paragraphs 25 and 26 of the MoU, including personnel dedicated to the project. Otherwise, the implementation of the Railway Law and the conversion of the accounting system concurrently with the implementation of the project could possibly lead to difficulties in controlling the utilisation of the funds. The standard controls for authorising payments and reconciling of bank accounts as well as similar controls should be made within this group. This sub-system should also be fully computerised from the inception of the project onwards.

8.1.7 Suggested Covenants

Railway operations are presently being subsidised and subsidisation can be expected to continue to be necessary in the short to medium term.

Further covenants should include the improvement of the Fixed Asset ratio and the Debt to Equity ratio after the adjustment for funds received from the Government.

8.1.8 Conclusion

VNR does not as yet have a management accounting system in place. A top priority must therefore be the introduction of a system encompassing as a minimum all the topics covered above. The work involved will require a complete review of the accounting systems and the introduction of new methods and procedures. It must also provide the ability to generate costing information on which management decisions can be made, including the calculations of user charges for use of the infrastructure.

To achieve this, a high level of computerisation will be needed.

A particular aspect of the system to be defined must be budgeting and control. The various sections of VNR must develop their own budgets which should be reviewed by top management for approval and controlled throughout the year for any serious variances. Management must then be in a position to make judgments and take whatever remedial action is necessary when such variances occur.

This task can only be performed over a number of years, in our view at least three, and will be taking place after the start of the proposed project, should it be approved for financing.

A particular effort will need to be made to evaluate the fixed assets and to set up a register which will tie in with the control account in the General Ledger. A similar effort will be required for inventory control. These exercises will inevitably be time consuming.

The only time VNR has been audited by external independent auditors was for the financial year 2004. For 2005 there will be no audit by external auditors but by those of the state. For future years VNR must be audited independently in order to conform to generally accepted practice and as part of the process of becoming a commercially oriented corporation.

In the past VNR has relied on subsidies to maintain the infrastructure and cover insufficient tariffs.

8.2 PROJECT COSTS

The project costs are as detailed in the technical sections of the report. They were only available after the financial analyst had left Viet Nam. Nonetheless, the costs are considered to be in line with the requirements of VNR and represent the reasonable outlay for the improvements to be made.

8.3 FINANCIAL STATEMENT REVIEW

8.3.1 Historical Performance

The figures obtained for the total VNR are restricted to the years 2003 and 2004 and are presented below in Vietnamese currency; VND, and US Dollars. Previous to 2003 the Railway was organised on a regional basis and no consolidated figures were available to the financial analyst. The figures for 2005 were not available as they were not yet audited.

The asset section of the Balance Sheet shows that VNR receives considerable subsidies to offset the low tariffs presently in force. The amount of these subsidies is currently running at approximately \$30 million p.a.. If VNR is to be run as a commercially oriented enterprise these subsidies will have to be reduced and finally removed. This process however, will take some time and depend on the ability of VNR's customers to pay realistic tariffs. It is therefore dependent on the development of the Vietnamese economy as a whole.

The current liabilities show that the amounts payable to related companies are offset by receivables from related companies and therefore no imbalance exists in this respect.

Long term loans amounting to \$128 millions will have to be serviced along with any loan granted in connection with the present project which is under consideration.

The Equity section shows reserves for infrastructure development and fixed assets procurement amounting to over \$600 million dollars which represents funds received from Government sources. These two items account for over 80% of VNR's equity, which shows that the Railway is not able to accumulate funds from its regular activities and will be dependent on Government support for the foreseeable future.

Table 8.1: Proforma Financial Statement (VND million)

Balance Sheet Total VNR		
Year	2003	2004
Assets		
Current Assets		
Cash	366,497	546,985
Short -term investments	5,036	5,610
Accounts Receivable from Customers (Net)	708,398	710,466
Receivables from Related Companies	1,169,071	1,882,221
Other receivables	500,483	333,571
Other Current Assets	64,833	54,520
Administrative subsidies	481,055	479,666
Inventories	601,210	628,142
Total	3,896,584	4,641,180
Fixed assets	12,319,754	13,317,302
Other Assets		
Long-term Investments	37,882	58,889
Total Assets	16,254,219	18,017,370
Liabilities		
Current liabilities		
Short-term loans	351,010	374,210
Current portion of long-term loan	116,726	168,413
Accounts Payable	476,511	676,963
Prepayments by customers	139,035	108,189
Taxes and social payments	249,673	266,580
Liabilities to related companies	1,145,850	1,819,429
Other liabilities	617,104	380,177
Total	3,095,909	3,793,961
Long-term liabilities		
Long-term loan	1,495,608	2,073,703
Other long-term liabilities	15,643	10,734
Total	1,511,251	2,084,437
Total Liabilities	4,607,160	5,878,399
Equity		
Capital	1,732,364	1,661,282
Asset re-evaluations	-8,464	4,189
Exchange rate gains (losses)	-22	-71,339
Reserves and contingencies	82,191	94,593
Reserve for infrastructure development	2,831,981	3,547,330
Administrative costs subsidies	577,311	531,631
Other reserves	22,102	23,436
Reserves for Fixed assets	6,409,595	6,329,097
Minority Shareholding		18,751
Total	11,647,058	12,138,971
Total Equity and Liabilities	16,254,219	18,017,370

Table 8.2: Proforma Financial Statements (US\$ 000)

Balance Sheet Total VNR		
Year	2003	2004
Assets		
Current Assets		
Cash	23,630	33,815
Short -term investments	325	347
Accounts Receivable from Customers (Net)	45,675	43,922
Receivables from Related Companies	75,377	116,360
Other receivables	32,269	20,622
Other Current Assets	4,180	3,370
Administrative subsidies	31,017	29,653
Inventories	38,764	38,832
Total	251,237	286,921
Fixed assets	794,331	823,285
Other Assets		
Long-term Investments	2,442	3,641
Total Assets	1,048,010	1,113,847
Liabilities		
Current liabilities		
Short-term loans	22,632	23,134
Current portion of long-term loan	7,526	10,411
Accounts Payable	30,724	41,850
Prepayments by customers	8,964	6,688
Taxes and social payments	16,098	16,480
Liabilities to related companies	73,880	112,478
Other liabilities	39,789	23,503
Total	199,612	234,546
Long-term liabilities		
Long-term loan	96,431	128,198
Other long-term liabilities	1,009	664
Total	97,440	128,861
Total Liabilities	297,052	363,407
Equity		
Capital	111,696	102,702
Asset re-evaluations	-546	259
Exchange rate gains (losses)	-1	-4,410
Reserves and contingencies	5,299	5,848
Reserve for infrastructure development	182,595	219,299
Administrative costs subsidies	37,223	32,866
Other reserves	1,425	1,449
Reserves for Fixed assets	413,266	391,270
Minority Shareholding	0	1,159
Total	750,958	750,440
Total Equity and Liabilities	1,048,010	1,113,847

Table 8.3: Financial Ratios

Ratios	2003	2004
Current Ratio	1.26	1.22
Return on Net Fixed Assets	0.0036	0.0031
Debt to Equity Ratio	28:72	33:67
Debt Service Coverage Ratio	0.01	0.01

The current ratio is increased to 1.39 if the inter-company transactions are eliminated. The return on fixed assets however, and the debt service coverage ratio are unacceptable as far as VNR's ability to service a loan are concerned. Moreover the Debt to Equity ratio is misleading since the Equity contains the funds provided by the Government for fixed assets and infrastructure. If these amounts are removed the ratio for 2004 becomes 63:37. See also Capital Structure below.

The findings of this review highlight the urgent need for VNR to introduce an accounting system in line with GAAP in market oriented economies. As has been already mentioned; considerable difficulties were encountered in obtaining documents and information which should normally be readily available. This included data such as Income Statements and Balance Sheets for past years, as well as explanations of figures contained therein. The problem is therefore not only one of introducing a new system, but also of training in the necessity for transparency of financial results. Part of the problem has been that up to 2003 the Railway was so organised that consolidated financial statements as such were not made. Since 2003 there has also been the introduction of a computerised cost accounting system which is presently being further developed.

As mentioned above, the only year for which VNR results have been audited is 2004 and then only 28 of 59 subsidiaries were audited. Included in the subsidiaries which were not audited are the 21 companies involved in the Infrastructure. Moreover, it is questionable whether all the subsidiaries should be separate legal entities, there would seem to be a need for regrouping many of these companies. Other subsidiaries should not be subsidiaries at all; VNR Office, Financial Dept., RPMU for example. An examination of this problem however, would be outside the scope of this assignment and should form part of a detailed investigation of the management accounting set-up of VNR in a separate project.

The effort required to bring the accounting system up to a level where the desired controls are in place and meaningful information produced will be considerable and will take well into the period of the upgrading project foreseen.

The agreement in the MoU to separate the project accounting from that of the total VNR will enhance the control over project funds but the underlying problem will still be the lack of transparency and inability of VNR to generate sufficient revenues to service a loan.

Due to the restructuring of VNR there is little in the way of comparative figures to review. However, the consolidated figures for 2001 to 2005 show that more than half of VNR's consolidated revenues emanate from activities other than railway transport. See Table 8.4 below. Of the company groupings listed, those considered as Production and Business and Materials and Tourism can be considered to generate funds outside of the Railway's sphere of operations whereas for the remainder the Railway is the main customer. This is a further area where transparency is required and consolidated revenues overstated.

Table 8.4: VNR Revenues (VND million)

Year	2001	%	2002	%	2003	%	2004	%	2005	%
	VND million									
Transportation	1,503,102	43.66	1,816,617	44.18	2,098,489	44.64	2,290,596	45.65	2,449,716	43.92
Construction Companies	480,262	13.95	676,052	16.44	510,632	10.86	375,000	7.47	221,282	3.97
Industrial Companies	366,667	10.65	367,317	8.93	326,145	6.94	494,060	9.85	454,802	8.15
Materials & Tourism	532,360	15.46	723,780	17.60	778,527	16.56	815,103	16.24	566,098	10.15
Infrastructure										
Management	560,150	16.27	527,868	12.84	594,487	12.65	575,318	11.47	649,883	11.65
Production and Business		0.00		0.00	392,309	8.35	467,736	9.32	1,235,685	22.15
Total	3,442,541	100.00	4,111,634	100.00	4,700,589	100.00	5,017,813	100.00	5,577,465	100.00
	US\$ 000									
Transportation	102,077	43.66	118,892	44.18	135,303	44.64	141,606	45.65	153,418	43.92
Construction Companies	32,615	13.95	44,246	16.44	32,924	10.86	23,183	7.47	13,858	3.97
Industrial Companies	24,901	10.65	24,040	8.93	21,029	6.94	30,543	9.85	28,483	8.15
Materials & Tourism	36,153	15.46	47,369	17.60	50,196	16.56	50,390	16.24	35,453	10.15
Infrastructure										
Management	38,040	16.27	34,547	12.84	38,330	12.65	35,567	11.47	40,700	11.65
Production and Business	0	0.00	0	0.00	25,295	8.35	28,916	9.32	77,387	22.15
Total	233,786	100.00	269,095	100.00	303,076	100.00	310,205	100.00	349,300	100.00

8.3.2 Capital Structure

The equity breakdown as contained in the Balance Sheet for 2004 consists of capital amounting to 5,236 bn VND and reserves of 6,884 bn VND.

Included under capital is an amount of 3,547 bn VND for infrastructure construction and an amount of 6,329 bn VND under reserves for costs for establishing fixed assets. The majority of equity therefore does not consist of accumulated earnings or paid-in capital but rather of contributions from Government sources.

The capital structure for the years 2003 and 2004 is shown in the following table:

Table 8.5: Capital Structure for the years 2003 and 2004 (VND million)

Equity	2003	2004
Capital	1,732,364	1,661,282
Asset revaluations	-8,464	4,189
Exchange rate gains (losses)	-22	-71,339
Reserves and contingencies	82,191	94,593
Reserve for infrastructure development	2,831,981	3,547,330
Administrative costs subsidies	577,311	531,631
Other reserves	22,102	23,436
Reserves for Fixed Assets	6,409,595	6,329,097
Minority Shareholding		18,751
Total	11,647,058	12,138,971

8.3.3 Debt Coverage

Based on the figures for 2003 and 2004 which have been obtained the following deductions can be made:

Figures for 2004 show a profit before tax of VND 51 billion (US\$ 3.2 million) on a turnover of VND 4,767 billion (US\$ 280 million) which represents a debt coverage ratio of 0.01.

The Balance Sheet shows a current ratio of 1.22 on current assets of 4,641,180 millions, and a return on Net Fixed Assets of 0.0029, on a balance of 13,317,302 millions of Fixed Assets. Although the Debt/Equity ratio is good at 33:67, over 80% of the Equity consists of funds for Infrastructure coming from the Government and when this is eliminated the Debt/Equity ratio falls to 63:27.

An analysis of VNR statements reveals that only approximately 44% of its revenues are from transport. The remainder is from the activities of its subsidiaries in other domains, including infrastructure management, whereby the chief customer is the Railway itself.

8.4 FINANCIAL PERFORMANCE SUMMARY

The income statements below show that the Railway, even with subsidies from Government funds for tariffs and infrastructure upkeep, is only barely able to cover its costs. There are therefore no funds generated for modernisation or renewal of capital. This situation is likely to continue for some time, so that it will take a number of years

until VNR is likely to be in a position to compete in a commercially oriented market on equal terms with private companies.

The figures presented are furnished by the VNR for the years up to 2005 and extrapolated over the subsequent years. The financial analysis did not include a review of the consolidation procedures. However, it would seem that there is a doubling of figures in that the 10% user charges for example may be recorded as revenue for the infrastructure without being shown as a cost to the transport companies, given that these funds are transferred to VNR from Government sources.

Table 8.6: VNR Income Statement

All VNR Activities																
Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
VND million																
Freight	557,920	665,534	769,924	817,938	874,757	1,000,741	1,126,725	1,252,709	1,378,693	1,504,677	1,612,120	1,719,563	1,827,006	1,934,449	2,041,892	2,193,549
Passenger	945,182	1,151,083	1,328,564	1,472,658	1,574,959	1,651,786	1,728,613	1,805,440	1,882,268	1,959,095	2,054,169	2,149,242	2,244,316	2,339,390	2,434,463	2,553,546
Total Transport	1,503,102	1,816,617	2,098,489	2,290,596	2,449,716	2,652,527	2,855,338	3,058,150	3,260,961	3,463,772	3,666,289	3,868,806	4,071,322	4,273,839	4,476,356	4,747,094
Other	1,939,439	2,295,017	2,602,100	2,727,217	3,127,749	3,175,924	3,235,393	3,306,664	3,390,270	3,486,764	3,597,021	3,721,353	3,860,394	4,014,804	4,185,277	4,304,312
Total Revenues	3,442,541	4,111,634	4,700,589	5,017,813	5,577,465	5,828,451	6,090,731	6,364,814	6,651,231	6,950,536	7,263,310	7,590,159	7,931,716	8,288,644	8,661,632	9,051,406
Costs	3,385,317	4,039,642	4,641,806	4,962,670	5,507,135	5,754,956	6,013,929	6,284,556	6,567,361	6,862,892	7,171,723	7,494,450	7,831,700	8,184,127	8,552,413	8,937,271
Net Revenues	57,224	71,992	58,783	55,142	70,330	73,495	76,802	80,258	83,870	87,644	91,588	95,709	100,016	104,517	109,220	114,135
Taxes	14,306	17,998	14,696	13,786	17,582	18,374	19,200	20,064	20,967	21,911	22,897	23,927	25,004	26,129	27,305	28,534
Net Income	42,918	53,994	44,087	41,357	52,747	55,121	57,601	60,193	62,902	65,733	68,691	71,782	75,012	78,388	81,915	85,601
US\$ 000																
Freight	37,889	43,557	49,642	50,566	54,783	61,542	67,224	72,513	77,427	81,984	85,220	88,190	90,908	93,385	95,634	99,675
Passenger	64,188	75,335	85,661	91,041	98,635	101,578	103,134	104,508	105,708	106,743	108,587	110,227	111,672	112,934	114,021	116,033
Total Transport	102,077	118,892	135,303	141,606	153,418	163,120	170,358	177,021	183,134	188,727	193,807	198,417	202,580	206,319	209,655	215,709
Other	131,709	150,202	167,774	168,599	195,882	195,306	193,034	191,406	190,396	189,979	190,146	190,855	192,085	193,814	196,022	195,588
Total Revenues	233,786	269,095	303,076	310,205	349,300	358,426	363,392	368,427	373,531	378,706	383,953	389,272	394,665	400,133	405,677	411,297
Costs	229,900	264,383	299,286	306,796	344,896	353,907	358,810	363,781	368,821	373,931	379,111	384,364	389,689	395,088	400,561	406,111
Net Revenues	3,886	4,712	3,790	3,409	4,405	4,520	4,582	4,646	4,710	4,775	4,842	4,909	4,977	5,046	5,115	5,186
Taxes	972	1,178	948	852	1,101	1,130	1,146	1,161	1,178	1,194	1,210	1,227	1,244	1,261	1,279	1,297
Net Income	2,915	3,534	2,843	2,557	3,303	3,390	3,437	3,484	3,533	3,582	3,631	3,681	3,732	3,784	3,837	3,890

8.5 FINANCIAL EVALUATION

The results of the financial analyses are presented in Table 8.7. The evaluation of the project indicates that the FIRR is greater than the WACC of 0.54%, which indicates that the project is financially viable.

Table 8.7: Results of Financial Analyses for the Project - Normal Revenue per unit USD 2.13 cents / unit-km – Cash Flow Analysis

Year	With Project		
	Incremental		Net Cash Flow
	Investing Cash Flow	Operating Cash Flow	
2006	0	0	0
2007	0	0	0
2008	50.4	0.0	-50.4
2009	50.4	0.0	-50.4
2010	50.4	0.0	-50.4
2011		7.0	7.0
2012		7.4	7.4
2013		7.8	7.8
2014		8.0	8.0
2015		8.1	8.1
2016		8.8	8.8
2017		9.4	9.4
2018		9.9	9.9
2019		10.2	10.2
2020		10.4	10.4
2021		8.7	8.7
2022		7.5	7.5
2023		6.7	6.7
2024		6.3	6.3
2025		6.1	6.1
2026		6.2	6.2
2027		6.5	6.5
2028		6.9	6.9
2029		7.6	7.6
2030	-66.2	8.3	74.4
2031		0.0	
2032	44%	0.0	
2033		0.0	
2034		0.0	
FIRR	3.0%		

8.5.1 Sensitivity Analysis

The sensitivity analysis takes into account the following variations:

- 10% increase in investment costs
- 5% increase in operating costs
- 10% reduction in forecasted incremental rail traffic
- Six months project delay

The sensitivity analysis indicates that the project is not very sensitive to changes in basic project parameters - see Table 8.8. Although the FIRR values obtained are lower, the trend does not change. Delay of 6 or 12 months slightly increases the FIRR.

Table 8.8: Sensitivity analysis

Case	Project FIRR Normal Tariff 2.13 cent per unit-km
Base case	3.0%
10% increase in investment costs	2.7%
5% increase in operating costs	2.7%
10% reduction incremental rail traffic	2.9%
Project delayed six months	2.9%

8.5.2 Proforma Financial Statements

From the results obtained in the financial analysis, proforma income statements and balance sheets were drawn up (shown in Appendix F3). The operating figures obtained were added to the actual figures received from VNR and the estimated figures up to the implementation of the project for the VNR as a whole, as no separate figures are available concerning the results for the line. The income statements show the incremental operating results for transport activities and constant figures for the remainder of VNR's activities. The Balance Sheets show the affect of the operations on the cash position and the reserves with the other figures remaining constant. In addition, for those scenarios involving the implementation of the project, the Fixed Assets figure is included net of the depreciation calculated on a linear basis.

Without Project

The income statement for this scenario shows slightly increasing revenues from 2011 onwards but net losses due to increasing transport costs. The net profit for VNR declines from 2016 onwards.

The Balance Sheet for this scenario shows an overall stable financial situation.

With Project

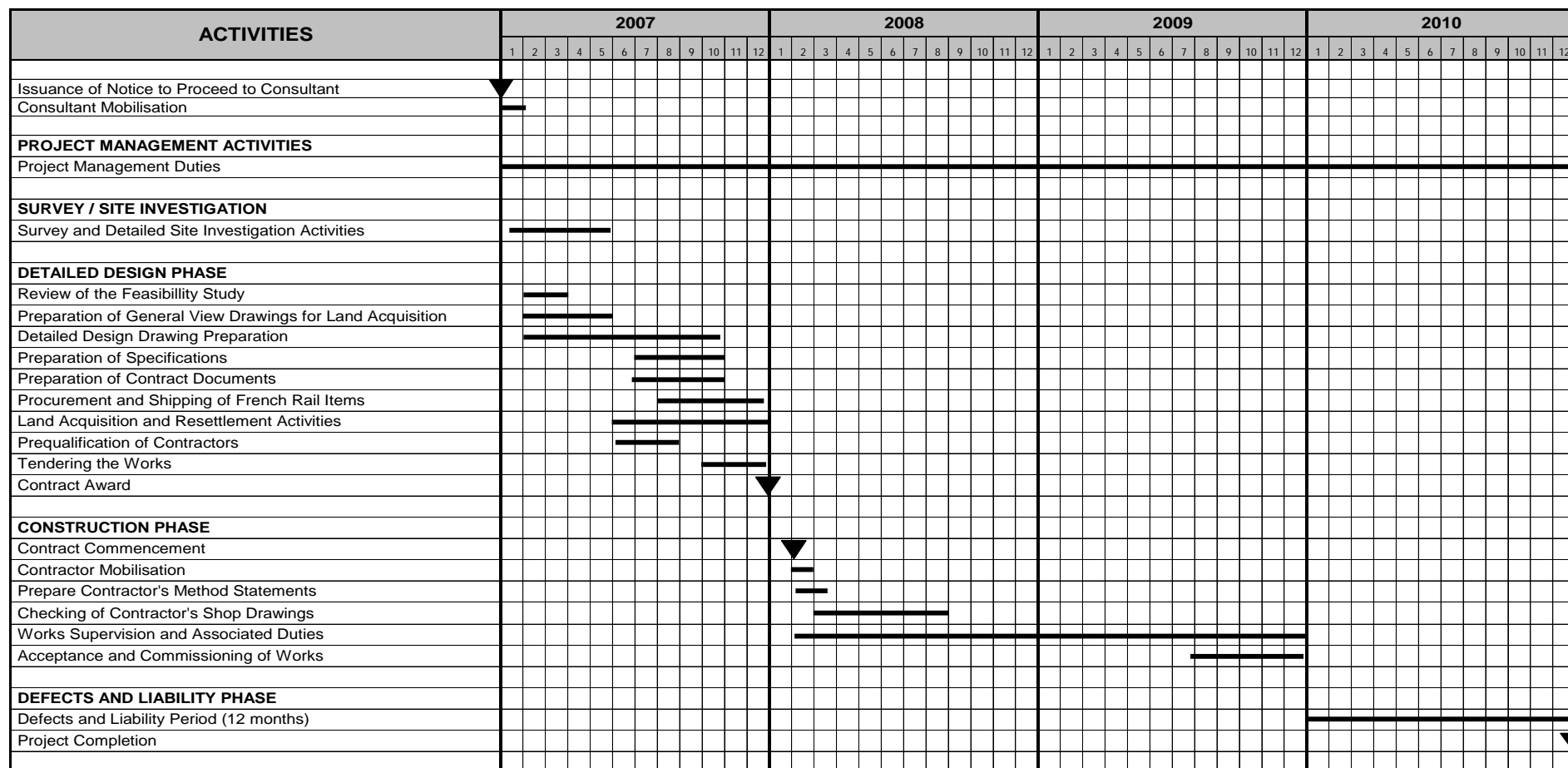
Under this scenario a negative operating result is obtained in 2011 with a gradual recuperation in the following years.

The Balance Sheet shows an improvement in the cash position and a stable Equity position.

9 IMPLEMENTATION PLAN AND PACKAGING

9.1 INTRODUCTION

The estimated timescale for the preparation of the detailed design, works supervision and defects liability phase, comprising project implementation, is as follows :



9.2 SOURCES OF PROJECT FUNDING

The proposed funding sources for the project are the :

- Asian Development Bank (ADB),
- French Development Agency (AFD),
- General Department of Treasury and Economic Policy (DGTPE)

In conformance with ADB and AFD procedures, International Competitive Bidding (ICB) procedures will be adopted for this project. DGTPE plan to provide “tied aid” which requires the goods or services to be procured from France.

As a result of the combination of funding sources, the financial management and control aspects of the supervision phase for this project have the potential to become rather complicated.

The arrangement may be further complicated since the railway operation and maintenance works along the line are administered by four separate Rail Public Utility Companies (RPUC).

9.3 RISK

The type of risks involved in these types of infrastructure upgrade projects are :

- No conforming or competitive bids are received for a particular contract package,
- Delays occur in land acquisition,
- Delays occur in release of project funds,
- Appointed Contractors are not adequately experienced,
- Delays occur in the design process,
- Delays occur in the construction phase,
- Delays occur in the delivery of key materials (eg rails),
- Appointed Contractors become financially insolvent,
- Significant claims are received from the Contractor,
- Lack of relevant experience by the Executing Agency,
- Structural collapse occurs on site,
- Delays occur in the delivery of materials,
- Unforeseen ground conditions are encountered,
- Major train accidents occur, and
- Site accidents occur during construction.

9.4 PROPOSED CONTRACT PACKAGING

The following key issues should be considered when preparing the contract packaging strategy for project implementation.

- Divide the works into reasonable sized packages in order to ensure adequate interest from a number of bidders,
- The structure of the loan is potentially complex,
- The construction works are required to be carried out whilst trains remain operational,
- Works are carried out over a geographically wide area,
- The number of project interfaces should be minimised in order to assist effective management and control of the project,
- Interruptions to train operations are required to be minimized,
- Road access is not possible to a significant number of the planned work locations. The majority of the material required for the reconstruction works will therefore have to be delivered by rail.

One approach to Contract packaging which has been considered by the Consultant was to divide the works according to activity type. For example a separate contract would be prepared for activities such as bridges, railway realignment, slope protection and safety works. However we do not recommend this approach. Problems frequently arise when different Contractors work in the same location. For example claims may be submitted for disruption by one of the parties. One Contractor may also claim that some of his materials may be missing or have been stolen. Disruption may also occur to planned work methods as both Contractors may be planning to work simultaneously in the same area. A preferable approach is that a single Contractor is responsible for all the works in a particular work area.

The Consultant therefore strongly recommends that the works are divided into three separate works sections. A single Contractor is therefore responsible for all works carried out within a single Contract package. The Consultant believes that three packages is the optimum number. Too many packages creates a large number of interfaces which makes management of the project more challenging. Too few packages will generate a huge scope of work and reduce the ability of Vietnamese Contractors to submit competitive and conforming bids.

In order to simplify the implementation and management of the project we also suggest that the works are divided to ensure only one RPUC, or a maximum of two, is involved in any one contract. The Consultant's suggested division of the works is as follows.

Contract Ref	Location (km)		RPUC
	From	To	
1	10.900	144.750	Vinh Phu & Ha Thai
2	144.750	225.000	Yen Lao
3	225.000	296.050	Yen Lao

The proposed division of contract packages results in Contract packages 1 and 2 each containing a section of the two proposed realignment works. Given the anticipated difficult access and working conditions, combined with the requirement to minimize disruption to rail services whilst the works are being carried out, dividing the realignment works between two contractors should ensure that the works can be implemented in a reasonable timeframe. The majority of the slope stabilization works and realignment are required in the North of the route. These three packages all contain slope stabilization, rail upgrade, bridgeworks and station improvement works.

The major engineering items required to be constructed (slope stabilization, bridge strengthening works etc) will likely be carried out by Vietnamese Contractors, who are familiar with local conditions. These activities are standard engineering items which are labour intensive and do not require specialist input. Local Contractors should be in a position to submit lower rates for the items. We therefore anticipate the majority of the bidders will comprise associations of local companies.

It is anticipated that International Contractors may be interested in the rail replacement activity. However the difficult and restricted access conditions, and the labour intensive bolted connection installation process, may limit their interest and result in their quoted costs being uncompetitive.

9.5 CONSULTANCY SERVICES

The Consultant recommends that a single Consultant is appointed to complete the detailed design. This will be the single point of contact for the Executing Agency (RPMU) which will simplify the management and control of the project.

Due to the scale of the project, and the required extensive Scope of works it is anticipated that the appointed Consultant may be formed from an association including several local firms. This will depend on the experience and capacity of the local Consultants.

It is suggested that the lead Consultant is a suitably experienced International firm. As outlined above, a portion of the proposed funds for this project will be sourced from “tied aid”. Given this requirement for French sourcing, it may be possible to specify that only French Consultants are eligible. Firms from other nations may form an association. However the lead firm should be French. The one concern regarding this approach is that it may be against the International Competitive Bidding (ICB) of the other two proposed lenders (ADB and AFD).

9.6 RAIL PROCUREMENT

As mentioned previously the portion of the loan proposed by DGTPE is “tied aid”. As a result it should be used to purchase French sourced goods or services.

There have been initial discussions concerning the possibility of using the funds to procure French rail. We understand that the best way to accomplish this is via a division of Vietnam Railways, or the Executing Agency (RPMU) procuring the track. The rail would then be stored at a secure location, close to the existing Hanoi-Lao Cai railway. Security and careful stock control will be imperative.

Once the preferred Contractors have been selected and appointed they will be able to collect the rail they require for their section of works. The rail can then be transferred to the required work location by train.

A key requirement in order to ensure the success of this arrangement is that the rail must be delivered and available for the Contractors to collect. Significant delays and additional costs will be incurred if the Contractors have to await rail delivery. The cost for rail storage, security and stock control could be included as a rate within the Contractor's Bill of Quantities.

The Consultant recognizes that the RPMU may not currently possess adequate resources or experience in order to be able to complete this important task. We therefore suggest that, as part of the Consultant services for the detailed design and

supervision phases of the project, a suitably experienced international procurement expert is seconded into RPMU to prepare the necessary documents and complete the procurement task. The secondment should be carried once the technical parameters of the required rail and switches are finalized by the detailed design Consultant.

The other alternative procurement method is that the Contractors each purchase the track required for their particular contract. We do not recommend this arrangement for the following reasons :

- There is the possibility for the leakage of funds,
- The appointed Contractors may ignore the DGTPE's strict loan requirements, and
- The Contractors may not all purchase exactly the same type of track

9.7 BUDGET FOR FRENCH RAILS AND SWITCHES

Given the maximum budget of 30 million Euros for French sourced rail products, it is recommended that the mainline rail and switches, both type P50, are procured from France. The rail fastenings and bolted connection pieces, are technically less complex and should therefore be procured via International Competitive Bidding (ICB). The revised cost estimates (see Tables 6.5 and 6.6) have been prepared based on these assumptions.

9.8 SIZE OF CONTRACT PACKAGES

Table 9.1 below shows the estimated value of each of the contract packages, both for civil works and for the supply of rail and fittings.

Table 9.1: Financial Value of Contract Packages (US\$ million)

Package	Location (km)		Costs
	From	To	
1	10.90	144.75	31.8
2	144.75	225.00	27.0
3	225.00	296.05	33.1
French Rail & Turnouts			35.9
Other costs (eg Proj Mgt)			17.6
Recycle Rail			-5.2
Total			140.2

TA No. 4050-VIE

**KUNMING – HAIPHONG TRANSPORT CORRIDOR PROJECT
UPGRADING HANOI – LAO CAI RAILWAY**

Feasibility Study and Preliminary Design

DRAFT FINAL REPORT

Technical Appendix A.1

OPERATIONS

July 2006

CURRENCY EQUIVALENTS
(05 MAY 2006)

Currency Unit	–	Vietnamese Dong (VND)
VND 1.00	=	\$ 0.00006272
\$1.00	=	VND 15,950

ABBREVIATIONS

ADB	-	Asian Development Bank
AFD	-	Agence Française de Développement
AP	-	Affected People
BCR	-	Benefit cost ratio
CAD	-	Computed Aided Design
CARB	-	Compensation and Resettlement Board
CPC	-	Commune People's Committee
CPI	-	Consumer Price Index
DFR	-	Draft Final Report
DGTPE	-	Direction Générale du Trésor et de la Politique Economique
DMC	-	Developing Country Member (of ADB)
DPC	-	District People's Committee
EA	-	Executing Agency
EIRR	-	Economic internal rate of return
EMSA	-	Ethnic Minority Special Actions
EPMD	-	Environmental Protection and Management Division
GDP	-	Gross Domestic Product
GOV	-	Government of Vietnam
GSO	-	General Statistical Office
GTZ	-	Gesellschaft für Technische Zusammenarbeit
IBRD	-	International Bank for Reconstruction and Development (World Bank)
ICB	-	International competitive bidding
IEE	-	Initial Environmental Examination
IoL	-	Inventory of Loss
IP	-	Indigenous People
IPDP	-	Indigenous Peoples' Development Plan
IMO	-	Independent Monitoring Organization
IPSA	-	Initial Poverty and Social Analysis
IRR	-	Internal rate of return
ISA	-	Initial Social Assessment
LURC	-	Land Use Rights Certificate
MOF	-	Ministry of Finance
MONRE	-	Ministry of Natural Resources and Environment
MOT	-	Ministry of Transport
MPI	-	Ministry of Planning and Investment
NGO	-	Non Government Organization
NPV	-	Net present value
OCR	-	Ordinary Capital Resources (of ADB)
O-D	-	Origin Destination
ODA	-	Official Development Assistance
OSPF	-	Office of the Special Project Facilitator
PIB	-	Project Information Booklet
PPTA	-	Project Preparatory Technical Assistance
PRC	-	People's Republic of China
PSA	-	Participatory Social Appraisal

ABBREVIATIONS

RALC	-	(Department of) Resettlement and Land Clearance
RoW	-	Right of way
RP	-	Resettlement Plan
RPI	-	Retail Price Index
RPUC	-	Railway Public Utility Company
RPMU	-	Railway Projects Management Unit
RRP	-	Report and Recommendation of the President (to ADB Board of Directors)
RRP	-	Report and Recommendation of the President (to ADB Board of Directors)
SAP	-	Severely Affected People
SES	-	Socio-Economic Survey
SIEE	-	Summary Initial Environmental Examination
TA	-	Technical Assistance
VNR	-	Vietnam Railways
VOC	-	Vehicle operating costs
vpd	-	Vehicles per day
VRA	-	Vietnam Roads Authority

WEIGHTS AND MEASURES

Metric system

NOTES

1. In this report, "\$" refers to US dollars.

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A	Technical Survey and Prioritization of Interventions
A.1	Operations
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A.3	Rolling Stock
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A.6	Geological Survey
B	Environment
B.1	Initial Environmental Examination
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F	Economic and Financial Analysis
F.1	Road and Rail Operating Costs

1 INTRODUCTION

1.1 BACKGROUND

The railway line traverses about 285 km in a generally north-westerly direction from Yen Vien (km 10+900) station near Ha Noi, along the northern bank of the Red River to Lao Cai (km 293+500) near the border transit point to the People's Republic of China. The railway, a metre gauge single-track and non-electrified line, forms an integral part of the Haiphong - Kunming transport corridor and carries substantial traffic consisting of transit traffic between Haiphong Port and the Yunnan Province of the PRC, bilateral trade between Viet Nam and China, and domestic traffic, for instance from the apatite mine at Xuan Giao to the Lam Thao Phosphate and Chemical Company production facilities near Tien Kien. The branch line from the junction km 262+101 (area of Pho Lu station) to the station Xuan Giao A (km 272+235) is part of this project. The railway line has also importance for passenger transport, especially to the tourist attractions of the mountainous region around Sapa (around 45 km from railway station Lao Cai).

The branch lines to Lam Thao Phosphate and Chemical Company and Bai Bong (both branching off at Tien Kien station) are not part of the project.

Figure 1.1 (at the end of this Chapter) shows a schematic overview of the station layouts.

1.2 SCOPE OF THE OPERATIONAL ANALYSIS

The overall objective of this project is: "... to rehabilitate and partially upgrade the railway (line section Yen Vien – Lao Cai) in its present general alignment to ensure sufficient capacity to cater for foreseeable traffic 2020; enhance transit traffic between Kunming and Haiphong Port; and improve safety, especially at road crossings. This will require rehabilitation and improvement of infrastructure, stabilisation of unstable embankments, selective improvements of the horizontal and vertical alignment and upgrading of stations and crossing / passing loops to enable the operation of train loads up to 1,200 tons and train length of up to 400 metres, construction of new freight stations and crossing / passing loops, improvement of safety by upgrading of at-grade crossings or by replacing them with over-/underpasses, modernization of auxiliary facilities, and provision of equipment and rolling stock."

The study is designed to propose an investment option consisting of a combination of economically and financially viable operational and engineering measures, civil works and rolling stock improvements that would enable Viet Nam Railways (VNR) to satisfy the 2020 demand forecast. This Technical Appendix describes the procedures used to determine the combination of investments required to achieve that objective.

Based on the results of the analysis of current railway operations by VNR on the HaNoi - Yen Vien - Lao Cai line, an operational model was developed to assess the future capacity of the line under a number of different investment options. Each of the operational scenarios analysed is connected to a specific programme package of improvements of infrastructure, rolling stock and operational procedures that are required to establish safe, reliable and stable operations at the expected traffic levels.

These options have been developed based on and hand-in-hand with the simulation of train circulation patterns aiming at providing the capacity corresponding to the assumed demand for overall transport capacity and line performance for the year 2020 to be met. The general structure of the operations defined on the basis of the status quo has been taken as the basis for modelling individual operations scenario options. In iterative

attempts to satisfy the assumed target figures for the forecast demand for transportation capacity in the year 2020 these options progressively incorporated improvements of the infrastructure along the line. Train categories in general and operating schedules were kept as closely to the present operating programme as possible, but variations in train length, hence train payload and available traction power on the other hand were used to take full advantage of the permanent way infrastructure improvements proposed.

Modernisation of signalling and telecommunications systems initiated under other investment programmes have been taken into consideration as being in operation and fully effective along the line by the time the various operations scenarios would come into effect.

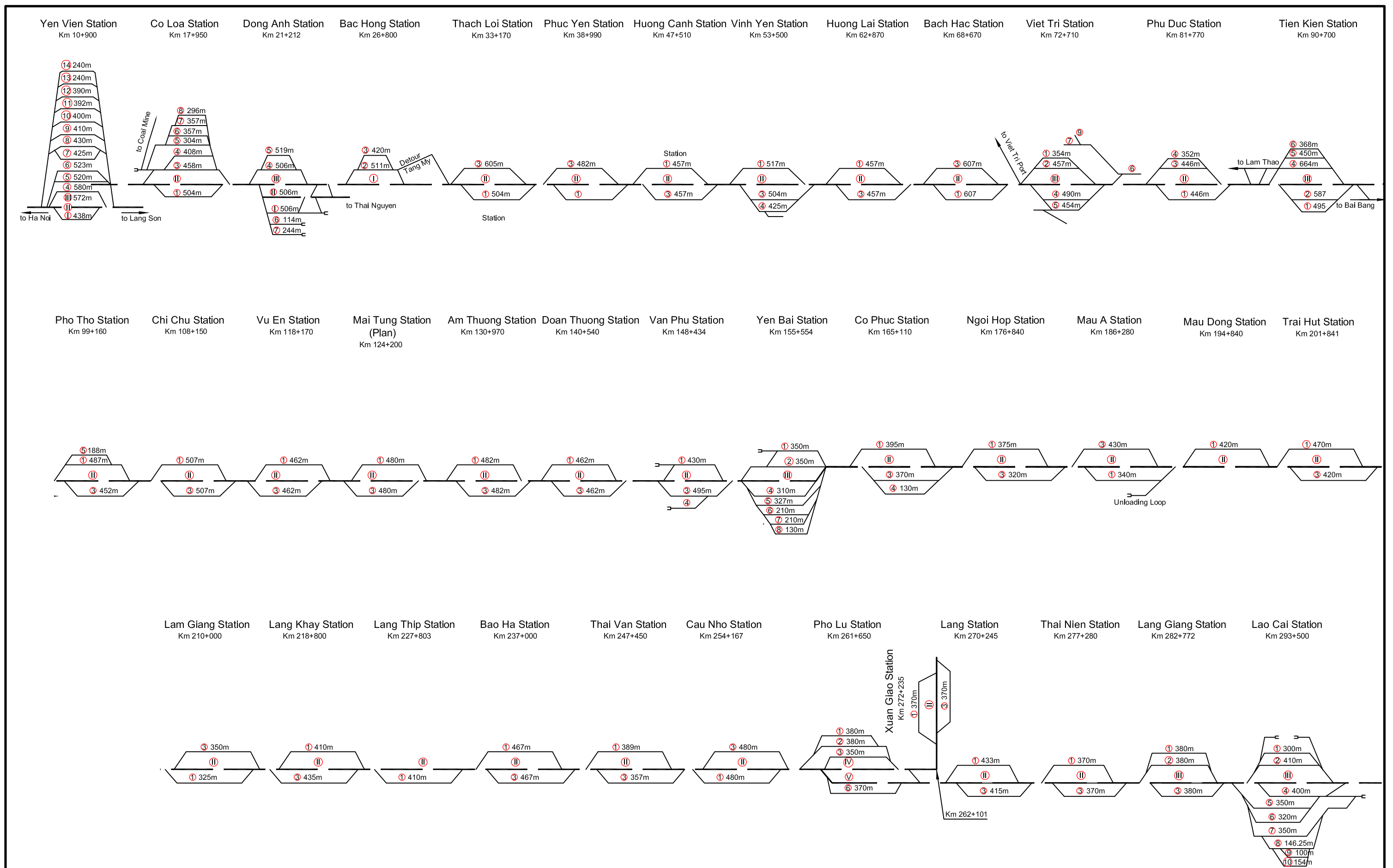


Figure 1-1:
Schematic Overview of
Station Lay-out

2 CURRENT TRAIN OPERATION PROGRAMME

2.1 INTRODUCTION

In 2005 VNR operated up to 38 trains per day on the railway line (Ha Noi) – Yen Vien – Lao Cai which carried according to VNR's figures about 2.5 million tons of freight and 2.6 million passengers per annum (on average 18 to 20 pairs of train per day on the busiest section).

In accordance with VNR's "Operation Diagram of the Lao Cai – Yen Vien Railway Line" issued by the General Director of Vietnam Railways on June 28th, 2005 and the "Local Passenger Train Operation Diagram on the Northern Line" issued by the General Director of Hanoi Railway Passenger Transportation Company on November 15th, 2005 the passenger and freight trains currently operating on the line have been taken as the basis for restructuring an improved operations programme¹.

Although a general railway operation diagram exists, presently the Railway Operation Control Centre regularly prepares adjusted operation diagrams for freight trains based on daily transport capacity demand.

2.2 TRAIN DENSITY 2005/2006

2.2.1 Main Line Yen Vien – Lao Cai

Currently, VNR currently operates up to 38 trains per day on the line which carry about 2.5 million tons of freight and 2.6 million passengers per annum.

Based on the above train operation diagrams, the train density is summarised and graphically shown in Figure 2.1 (at the end of this chapter). The train density per section represents figures as an average, because as can be seen from some of the train density diagrams, in some cases only one half of train pairs shows. This is because of trains running on demand, on specific days only or the return trip is beyond midnight in the schedule of the next day. Saturday, Sunday, public holidays and special events are counted with a probability of 50%.

On the dual gauge section Yen Vien – Bac Hong, only trains running on the metre gauge track are considered.

The busiest sections with nominally 38 trains per day are the sections Viet Tri – Phu Duc and Phu Duc -Tien Kien; there of 14 are passenger trains and 23 freight trains. The lowest train density is between Pho Lu and Lao Cai with 23 trains; thereof 12 passenger trains and 11 freight trains.

As already mentioned, the trains circulating between Lao Cai and Lang Giang are not taken into account.

2.2.2 Branch Line Pho Lu – Xian Giao A

Four train pairs (271/272, 273/274, 371/372 and 373/374) circulate regularly between Xuan Giao A (apatite mine) near Pho Lu and Lam Thao (Thao Phosphate and Chemical Company) near Tien Kien.

¹ A more detailed treatment of the current timetable can be found in the Interim Report (Technical Appendix A.1: *Operations*)

2.3 SUMMARY OF CURRENT RAILWAY OPERATIONS ANALYSIS

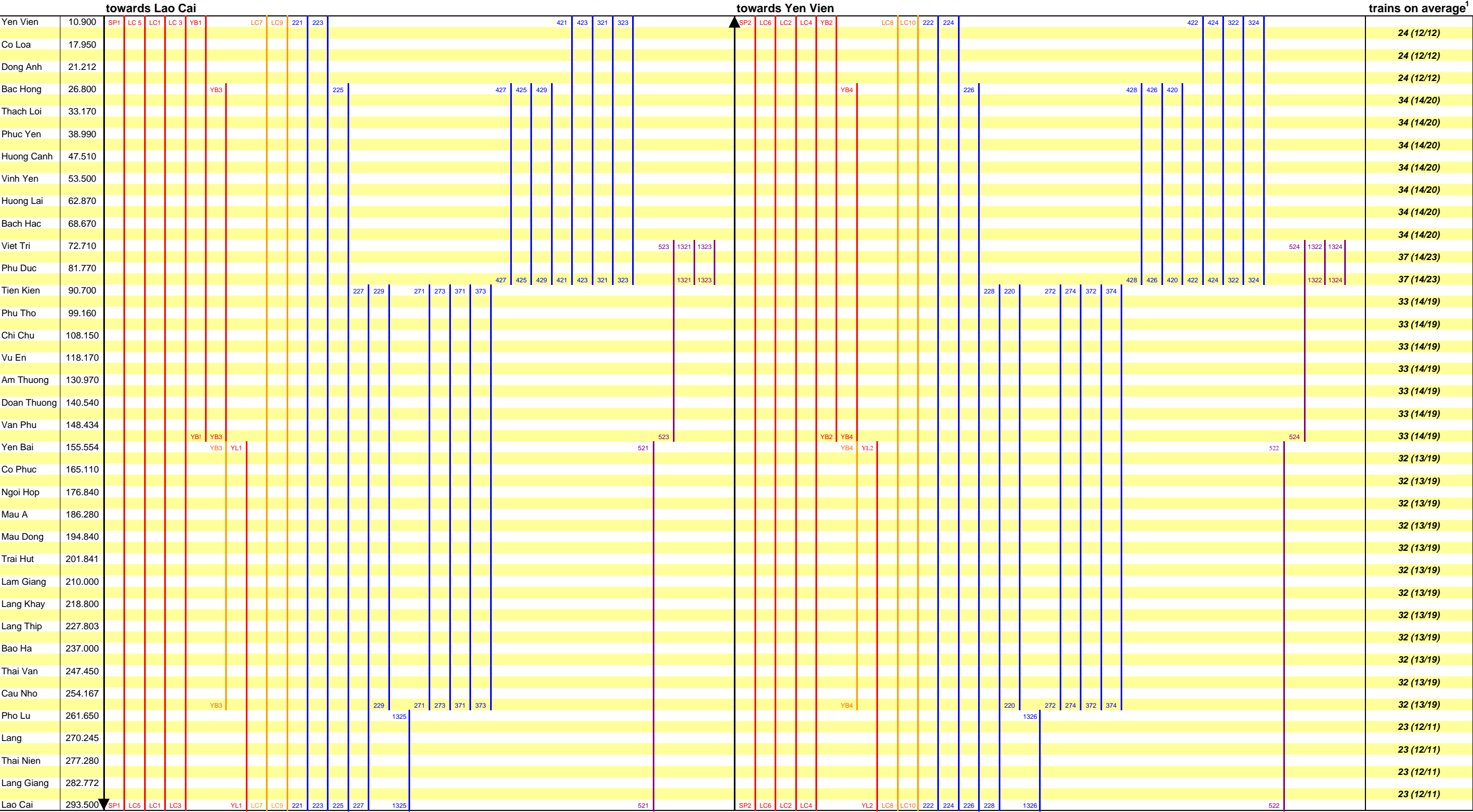
Railway operations and efficient performance on the Yen Vien – Lao Cai line are severely hampered by major shortcomings which have been identified as follows:

- In general, the capacity of a single line is rather limited; especially through different distances between the neighbouring stations and/or different speed of the trains. The capacity of the longest section determines more or less the capacity of the entire line.
- The distance between any two stations is not uniform, with a large distance of 14.2 km (between Pho Lu and Thai Van stations) and a short distance of 3.4 km (between Co Loa and Dong Anh stations).
- The permanent way of some sections (track, embankment, drainage, etc.) is in a poor condition with danger for safe train operations
- The maximum train load is restricted to around 1,200 tons and the maximum length of trains is 400 m. However, the passing loops of 7 stations have a usable length of less than 400 m and shall be extended: Due to the short effective length of these passing loops, train length must be correspondingly limited causing reduction of traffic capacity.
- As mentioned, the number of passing loops of the stations Yen Bai and Lao Cai and their length are not sufficient for train operations.
- Most of the bridges and culverts are in a very poor condition; in total of thirteen bridges do not fulfil the requirements (train loading less than T14+4.2 tons/metre) causing speed restrictions for freight trains and partly also for passenger trains.
- A lot of narrow curves with radii of up to 100 m and partly without any cant and without transition curves or insufficient length of transitions curves or shorter straight sections between two narrow curves than stipulated in the Technical Design Specifications are causing speed restrictions of up to 35 km/h.
- Some powerful locomotives with higher tractive effort, especially 6-axle locomotives, are not allowed to work the section Yen Bai – Lao Cai due to infrastructure deficiencies (radii, bridges, permanent way condition, etc.). The precise reason for this regulation could not be determined and it is unclear under what circumstances, the ban might eventually be lifted.
- The inadequate signalling system especially on the section Thach Loi – Lao Cai impedes safe train operations and higher line capacity. The operating time cycles at stations (time from arrival of one train to the departure of the second train in opposite directions) presently are around 7 to 10 minutes.
- Many authorised and unauthorised level crossings as well as unauthorised civilian traffic along and across the line and within station areas impedes safety of operations and cause speed constraints; for instance around Yen Vien to 15 km/h only.
- Operation of freight trains generally does not follow the general operating diagram but follows the daily adjusted operation diagram and the decisions consequently made by the Railway Operations Control Centre.
- All turnouts (switches) are manually operated. Due to missing locking of the switch blades, the permissible speed at turnouts is 60 km/h in the straight direction and 15 km/h in the turning direction only.
- According to VNR's rules, presently simultaneous entry of two opposing trains into a station (one train to the loop and the other one to the main line or another passing loop) is not allowed. One train has to stop at the entry signal until the other one has entered the loop completely and all turnouts are returned to the safe position. Stopping trains exit from the loop with a maximum permissible speed of 15 km/h. After the train left completely the turnouts its speed can be increased up permissible to the permissible speed.

Summarising, constraints on railway operations are mainly caused by insufficient infrastructure including the signalling and telecommunications systems.

Figure 2.1. Train Density 2005

Main line Yen Vien - Lao Cai



¹ in brackets passenger trains/freight trains

passenger trains running daily
passenger trains running on demand and/or special days

freight trains running daily
freight trains running on demand

3 DEVELOPMENT OF TRANSPORT VOLUME

3.1 GENERAL

In order to provide a basis for future planning of the corridor the 'Kunming-Haiphong Transport Corridor Multimodal Transport Study' was commissioned by the ADB and carried out by COWI Consult.

The following service level improvements of the railway line Ha Noi – Lao Cai were assumed by COWI²:

- Commercial speed is 40 km/h for freight trains and 80 km/h for passenger trains on the northern part of the rail line compared to the existing values of 20 km/h for freight trains and 40 km/h for passenger trains respectively (this could also be interpreted as reduced handling time underway due to improved operations)
- Commercial speed is the same in both scenarios for the southern part

The Multimodal COWI study provides traffic forecasts for the years 2005, 2010 and 2025. Additional data was therefore requested for year 2020 in the form of freight (by main commodities) and passenger origin - destination matrices. However, origin – destination matrices could not be made available. In agreement with the authors of the COWI study an adjusted approach for the calculation of the numbers of passengers in 2020 is made as explained below.

3.2 PASSENGER TRANSPORT

Based on figures provided by VNR for 2002, the passenger transport volume on the line Yen Vien – Lao Cai for 2005 is summarised in Table 3.1. For the calculation, the growth rates included in the COWI study are used.

Table 3.1: Rail passenger flows in 2005, both directions

Line Section	000 passengers/year
Lao Cai-Yen Bai	915
Yen Bai – Viet Tri	1,353
Viet Tri – Yen Vien	1,443

The passenger transport volume for 2020 is also calculated using these growth rates and deducted by the diversion rate (from rail passenger transport to the expressway) as analysed in the COWI study; however, for the section Yen Bai – Lao Cai adjustments have been made³. The figures used as base for the calculation for the number of passenger trains by category and section are shown in Table 3.2

Table 3.2: Passenger Flows by Sections - 2020 (both directions)

Line Section	1000 passengers/year	compared to 2005
Lao Cai - Yen Bai	1,677	151 %
Yen Bai - Viet Tri	2,657	162 %
Viet Tri – Yen Vien	2,909	166 %

² Kunming-Haiphong Corridor – Multimodal Transport Demand COWI for ADB – Revised Draft Final Report, October 2005, page 63/64

³ The diversion rate of 82 % seems to be too high and has been modified in this Study.

3.3 FREIGHT TRANSPORT

The COWI study provides the following figures for the existing situation (year 2005):

Table 3.3: Rail Freight Flows - 2005 (both directions)

Line Section	1000 ton/year (total freight)
Lao Cai-Yen Bai	974
Yen Bai – Viet Tri	1,230
Viet Tri - Noi Bai ⁴	2,142

For rail freight transport volume, the following data were made available by COWI on request:

Table 3.4: Rail Freight Flows by Sections and Type - 2020 (both directions) (000 tonnes p.a.)

Line Section	Bulk shippers with industrial tracks	Bulk, other shippers	Total bulk	Containers shippers with industrial tracks	Containers other shippers	Total containers	Total freight	% increase vs 2005
Lao Cai - Yen Bai	2.059	364	2.423	348	0	348	2.771	284 %
Yen Bai – Viet Tri	2.227	654	2.881	426	614	1.040	3.921	319 %
Viet Tri - Noi Bai ⁵	2.191	1.470	3.661	679	3.282	3.961	7.623	356 %

The empty return percentages for the line are, as documented in the COWI report, 35%, had to be added to reach the total number of wagons and trains.

3.4 OPERATIONS MODEL FOR THE YEAR 2020

Before any simulation can be performed the freight and passenger forecasts have to be 'transformed' into an operational model which will include the following:

- Number of trains by category
- Train Run requirements
- Distribution of trains appropriately over the course of a day
- Time-windows for maintenance (as far as applicable)

Transforming the number of passengers forecast by COWI into the number of **passenger trains** required needs a logical approach taking into account the operational requirements along the line. However, for an accurate calculation at least the transport volume per station (number of passengers boarding and alighting per day, week and year), timely distribution as well as origin and destination for the reference year 2005 and the year 2020 would be needed. Due to the absence of such figures, it is assumed that the number of passenger trains will increase by 50 % on average, taking into account the different categories of trains by section.

Making a simple approach, the number of **freight trains** per section would increase by the above percentage; that means on average a factor of three. In the Base Case, minor operational improvements (e.g. better utilisation of rolling stock and the reduction of the

⁴ These figures do not include the line segment Viet Tri - Yen Vien

⁵ Not to full extent of the Viet Tri –Yen Vien segment

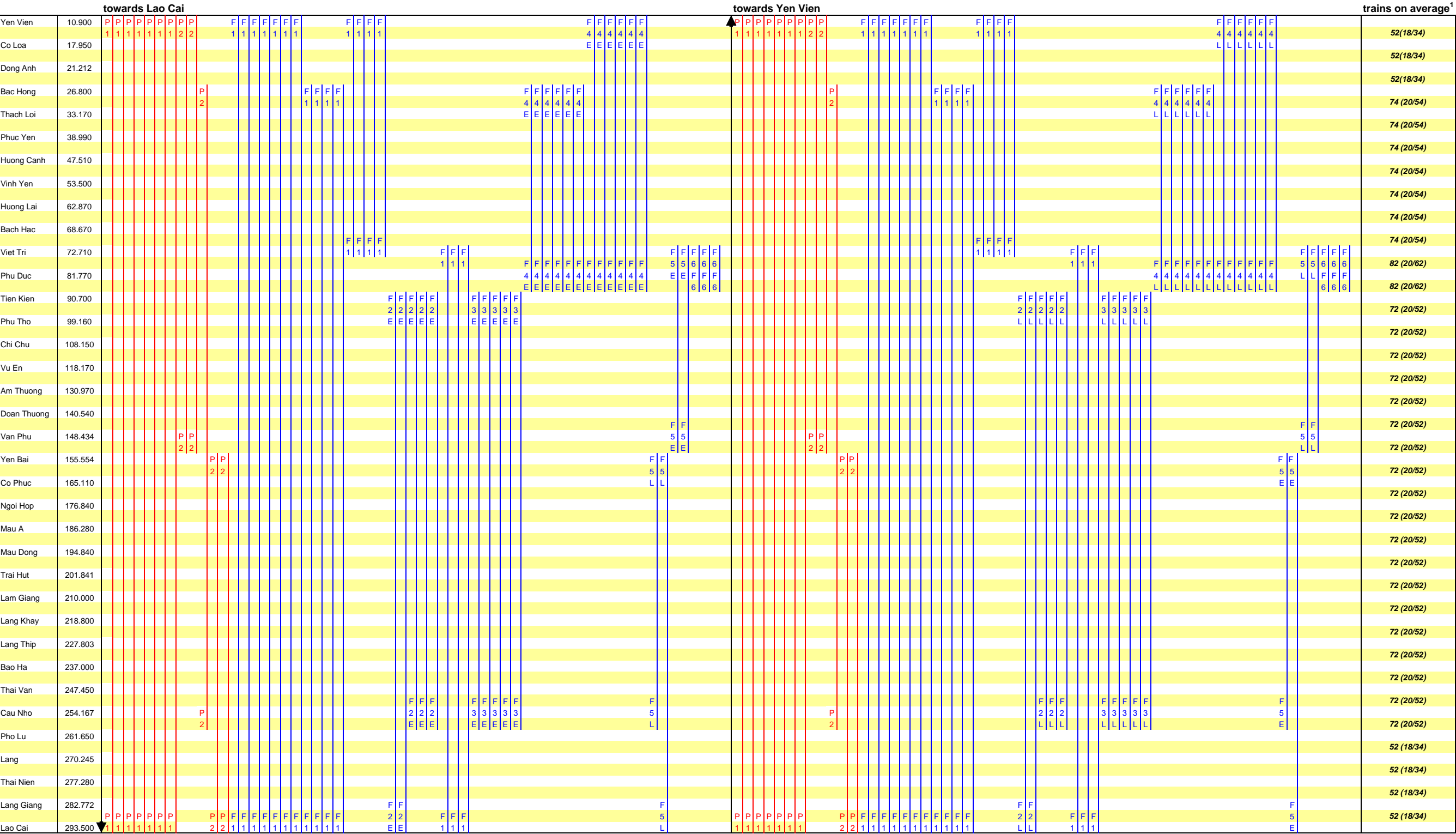
percentage of empty wagons to be hauled in comparison to the present status as well as measures which will reduce irregularities of train operation) will be considered. Therefore, it is assumed that, the factor will be 2.8 on average. The main operational constraints, as long block sections, low speed permitted along the line (especially on the northern section), many speed restrictions, insufficient length and number of passing loops, inadequate traction power, etc. still remain.

However, the different development of the main commodities relevant to the line section Yen Vien - Lao Cai must be taken into account. According to "Vietnam Railway Transport Development Plan up to 2020" (Economic Data and Policies of Transport Development and Strategy Institute), the total freight transport volume by rail will increase by about 435 % in the period 2005 to 2020. The transport of apatite by rail will increase by about 120 % only. On the other hand, the increase in the volumes of general freight and containers – goods mainly from the lines of export and import - will be greater than average.

The train requirements for 2020 (under current operating practice) are shown in Figure 3.1 and can be compared with the line capacities for each option in the summary Table 4.4 (in Section 4.8)

Figure 3.1: Required Train Density 2020

Main line Yen Vien - Lao Cai



¹ in brackets passenger trains/freight trains

4 ITERATIVE SIMULATION OF OPERATIONS PLANS

4.1 GENERAL DESCRIPTION OF INTEGRATED SIMULATION

The simulation process involves analysing the effect and efficiency of individual improvement measures (or packages of measures) in a dynamic process taking into account the operational interactions between individual categories and technical configurations of trains. In such a manner optimisation can be achieved from the first step of the analysis.

Based on the results of the simulation of the Base Case, various options have been prepared in consultation with 'stakeholders' and other experts concerned.

Each option is built upon the predecessor; that means all improvements already assumed will also be inserted into the following option.

Five cases have been considered, as follows:

- Base Case:
 - Existing operating practice (in particular with respect to train length and composition)
 - Current system, incorporating committed changes
 - Improved signalling (being installed with Chinese assistance)
 - New station at Cau Nho
- Option 1: incorporates Base Case with following improvements
 - Rehabilitation of the 13 bridges that currently have speed restrictions
 - Construction of a new station at Mai Tung
 - Extension of passing loops (to 450m) at 7 stations
 - Provision of additional loops at 2 stations
- Option 2: Option 1, plus:
 - Realignment on key sections
 - Additional passing loops at 5 station
- Option 3: Option 2, plus:
 - Introduction of more powerful locomotives (D20E), that will make it possible to pull longer, heavier trains
- Option 4: Option 3, plus
 - Double-heading of D20E, to obtain a further reduction of section times

In addition, Options 2 and 3 have been run without the realignments.

4.2 GENERAL INPUT DATA

The performance target for the year 2020 in terms of transport volume (passengers and freight) and number of trains by category is defined in Chapter 7.

Each Option, respectively each result of the option in terms of meeting the performance target, shall be evaluated for its implications on railway operations, resettlement and the environment.

The following input data have been used for the simulation process

- Schematic overview of station lay-out (including number and length of passing loops) and the chainage of stations
- Performance target (year 2020) in terms of number of trains by category
- Local operating speed restrictions

- List of gradients
- List of entry signals and points/turnouts
- Train characteristics by category including technical parameters of the locomotive(s) assigned
- Speed limits in turnouts: 15 km/h for the Base Case, 60 km/h for improved trackwork in straight direction, also as maximum in cases of alignment design speed higher than 60 km/h
- Absolute max. speed on the section up to Thach Loi 80 km/h, from Phu Tho max. 55 km/h
- Station dwell times for passenger trains shall be optimised aiming at a value of about 3 minutes

The running times for the entire line or separate sections calculated by the simulation programme include recovery time (in this case 3%). The recovery time is generally included for scheduling purposes to provide a time buffer that permits trains to remain on schedule after any delays at station or due to temporary speed restrictions attributable to maintenance work along the line.

For all options including the Base Case it has been assumed that the implementation of the new signalling system is complete and effective and the station Cau Nho (at km 254+167; presently under construction) has been put into operation.

The modernised signalling system will reduce the operating times at stations (time from arrival of the first train to departure of the second train in the opposite direction) from 7 to 10 minutes at present (on the section Thach Loi - Lao Cai) to 3 minutes (Base Case) with further improvement to 2 minutes after reaching full performance. This includes a staggered arrival sequence of two trains at a station of about 1 minute.

4.3 BASE CASE

No improvement measures have been assumed for the Base Case apart from the new station Cau Nho and the modernised signalling system.

However, minor operational improvements (e.g. better utilisation of rolling stock and the reduction of the percentage of empty wagons to be hauled by comparison to the present status) are taken into consideration. These operational improvements can hardly be quantified; however, they are indirectly considered by the calculation of the number of freight trains required in 2020.

Figure 4.1 (at the end of this Chapter) shows the number of trains that can be operated on each section, and it can be seen that capacity throughout the line is lower than the number of trains required. The most serious discrepancies occur on the section Tien Kien – Pho Lu (number of trains required 72; number of trains that can be operated 46 and 47, respectively). (See also Table 4.4)

The minimum headway on the following sections is extremely high

- Viet Tri station - Phu Duc Station (in addition, there is a extremely high train frequency)
- Co Phu station - Ngoi Hop station
- Lang Giang station - Lao Cai station

Some trains cannot run, because Mau Dong station and Lang Thip station each have one passing loop only. Furthermore, some trains cannot be operated due to insufficient

number of passing loops at other stations. In addition, the number and length of passing loops / sidings at Lao Cai and Yen Bai is far away from the requirements.

As can be deduced from the figures, there are no time windows for maintenance included and any irregularities will lead to blockage of the entire line and as consequence to total disruption of rail traffic. Therefore, the practical line capacity can be assumed only at around 85 % to 90 % of the theoretical capacity shown in the simulation results for the Base Case.

4.4 OPTION 1

Modifications included in Option 1 as compared to the Base Case:

The following infrastructure improvement measures are considered for option 1:

- All bridges with a train loading less than T14+4.2 tons/meter and/or speed restrictions will be replaced or rehabilitated. This rehabilitation programme includes the following 13 bridges where speed restrictions for freight trains and partly also for passenger trains severely hamper train railway operations at present:
 - Man bridge km 145+520 (from 30 km/h to 45 km/h for freight trains)
 - Van Phu bridge km 148+920 (from 35 km/h to 50 km/h for freight trains)
 - Dao Thinh bridge km 171+414 (from 35 km/h to 45 km/h for freight trains)
 - Con Tran bridge km 173+960 (from 35 km/h to 45 km/h for freight trains)
 - Moc Thom bridge km 174+185 (from 35 km/h to 45 km/h for freight trains)
 - Dieu bridge km 179+304 (from 35 km/h to 45 km/h for freight trains)
 - Khe Se bridge km 209+705 (from 30 km/h to 45 km/h for passenger and freight trains)
 - Khe But bridge km 218+486 (from 35 km/h to 50 km/h for freight trains)
 - Bun bridge km 232+612 (from 35 km/h to 45 km/h for freight trains)
 - Khoai bridge km 241+710 (from 35 km/h to 45 km/h for freight trains)
 - Van bridge km 245+735 (from 35 km/h to 45 km/h for freight trains)
 - Nhai bridge km 250+412 (from 35 km/h to 45 km/h for freight trains)
 - My bridge km 265+775 (from 30 km/h to 40 km/h for passenger and freight trains)
- In order to increase capacity of the line, a new intermediate (crossing) station with 2 passing loops (usable length of track 480 m each) will be built at km 124+200 (station Mai Tung). This new station will increase the capacity of the section Vu En (km 118+170) - Am Thuong (km 130+970) by nearly 40 %. The section Vu En – Am Thuong at present with a length of nearly 13 km is the longest section between any two stations and presents one of the major bottlenecks of the entire railway line Yen Vien – Lao Cai.
- Upgrading of stations and passing loops for train loads up to 1,200 tons and train length of up to 400m.
- Cycle Time for crossing trains in stations reduced to 2 minutes from 3 minutes (in the Base Case)
- The total number of stations on the railway line is 36 (including Cau Nho station presently under construction, without Mai Tung station) out of which 7 stations have effective length of passing loops of less than 400 m.

The following passing loops will be extended:

Table 4.1: Passing Loops to be Extended

km	station	number of tracks	existing usable length of track (m)	future usable length of track (m)	additional length (m)
72+710	Viet Tri	1	354	450	96
81+770	Phu Duc	4	352	450	98
165+110	Co Phuc	1	395	450	56
186+280	Mau A	1	340	450	110
210+000	Lam Giang	3	350	450	100
247+450	Thai Van	3	357	450	93
277+280	Thai Nien	3	370	450	80

Furthermore, the stations Mau Dong (km 194+840) and Lang Thip (km 227+803) shall be equipped with one additional passing loop each (450 m each).

Results

As can be seen in Table 4.4, more trains can be operated than in the Base case, with the main reason being the reduced crossing cycle times. Figure 4.2 (at the end of the Chapter) shows the attainable train density. Although the line capacity can considerably be improved, the number of trains that can be operated is on all sections lower than the number of trains required. However, the differences are in most of the sections lower in comparison to the Base Case. The biggest differences are still on the section Tien Kien – Pho Lu (number of trains required 72; number of trains that can be operated 53 to 59).

The main problems are more or less the same as of the Base Case. In particular, the minimum headway on the following sections is extremely high

- Viet Tri station - Phu Duc Station (in addition, there is a extremely high train frequency)
- Co Phu station - Ngoi Hop station
- Lang Giang station - Lao Cai station

There are still restrictions due to insufficient number of passing loops at other stations.

Some of the additional freight trains will be very unattractive because of frequent train crossings with long dwell times causing extremely long journey times.

In addition, the number and length of passing loops / sidings at Lao Cai and Yen Bai is still far away from the requirements as there is no change in comparison to the Base Case. As can be seen from the figures, there are also no sufficient time windows for maintenance available in this option and any kind of irregularities will lead to blockage of the entire line and as consequence to total disruption of rail traffic.

Although major infrastructure improvements have been incorporated in the data model for option 1 the line capacity is still less than the performance target in terms of transport capacity and number of trains.

4.5 OPTION 2

4.5.1 Modifications in Option 2 as Compared to Option 1

In addition to the improvements taken into account for the Base Case and Option 1, **rehabilitation and realignment** of the following sections is considered:

- km 165+110 (Co Phuc) – 237+000 (Bao Ha): increase of permitted line speed to 55 km/h
- km 282+772 (Lang Giang) – end of line (Lao Cai) km 296+050: increase of permitted line speed to 45 km/h

The following stations will be equipped with one additional passing loop each (at least 450 m each):

- Thach Loi (km 33+170)
- Huong Canh (km 47+510)
- Tien Kien (km 90+700)
- Chi Chu (108+150)
- Vu En (km 118+170)

Furthermore, it is assumed that the operating time at stations (time from arrival of the first train to departure of the second train in the opposite direction) can be optimised (less than 3 minutes on average).

Results

A few additional trains can be installed in the schedule, mainly trains running over longer sections. This on the other hand requires elimination of a few short-distance trains.

The absolutely critical bottleneck situation in this scenario obviously occurs in the Viet Tri - Tien Kien section.

Figure 4.3 (and Table 4.4) show results of the simulation. There are some remarkable increases of the line capacity. Assuming no irregularities the number of trains required is able to run on the southern section from Yen Vien up to Viet Tri. However, a remarkable deficit remains still on the following sections in direction to Lao Cai; especially between Tien Kien – Pho Lu, where the number of trains required is 72 and the number of trains that can be operated is 59 to 60 only.

In addition, the number and length of passing loops / sidings at Lao Cai and Yen Bai is still far away from the requirements; no change in comparison to the Base Case in this respect.

There are also no time windows available for permanent way maintenance and any irregularities will lead to blockage of the entire line and as consequence to total disruption of rail traffic.

Although major infrastructure improvements have to be implemented for option 2, the line capacity is still not meeting the performance target or the number of trains required on the northern sections.

4.5.2 Sub-Variant 2(a):

Infrastructure configuration corresponding to Option 1 (i.e. without realignment), with additional passing/crossing loops in the following locations:

- Thach Loi (km 33,170)
- Huong Canh (km 47,510)
- Tien Kien (km 90,700)
- Chi Chu (km 108,150)
- Vu En (km 118,170)

Results

Compared to Option 1 two more trains can be inserted into the schedule. However, one train (No.7043) can be operated theoretically, but due to extremely long trip time (22 to 24 hrs) is not feasible in practical terms.

In this case crossing / passing loops are not the reason for bottleneck situations, but additional tracks in some strategic locations could stabilise the operations and make it significantly more robust.

Figure 4.4 shows the attainable train density.

4.6 OPTION 3

4.6.1 Modifications in Option 3 as Compared to Option 2

The performance target can be met only by a combination of measures including infrastructure and operational improvements as well as improvements related to Rolling Stock.

Therefore, Option 3 contains, beside the infrastructure improvements considered for options 1 and 2, a reduction of the number of trains becomes possible by running heavier and longer trains within the limitations given, such as the maximum length of 400 m and the maximal gross hauled tonnage per train around 1,200 tons.

For the inclusion of the heavier and longer trains further operational improvements have been considered implicitly: better utilisation of rolling stock and the reduction of the percentage of empty wagons to be hauled.

It is assumed that all freight trains are hauled by the new locomotive type D20E (SIEMENS AsiaRunner AR15 VN) presently under procurement and to be introduced into VNR operation during the year of 2007.

As mentioned, the improvement measures at level crossings and measures reducing or eliminating unauthorised civilian traffic along and across the line and within station areas are implicitly included.

Results

The reduction of the number of trains and the use of the more powerful locomotives for freight trains in combination with the infrastructure improvements described in the previous section leads to the result that all trains required can be operated on the line. However, the section Bao Ha – Pho Lu is fully occupied; no capacity reserves are

existing in this section. Doubling of the track of this section should be considered and be carefully investigated.

Except the section Bao Ha – Pho Lu, time windows for maintenance are available. Irregularities in operations can be compensated and will not lead to blockage of the entire line.

Figure 4.5 shows the attainable train density.

4.6.2 Sub-Variant 3(a)

Infrastructure corresponding to Sub-Variant 2(a) and operational data corresponding Option 3 (i.e. all station improvements plus longer trains, but without realignment). For making full use of the maximum load carrying performance it is proposed to utilise the full length and weight capacity of the line by putting the new D20E locomotives in front of the freight trains. Train density is shown in Figure 4.6.

In case of the 400 m - 1400 t - trains for achieving a reasonable commercial speed double traction of these DE units is recommended.

Results

Three trains cannot be operated under these conditions due to a bottleneck situation in the timetable for the section between Co Phuc and Ngoi Hop. If at Ngoi Hop four tracks (three loop tracks) would be available, one more train (No.8036) could be operated. Also the train pair 9011/9012 is not feasible in practical terms.

4.7 OPTION 4

Modifications included in Option 4 as compared to Option 3:

In addition to option 3, simulations have been carried out assuming double traction for the train categories F1, F1*, F2L, F3L, F4L* and F5L* (reference is made to Table 4.2).

Results

However, the results of the simulations do not justify this additional effort. There is not any considerable increase in the line capacity. The reduction of running time between stations is very small as can be demonstrated with the following example.

Table 4.2: Comparison of Running Times (option 3 in comparison to option 4)

Train number	Option 3 (1 locomotive)	Option 4 (2 locomotives)
ExC 7001 (Category F1*)		
section Yen Vien – Yen Bai	166 min	162 min
section Yen Bai – Lao Cai	177 min	174 min
ExC 7002 (Category F1*)		
section Lao Cai – Yen - Bai	177 min	174 min
section Yen Bai – Yen vien	165 min	162 min

In case the more powerful D20E locomotive cannot be assigned to these heavy trains because of availability and/or technical reasons, double traction by other, less powerful locomotives, can be an option.

4.8 TRANSPORT CAPACITY AND SYSTEM PERFORMANCE DATA

The resulting system performance data in the table below, extracted from the operations scenarios created for the various options of infrastructure improvement measures and the corresponding stages of implementation reflect the major influence parameters:

- Operating speed - or rather absence of numerous local speed restrictions
- Availability of sufficient crossing / passing loops at stations
- Size and load capacity of trains based on the traction performance of available locomotives.

Table 4.3: Train Performance by Option: 2020

Passenger Trains	Seat-km	Loco-km	Coach-km	Trains p.day¹
Base Case	2.686.672	5.557	85.616	20
Option 1	2.686.672	5.557	85.616	20
Option 2	2.686.672	5.557	85.616	20
Option 2A(a)	2.686.672	5.557	85.616	20
Option 3	2.244.461	4.715	80.650	18
Option 3A(b)	2.244.461	4.715	80.650	18
Target 2020	2.686.672	5.557	85.616	20
Freight Trains	Freight tkm	Loco-km	Wagon-km	Trains p.day¹
Base Case	8.102.543	8.769	160.885	51
Option 1	10.039.989	11.054	204.128	53
Option 2A	10.080.496	11.070	207.138	54
Option 2B	10.562.138	11.542	215.942	54
Option 3A	13.111.543	19.180	279.221	45
Option 3B	13.172.211	16.159	276.080	48
Target 2020	12.425.083	14.107	260.384	62

¹ Highest frequented section

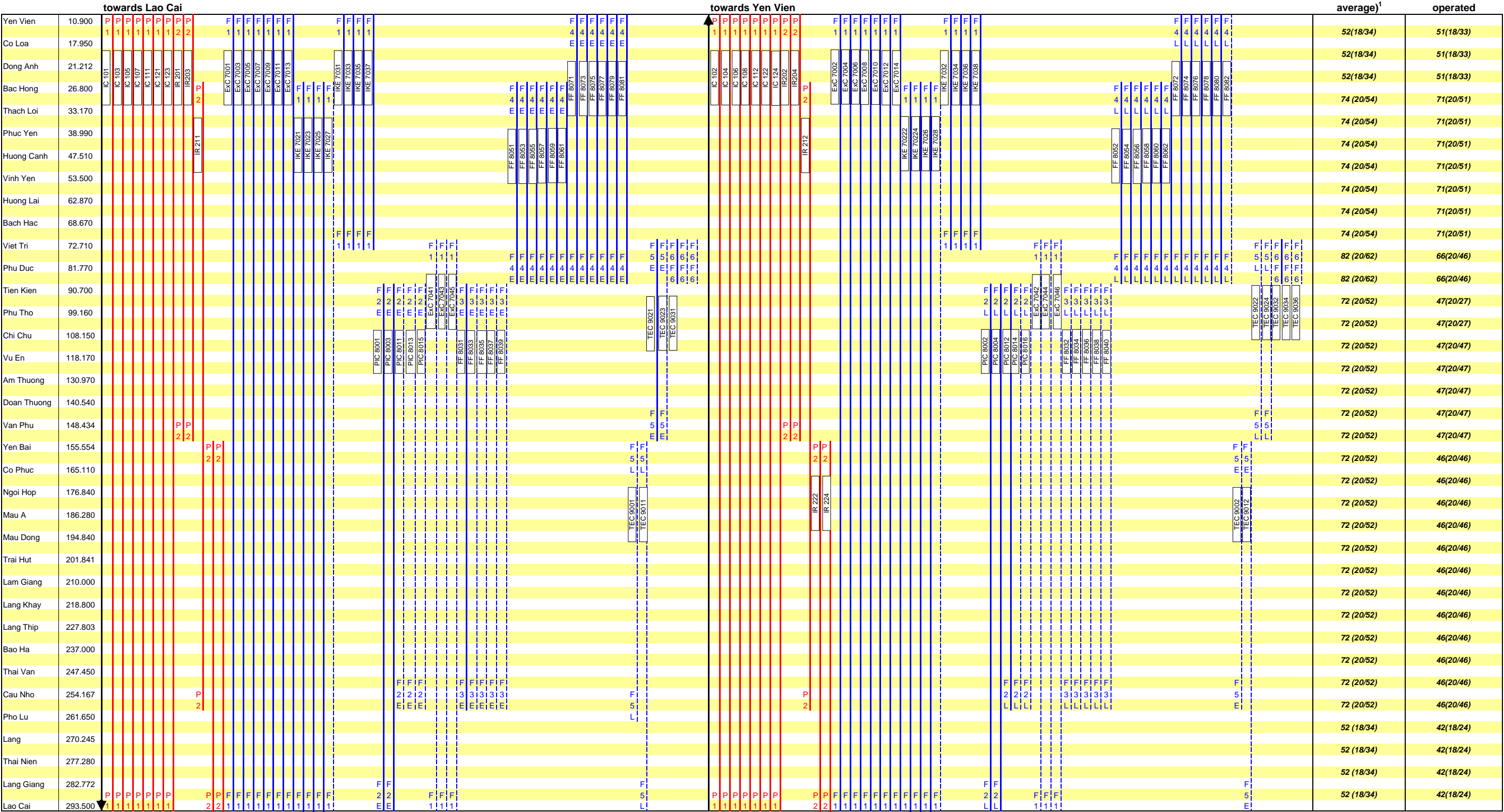
The capacity of the line in terms of trains that can be operated per section is shown in Table 4.4 below.

Table 4.4: Train Capacity by Section: 2020

Option	Yen Vien - Bac Hong	Bac Hong - Viet Tri	Viet Tri - Tien Kien	Tien Kien - Yen Bai	Yen Bai - Pho Lu	Pho Lu - Lao Cai
Base Case	33	51	46	27	26	24
Option 1	33	53	53	39	36	29
Option 2(a)	34	53	54	41	37	29
Option 2	34	54	51	40	39	30
Option 3(a)	26	40	44	45	44	31
Option 3	26	40	44	48	48	32
Target 2020	34	56	62	52	52	34

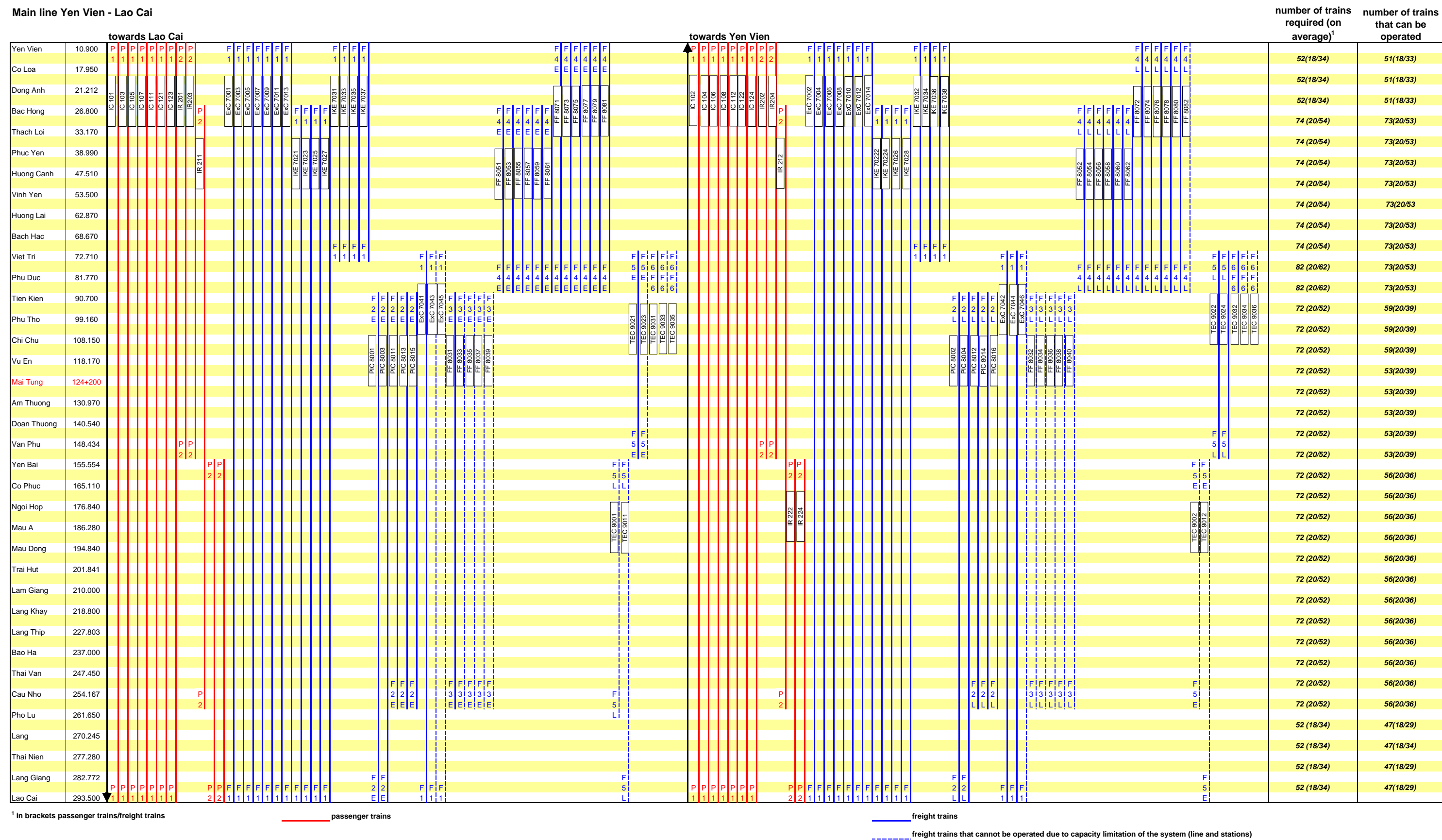
Figure 4.1: Train Density 2020 - Base

Main line Yen Vien - Lao Cai



¹ in brackets passenger trains/freight trains
passenger trains
freight trains (demand)
freight trains that cannot be operated due to capacity limitation of the system (line and stations)

Figure 4.2: Train Density 2020 - Option 1



Main line Yen Vien - Lao Cai

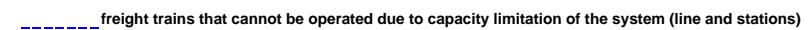
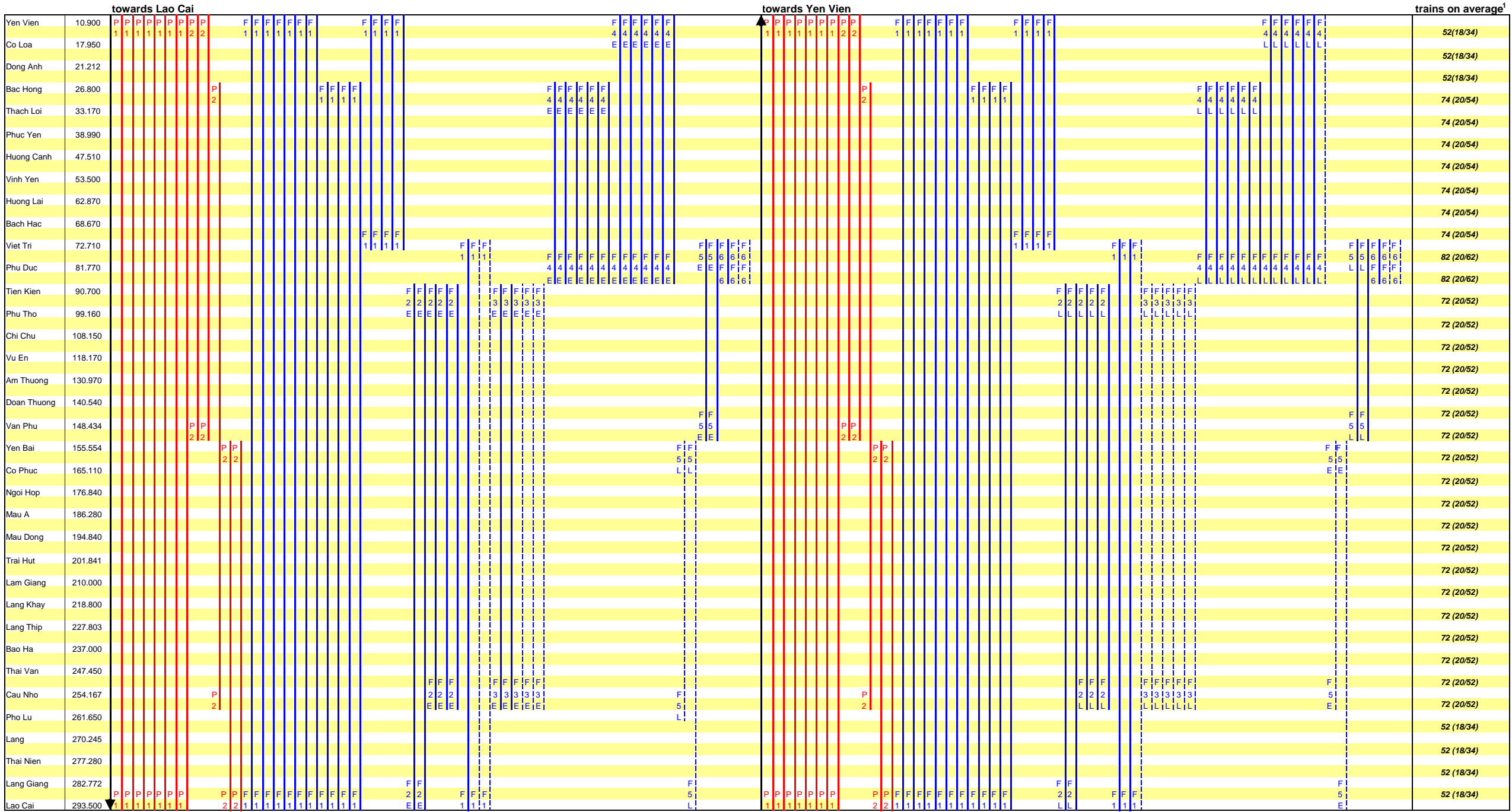


Figure 4.4: Train Density - 2020 - Option 2(a) (no realignment)

Main line Yen Vien - Lao Cai

Option 2(a)



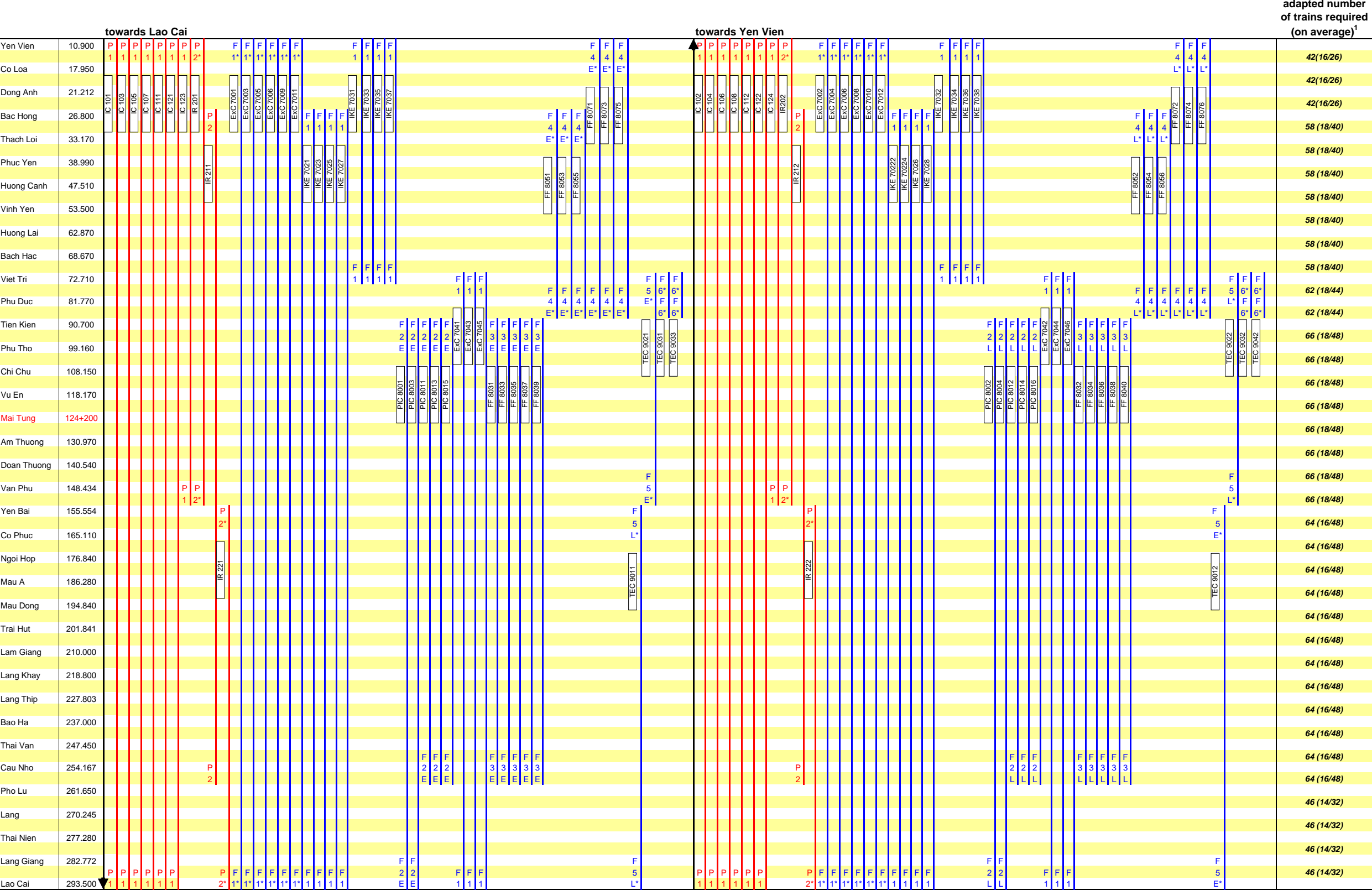
¹ in brackets passenger trains/freight trains

passenger trains

freight trains

Figure 4.5: Train Density 2020 - Option 3 (with realignment)

Main line Yen Vien - Lao Cai



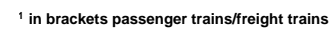
¹ in brackets passenger trains/freight trains

passenger trains

freight trains (demand)

freight trains that cannot be operated due to capacity limitation of the system (line and stations)

Main line Yen Vien - Lao Cai



 passenger trains

 freight trains (demand)

----- freight trains that cannot be operated due to capacity limitation of the system (line and stations)

5 EXTENSION OF STATIONS VAN PHU AND LAO CAI

As mentioned, considerable extension of the stations at Van Phu (in preference to Yen Bai) and Lao Cai is a pre-condition for any improvement measures of the line.

Taking into account that more trains can be operated and more wagons will arrive at Lao Cai, the discrepancy between offer and demand in terms of number and length of passing loops / sidings at Lao Cai and Yen Bai is increasing considerably. Without extension of these stations by additional passing loops / sidings, the theoretical line capacity available in this option cannot be utilised fully.

5.1.1 Van Phu and Yen Bai

The initial analysis showed that, under current operating practices, which involves scheduled stops for freight trains in Yen Bai, at least 7 tracks will be necessary to accommodate the trains passing through the station at peak times; this may be up to 6 trains at the same time at different points in time throughout the day. For trains starting and ending here additional stabling tracks will be required, as much as 5 according to a first estimation.

The 6 existing passing loops have a length between 350 m and length 210 m only. Track No 7 with a length of 130 m cannot be used for crossing trains.

According to calculations made for option 3, 7 passing loops would be needed in the rush hour. Neither the number is available nor can the necessary length be offered. Taking into account that at least 2 additional tracks are needed for splitting-up and forming trains and 1 track is needed as loop line for locomotives, in total 10 tracks, without the main line track and the sidings for storage of wagons, are required.

In total, about 5 additional stabling tracks must be available for a robust operation pattern, especially during peak hours. However, it is clear that the location of Yen Bai in the middle of an urban area, precludes any extensions to the existing facilities. It has therefore been proposed to provide the additional capacity in Van Phu, immediately to the south of Yen Bai, to allow for marshalling operations and inspections to take place there, rather than in Yen Bai.

5.1.2 Station Lao Cai

Four tracks will be occupied by passenger trains more or less during the whole daytime. Taking into account that the average dwell time of the freight wagons for customs and border procedures as well as loading and unloading can be reduced from 2 days presently to 20 hours, around 2,600 m additional tracks (or 6 tracks with a usable length of 480 m each) for stabling freight wagons is required. This calculation is based on the present track lay-out taking into account that around 750 track length is available for stabling wagons. Furthermore, it is assumed that on average about 25% of the freight wagons are permanently in the shuttle trains to Ha Khau – Son Yeu and vice versa or at Son Yeu station.

In addition, one track is needed as loop line for locomotives and at least 2 tracks for splitting-up and forming trains. Furthermore, one additional track is required as turnout track. The track must have the minimum length of freight trains (in future at least 400 m). A more detailed calculation is given in Table 5.1 below.

Table 5.1: Lao Cai Station – Stabling Track Requirement

							sum per day			
	length of train on average	number of wagons	length loco	train length without loco	length of one wagon on average	number of trains - arriving at Lao Cai	number of wagons to be stabled	length of wagons to be stabled	dwel time on average (20 hours)	
	[m]		[m]						0.833	
P1	384	18	19	365	20.3	6				
F1	316	20	19	297	14.9	7	140	2079	1731.8	
F1*	365.5	23	19	337.5	14.7	6	138	2025	1686.8	
F2, F3	331	21	19	312	14.9	2	42	624	519.8	
F5*	341	22	19	322	14.6	1	22	322	268.2	
			total track length required for stabling freight wagons						4,207	m
			existing track length for stabling freight wagons						750	m
			reduction factor (wagons in the shuttle trains to Ha Khau – Son Yeu and v v or at)						0.25	
			additional track length for stabling wagons required						2,592	m
			usable length of each additional stabling track						480	m
			number of additional stabling tracks required						5.4	

6 SUMMARY

The performance target (expressed in terms of seat-km for passenger trains and t-km for freight trains) can be achieved only by a package of measures containing infrastructure and operational improvements as well as improvements in Rolling Stock.

These measures can be summarised as follows and eventual implementation programmes should follow the sequence presented below.

The new station Cau Nho (km 254+167 presently being under construction) with 2 passing loops (usable length 480 m each) has to be put into operation.

The implementation of the new signalling system shall be finalised. This will reduce the operating times at stations (time from arrival of the first train to departure of the second train in the opposite direction) from 7 to 10 minutes at present (on the section Thach Loi - Lao Cai) to 2 to 3 minutes.

All bridges with a train loading less than T14+4.2 tons/meter and/or speed restrictions will be replaced or rehabilitated. This rehabilitation programme includes the following 13 bridges where speed restrictions for freight trains and partly also for passenger trains severely hamper train railway operations at present:

- Man bridge km 145+520 (from 30 km/h to 45 km/h for freight trains)
- Van Phu bridge km 148+920 (from 35 km/h to 50 km/h for freight trains)
- Dao Thinh bridge km 171+414 (from 35 km/h to 45 km/h for freight trains)
- Con Tran bridge km 173+960 (from 35 km/h to 45 km/h for freight trains)
- Moc Thom bridge km 174+185 (from 35 km/h to 45 km/h for freight trains)
- Dieu bridge km 179+304 (from 35 km/h to 45 km/h for freight trains)
- Khe Se bridge km 209+705 (from 30 km/h to 45 km/h for passenger and freight trains)
- Khe But bridge km 218+486 (from 35 km/h to 50 km/h for freight trains)
- Bun bridge km 232+612 (from 35 km/h to 45 km/h for freight trains)
- Khoai bridge km 241+710 (from 35 km/h to 45 km/h for freight trains)
- Van bridge km 245+735 (from 35 km/h to 45 km/h for freight trains)
- Nhai bridge km 250+412 (from 35 km/h to 45 km/h for freight trains)
- My bridge km 265+775 (from 30 km/h to 40 km/h for passenger and freight trains)

At the same time, the extension of the stations Lao Cai and Van Phu shall be executed. This can be done in phases to be defined by the Infrastructure Expert taking into account resettlement conditions and constraints. In cooperation with the authorities and companies concerned, procedures have to be implemented to reduce the dwell time at Lao Cai, especially time required for customs and border procedures as well as loading and unloading, from presently around 2 days to less than 1 day.

The stations Mau Dong (km 194+840) and Lang Thip (km 227+803) shall be equipped with one additional passing loop each (450 m each).

The new station Cau Mai Tung (km 124+200) with 2 passing loops (usable length 480 m each) should be built-up.

The passing loops of the following stations shall be upgraded for train loads up to 1,200 tons and train length of up to 400 m.

Table 6-1: Passing Loops to be Extended

km	station	number of tracks	existing usable length of track (m)	future usable length of track (m)	additional length (m)
72+710	Viet Tri	1	354	450	96
81+770	Phu Duc	4	352	450	98
165+110	Co Phuc	1	395	450	56
186+280	Mau A	1	340	450	110
210+000	Lam Giang	3	350	450	100
247+450	Thai Van	3	357	450	93
277+280	Thai Nien	3	370	450	80

The following stations must be equipped with one additional passing loop each (at least 450 m each)

- Thach Loi (km 33+170)
- Huong Canh (km 47+510)
- Tien Kien (km 90+700)
- Chi Chu (108+150)
- Vu En (km 118+170)

The following sections shall rehabilitated including realignment:

- km 165+110 (Co Phuc) – 237+000 (Bao Ha); increase of permitted line speed to 55 km/h
- km 282+772 (Lang Giang) – end of line (Lao Cai) km 296+050; increase of permitted line speed to 45 km/h

All these measures should be accompanied by further operational improvements (better utilisation of rolling stock and the reduction of the percentage of empty wagons to be hauled) which are implicitly considered but cannot be exactly quantified in terms of time and/or increase in speed.

The improvement measures at level crossings and measures reducing or eliminating unauthorised civilian traffic along and across the line and within station areas should start immediately. These measures will reduce the number of hold-ups of train operations and irregularities that severely influence line capacity.

In addition, optimisation of operations programme by reducing the number of trains required by running heavier and longer trains as far as possible shall be introduced step by step depending on the availability of new (more powerful) locomotives. However, the maximum length remains still 400m and the maximal gross hauled tonnage / train around 1,200 tons (with minor exceptions).

Finally, doubling of the track section Bao Ha – Pho Lu should be additionally investigated.

TA No. 4050-VIE

KUNMING – HAIPHONG TRANSPORT CORRIDOR PROJECT

UPGRADING HANOI – LAO CAI RAILWAY

DRAFT FINAL REPORT

Technical Appendix A.2

INFRASTRUCTURE

July 2006

CURRENCY EQUIVALENTS
(05 MAY 2006)

Currency Unit	–	Vietnamese Dong (VND)
VND 1.00	=	\$ 0.00006272
\$1.00	=	VND 15,950

ABBREVIATIONS

ADB	-	Asian Development Bank
AFD	-	Agence Française de Développement
AP	-	Affected People
BCR	-	Benefit cost ratio
CAD	-	Computed Aided Design
CARB	-	Compensation and Resettlement Board
CPC	-	Commune People's Committee
CPI	-	Consumer Price Index
DFR	-	Draft Final Report
DGTPE	-	Direction Générale du Trésor et de la Politique Economique
DMC	-	Developing Country Member (of ADB)
DPC	-	District People's Committee
EA	-	Executing Agency
EIRR	-	Economic internal rate of return
EMSA	-	Ethnic Minority Special Actions
EPMD	-	Environmental Protection and Management Division
GDP	-	Gross Domestic Product
GOV	-	Government of Vietnam
GSO	-	General Statistical Office
GTZ	-	Gesellschaft für Technische Zusammenarbeit
IBRD	-	International Bank for Reconstruction and Development (World Bank)
IEE	-	Initial Environmental Examination
IoL	-	Inventory of Loss
IP	-	Indigenous People
IPDP	-	Indigenous Peoples' Development Plan
IMO	-	Independent Monitoring Organization
IPSA	-	Initial Poverty and Social Analysis
IRR	-	Internal rate of return
ISA	-	Initial Social Assessment
MOF	-	Ministry of Finance
MONRE	-	Ministry of Natural Resources and Environment
MOT	-	Ministry of Transport
MPI	-	Ministry of Planning and Investment
NGO	-	Non Government Organization
NPV	-	Net Present Value
OCR	-	Ordinary Capital Resources (of ADB)
O-D	-	Origin Destination
ODA	-	Official Development Assistance
PIB	-	Public Information Booklet
PPTA	-	Project Preparatory Technical Assistance
PRC	-	People's Republic of China
PSA	-	Participatory Social Appraisal
RALC	-	(Department of) Resettlement and Land Clearance
RoW	-	Right of way
RP	-	Resettlement Plan

ABBREVIATIONS

RPI	-	Retail Price Index
RPMU	-	Railway Projects Management Unit
RRP	-	Report and Recommendation of the President (to ADB Board of Directors)
RRP	-	Report and Recommendation of the President (to ADB Board of Directors)
SIEE	-	Summary Initial Environmental Examination
TA	-	Technical Assistance
VOC	-	Vehicle operating costs
vpd	-	Vehicles per day

WEIGHTS AND MEASURES

Metric system

NOTES

- In this report, "\$" refers to US dollars.

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1 TECHNICAL BACKGROUND

1.1 INTRODUCTION

The railway line considered in this preliminary design study runs from the port of Haiphong in Vietnam to Kunming in Yunnan Province of the Peoples Republic of China (PRC). The section to be upgraded is approximately 285 kilometres long and traverses in a generally northwesterly direction from Yen Vien station near Hanoi, along the northern bank of the Red River to Lao Cai on the border with PRC. The railway line is a single track mainly one metre gauge and not electrified. The line forms an integral part of the Haiphong-Kunming transport corridor. A plan of the railway alignment is shown in Figure 1.1 overleaf.

Construction of the railway line running along the Red River from Haiphong to Kunming commenced in the year 1900. The Haiphong to Lao Cai section was opened in phases between 1903 and 1906. Construction of the railway link to Yunnan (Peoples Republic China) was commenced 1906 and the line was opened on 1st April 1910.

There is considerable variation in the topography along the railway's existing alignment. It varies from broad plains from Hanoi to Viet Tri, narrow valleys in the midlands in Vinh Phuc and Phu Tho provinces and then high mountainous uplands between Yen Bai and Lao Cai.

The existing railway line between Yen Vien and Lao Cai is characterised by numerous tight curves, some with tight radii of only 100 metres. In addition the cant and transition lengths provided at several sections do not comply with Vietnamese standards which have the potential to affect train and passenger safety. The permanent way and existing bridges are in poor condition which results in the imposition of speed restrictions of up to 35 km/h. In the area around Yen Vien a speed limit of 15 km/h is enforced.

The signalling system is inadequate, particularly on the Yen Bai – Lao Cai section. There is insufficient line and station capacity particularly at Yen Bai and Lao Cai stations. Numerous authorised and unauthorised level crossings have been constructed.

Due to the fact that the system has been operational since the start of the twentieth century, and the lack of maintenance funds available over many years, the condition of railway bed and track have deteriorated and no longer meet the safety requirements. Traffic capacity of the line is also affected. The aim of this upgrade project is to ensure the rail system is capable of operating safely and efficiently up to the year 2020. It is then anticipated that a new replacement line may be constructed along the other side (South) of the Red River.

This report details the technical aspects of the Hanoi-Lao Cai portion of the rail study. It summarises the Consultant's findings and recommendations. The method which has been adopted in order to prioritise the proposed solutions is explained. Safety recommendations are detailed and a recommended approach to contract packaging is outlined.

In addition cost estimates are provided for all work items. The design codes, standards and design principles adopted for the upgrade works on the Yen Vien to Lao Cai Railway Line are detailed in Annex A.

A number of preliminary design drawings are included within this document. However the complete package of preliminary drawings are provided separately in Technical Appendix E1.

Figure 1.1: Location Plan of the Haiphong–Viet Tri–Lao Cai Railway Line (including Stations)



1.2 EXISTING ALIGNMENT

The Hanoi–Lao Cao railway connects Vietnam's mountainous border provinces in the West with the midlands and red River plains towards Hanoi. This railway forms part of an important East-West transport corridor.

The existing track alignment is characterised by:

- Tight curves, many without adequate cant or transition curves,
- Sections of steep gradients,
- Poor quality track, in particular :
 - lack of ballast,
 - old and worn rail (typically 38 or 43 kg per meter),
 - insufficient track capacity at main stations, and
 - passing loops that are too short to accommodate full length trains.

In order to improve the technical condition of the existing line, the following engineering interventions have been considered by the Consultant:

- Bridge replacement or upgrading,
- Upgrading and adding passing loops,
- Selective improvement to horizontal and vertical alignment,
- Stabilisation of slopes and embankments,
- Improvements to trackwork including turnout, and
- Improvement of selected at-grade crossings.

The Consultant has a clear understanding of the condition of the existing track, structures (bridges and culverts) and stations along the line. Further, the poor state of the track in certain areas is both reducing speeds and increasing the risk of derailments. Sections of embankment have been subject to landslides and require stabilization works. The poor condition of the bridges and the large numbers of tight turns reduce operating speeds and the lack of passing loops limits capacity.

1.3 SURVEYS

1.3.1 Introduction

In order to complete this Feasibility Study and prepare the engineering recommendations a number of surveys have been carried out during the course of the study. These surveys included

- Topographical
- Bridge condition surveys, and
- Geological/materials investigations.

Prior to finalizing the scope of each survey a considerable number of reconnaissance and site visits were made to the railway. In addition discussions were held with Vietnam Railways (VNR) and the Executing Agency (RPMU) in order to identify their major concerns regarding the existing track condition. Copies of the surveys will be provided to the Executing Agency (RPMU) by the Consultant in order that they can be used by the Consultant appointed to carry out the detailed design, which forms the next stage of this project. Details concerning the extent of the surveys carried out are provided in Annex B.

1.3.2 Digital Maps

Digital maps have been obtained covering the whole line between Hanoi and Lao Cai. These documents have been used as a base for creation of working maps for engineering, environmental, social and resettlement studies. Copies of the digital maps are provided for reference in Annex H.

1.3.3 Topographical Survey

During the initial phases of this study the Consultant carried out a desk study, site reconnaissance exercise and numerous meetings were held with relevant parties (VNR, RPMU etc). As a result the Consultant was able to establish the areas and scope of likely improvement works required. The topography survey was then carried out in areas where new or remedial works, such as slope stability, railway realignment or station passing loop were planned to be implemented. The topography work was carried out according to the Vietnamese survey standard No. 1105/QD-DS-KHCN.

The survey covered 81.9 kilometers of the mainline including an area 30m each side of the track centreline. The surveys recorded vertical and horizontal data. The results were linked to the network of national and railway benchmarks. A number of new benchmarks were also installed as part of the survey works. The table below summarises the extent of the topographical survey.

Table 1.1: Extent of Topographical Survey

Location (km)		Objective	Topographical
From	To		
118	293	Realignment	√
223 & 273		Land slides	√
16 stations		Station extension	√
5 bridges		Bridge rehabilitation	√

The results of the topography surveys were used by the Consultant in order to prepare more detailed designs and carry out further investigations in order to be able to prioritise the recommended technical interventions such as realignment works or station upgrading. The estimated quantities obtained from the digitized drawings were used in preparing the cost estimates.

1.3.4 Bridge Survey

Information concerning the condition of the existing bridges was obtained early during the course of this study from Vietnam Railways (VNR). This was supplemented by information obtained as a result of site visits to inspect bridges and sections of alignment concerned.

The condition survey was targeted towards structures which were known to be in structural distress or where speed limits were currently in force as a result of poor current condition. In total 65 existing structures were identified as being at risk and in need of surveying and further investigation.

The results of the bridge survey have been forwarded separately to the executing Agency (RPMU). The survey drawings produced include plan views, elevations and end views. As built dimensions are also provided.

The design drawings have been consulted in order to establish the size and type of abutment foundations which were installed. Where available design loads and details concerning the existing ground conditions encountered during construction have been provided. In addition details concerning notable events, such as records of any particular war damage, have been included.

1.3.5 Geological Survey

The geological survey works were carried out to assist the Consultant in preparing the preliminary design recommendations for the slope stabilization, bridge rehabilitation and realignment works. Boreholes were drilled at each kilometer along the 82 kilometres of planned realignment works. The investigative boreholes were 7m deep. The length of boreholes was increased to 20 metres where slope stability works were being proposed. Laboratory tests were carried out on samples taken for the planned slope stability and bridge rehabilitation works.

1.4 PRIORITISATION OF WORK RECOMMENDATIONS

As required in the Terms of Reference document a prioritized approach has been adopted by the Consultant when preparing the preliminary design recommendations. This was also confirmed during the ADB bank mission and subsequent meetings with RPMU. It has therefore been decided that three levels of priority should be considered. These are defined as follows:

Priority 1 works are those which the Consultant recommends are carried out as a matter of urgency and without undue delay. Types of work which have been included within this highest priority are:

- Works which, if not carried out, may affect the safety of the train operations and passengers,
- at locations where serious damage has previously been recorded,
- at locations where periods of long interruption to rail operations have been encountered in the past,

- at locations where repeated events, such as failures, occur regularly, and
- at locations where frequent maintenance is required.

Priority 2 works are not urgently required and are not currently a threat to safety or reliability of train operations. The works in this category are not recommended to be included in the scope of the current upgrade project. However the Consultant believes that implementing these works at some stage in the future, perhaps within a five year timeframe, would be beneficial.

Priority 3 works are those which can be carried out by Vietnam Railways as part of their routine maintenance program.

1.5 TRACK ACCESS AND SAFETY CONSIDERATIONS

The railway line between Yen Vien and Lao Cai operates on a single track. The majority of the rehabilitation and upgrading works will be required to be carried out whilst the railway remains operational. It is required that the majority of the construction works should take place without disruption to the existing services. The Contractors appointed to carry out the recommended improvement works will therefore be required to liaise closely with Vietnam Railways.

The Civil Works required to be rehabilitated or constructed under this Project will involve working on, over, under and alongside the Operating Railway. The safety of rail traffic, passengers and construction workers is of paramount importance at all times and safety considerations must take precedence over any and all other considerations. No work may be undertaken on the existing railway track except under a track possession approved in advance by Vietnam Railway. No activity is to be undertaken or performed which jeopardises the safety of train operations.

Where space is available alongside the tracks, repair works can be carefully carried out independently of train operations. However this work will have to be strictly controlled in order to ensure that no activities impact the railway's safe working envelope.

If the planned works cannot be carried out safely whilst the train services remain operational (eg bridge girder replacement works, extension of station loops or replacement of track devices) the Contractors will be required to request track possessions from Vietnam Railway. The unauthorized interruption of rail traffic is not permitted.

Where temporary works are required to be constructed (eg temporary bridges or sections of rail) the Contractor will ensure the quality of these temporary works so that the safety of trains, passengers and the surrounding area (people, properties and environment) is not jeopardised. It will also be necessary to prepare a special storage area for the assembly and loading of materials.

Access to some planned work locations along the route will be difficult and restricted. Road access is not possible to all areas along the route. Wherever possible the Contractors should arrange for delivery of the majority of materials by rail. This will minimize the amount of heavy vehicles on the existing highway.

2 REALIGNMENT WORKS

2.1 INTRODUCTION

The rail alignment between Haiphong and Lao Cai was opened in three phases at the start of the 1900's. The operation and maintenance work on this section of railway is administered by four Rail Public Utility Companies (RPUC). The extent of each Management Unit is illustrated in Figure 2.1 overleaf.

The railway line was originally designed and constructed in accordance with the Technical Standards applicable at that time. This resulted in the original alignment only consisting of simple curves and straight sections without the need for transition curves. Generally the rail (24 kg/m) was mounted on steel sleepers. However in areas close to the sea, such as the Haiphong port area, wooden sleepers were adopted. The original designers recognized that salt in the atmosphere may induce corrosion problems.

After the war was over, in order to stimulate economic development of the North-western area, a branch line to the Apatite Mine at Pho Lu Station was developed simultaneously with a general upgrading and realignment of the railway. At this time the vertical profile was improved and extensions were provided to the station siding loops.

However in recent years the condition of the railway has deteriorated. In addition maintenance, in some areas, has not been adequate. As part of this study the Consultant has investigated the existing alignment and has prepared prioritized recommendations concerning the sections which should be upgraded in order to improve the safety and efficiency of the railway operations.

2.2 TOPOGRAPHY

There is considerable variation in the topography along the railway's alignment. The route varies from broad plains between Hanoi to Viet Tri, narrow valleys in the midlands in Vinh Phuc and Phu Tho provinces, denuded low mountains and hills near Yen Bai, typical loose masses, deeply incised slopes, eroded gullies and high mountainous uplands between Yen Bai and Lao Cai. The main sections of alignment are summarized below :

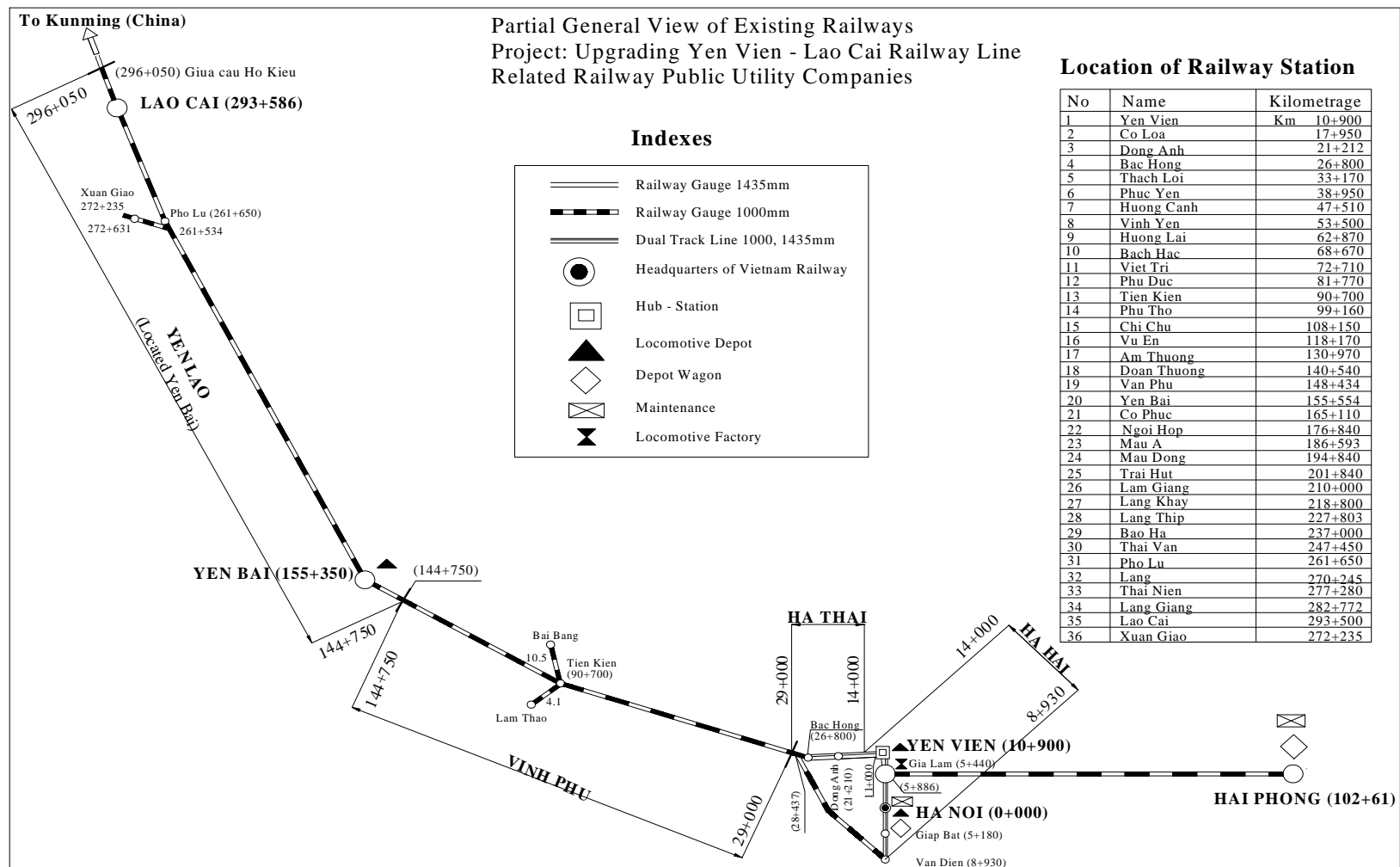
Haiphong to Hanoi (Length = 101 km) - The first section of rail line connecting Haiphong to Hanoi was completed and opened on 1st April 1903. The existing topography along this section of the line is generally flat and undulating. As a result the track was built on filled embankment to avoid flooding, subsidence and collapse of the line during the rainy season flood. The line crosses the Red River at Hanoi on the significant Long Bien Bridge.

Yen Vien – Viet Tri The line runs from Yen Vien, alongside the Red River towards Viet Tri. The railway line remains on filled embankment in this area until it leaves the delta area via the Viet Tri Bridge (Length = 295 m) over the Lo River. This railway section was completed and opened in 1904.

Yen Bai to Lao Cai (Length = 181 km) The last section to be completed was between Yen Bai and Lao Cai. This section runs along the bank of the Red River with the mountain range on the adjoining side. A large number of very tight turns in this mountainous region. This section includes 11 Stations, several of which are used as sidings.

A summary of the detailed geological and hydrological characteristics along the route are provided in Annex C.

Figure 2.1: Location of Stations and RPUC Responsibilities



2.3 EXISTING ALIGNMENT

The existing railway line has a poor geometric vertical and horizontal layout. The existing alignment from Yen Vien to Lao Cai is 285 km long. The track contains 943 curves with a combined length of 115.5 km (41% of total length). A considerable amount of the existing ageing infrastructure and facilities are in poor condition. This has the potential to affect the safe operation of the railway.

From Viet tri to Lao Cai the line runs on the North-eastern side of the Red River. In order to reduce the amount of earth work, the railway track winds its way, closely following the natural landscape. Therefore the line has many curved sections, some with very small radii as low as 100 metres.

Tight curves increase track wear, reduce the safe train operating speed and increase the risk of derailment. As a result of the existing layout, there is frequently inadequate provision of railway cant between two adjacent curves. This was previously identified in the Decision of Vietnam Railway No 364 dated 24th April 1999. This affects ride comfort and increases the risk of derailment. This situation is illustrated in Figure 2.2 below where the straight railway segment between inverse curves is only 5 metres, which is inadequate.

In order to minimise the risk of derailment, additional guardrails have been installed in high risk areas in order to ensure that the train stays on the track. As a result of the existing cant being non-compliant with the relevant Vietnamese standards, the train speed is limited at the sections concerned.

Figure 2.2: Section of track illustrating the existing rail alignment and guard rails



A number of existing bridges and sections of track along the existing alignment are at risk of flooding. In particular this occurs during the rainy season, when excess water flows down from the mountainous areas along the valleys. This meets the raised Red River water levels and causes flooding of the existing alignment and associated bridges. This can significantly affect rail operations, particularly during the rainy season. In addition train and passenger safety could be affected. This is a particular problem between Km170+6 and Km171+300.

2.4 REALIGNMENT OPTIONS

As required in the Terms of Reference (TOR), the Consultant has prepared recommendations concerning sections of line to be realigned.

Since extensive and detailed topographic data were not available at the outset of this study, initial assessments were carried out using as-built drawings, topographical maps and the existing survey data. The Consultant was then able to identify sections of track which should be investigated for possible upgrade and improvement.

Detailed topographic surveys were carried out in the areas concerned. Once these results were obtained and the digitised information was input on to the Autocad system, further detailed investigations were carried out concerning possible alignment improvement works. During the course of this study over 60 kilometres of track was investigated by the Consultant's team.

The selected realignments have been designed in accordance with VNR standards (MOT Standard 1976 & VNR Regulation 364 of 1999). The new alignment aims to increase the radii of the tightest curves and improve transitions between curves and straights. The modified alignment also avoids low areas which are subject to flooding.

The typical cross section profile for existing sections of track and embankment are 4.4 metres wide. This does not comply with current Vietnamese standards. As part of the improvement works the newly realigned track will have a typical 5.0 m wide embankment. The applicable design codes, standards and principles adopted in the realignment works are detailed in Annex A.

The sections considered for realignment were those containing the tightest bends and those with significant sections with technical parameters which are not compliant with the current standards applicable in Vietnam. In addition sections of track where train safety could be affected, reliability of operations are threatened or where frequent heavy maintenance was required. In addition the following issues were considered :

- The feasibility of constructing the realigned sections bearing in mind that the railway must remain largely operational whilst the works are carried out.
- Ensuring that the engineering scope of realignments (eg volume of earthworks, number of bridges to be reconstructed) and thus the estimated costs of the realignment work were not excessive.
- Minimise the land acquisition requirements or possible resettlement requirements in order to reduce possible project implementation difficulties.

Short and isolated lengths of track realignment produce only very small gains in train speed (and hence track capacity). Rather than considering individual sharp bends, the Consultant considered sections which are several kilometers long in order to provide significant improvements. A total of 58.4 km of realignment was studied and investigated on the basis of the detailed horizontal topographical work.

2.5 SECTIONS CONSIDERED FOR POSSIBLE REALIGNMENT

Upon completion of the study, having carefully considered the planned realignment, and the implications (estimated construction costs, safety benefits, engineering difficulties, journey time savings etc) the Consultant prepared preliminary designs for five sections of track to be realigned. The works proposed for these sections are summarised in Section 2.5.1 and 2.5.2. Further details are provided in Annex D.

The Consultant has divided these sections into Priority 1 and 2 recommendations as detailed below. The Consultant recommends that the Priority 1 works are carried out as soon as possible. The realignment will provide safety benefits and improve operating speeds. The Consultant considers that the realignment works identified as Priority 2 works do not need to be carried out immediately. However Vietnam Railways may wish to consider implementing these works at some stage in the future, perhaps in five years time.

The Consultant has prepared vertical and horizontal realignment drawings for the works identified as these as Priority 1. These drawings are provided separately in Technical Appendix E1.

2.5.1 Recommended works (Priority 1)

Section between Lang Giang – Lao Cai (km 282+772 - km 293+586).

This section has been identified as Priority 1 for the following reasons:

- The existing alignment runs alongside and close to the North-eastern bank of the Red River. There is risk of erosion and track collapse. In addition frequent disruptions currently occur to operations, particularly during the rainy season.
- The current alignment follows the mountainous ground topography very closely which results in a large number of relatively sharp curves being required. For example the present alignment contains 31 curves with radii between 100m and 120m. In addition there are ten further curves with radii of between 120m and 150m.
- Landslides in this section are a frequent occurrence which endanger train and passenger safety in addition to potentially blocking the line.
- An additional advantage of carrying out the realignment works in this section is that at some point in the future, perhaps around the year 2020, a new double track alignment may be required. This may be constructed on the South-western side of the Red River. It is understood that parts of this section new alignment will be incorporated into the proposed new standard gauge railway alignment in the section towards Lao Cai.

The length of the existing alignment in this section 10.814 kilometres. The length of the realigned section is 10.638 km. Four new bridges are also required to be constructed.

The new and smoother alignment will improve the potential operating speeds and reducing the risk of derailment. The track is also moved away from the Red River which reduces the risk of erosion and disruption due to flooding.

Part of the Co Phuc – Ngoi Hop Section (Km 170+110 to Km 171+409)

This realignment section has been identified as Priority 1 due to frequent flooding problems, particularly during the rainy season. This is a particular problem between Km170+600 and Km171+300. This delays train services and potentially affects safety of operations. Once the track and related rail facilities become submerged their engineering properties and performance are adversely affected. The actual length of track to be realigned within this section is 1.299km. The alignment will be raised by up to 80 centimetres. In addition two bridges will be reconstructed to match the new route.

Table 2.1: Summarizing the Key Parameters for the Five Sections of Track Considered for Re-alignment

Railway Section	Existing Alignment	Proposed New Alignment	Minimum Train Speed (km/h)		Earthwork Volume (m3)	Affected Assets			
			Existing line	New line		Total Land Acquisition (m2)	Main Structure (No.)	Sub-structure (No.)	Total Affected Households (No.)
Co Phuc - Ngoi Hop			35	45		70,120	1,504	861	86
Km 165+110 - Km 176+380									
Total Length (m)	11,270	10,424							
Rmin	150	200			73,588 (Fill)				
Curve quantity	50	23			55,734 (Excavated)				
Lstr. minimum	14	42							
Lcurve minimum	34	96							
Km 169+909 to Km 171+409	Submerged	Elevated							
Ngoi Hop – Mau A			35	45		38,775	307	153	44
Km 176+380 - Km 186+593									
Total Length (m)	10,213	8,205							
Rmin	100	180			49,275 (Fill)				
curve quantity	50	22			38,003 (Excavated)				
Lstr. minimum	8	44							
Lcurve	63/R150	87/R500							
Trai Hut - Lamgiang			30	45		39,795	307	185	35
Km 201+582 - Km 210+000									
Total Length (m)	8,418	7,801							
Rmin	150	200			13,996 (Fill)				
curve quantity	41	24			21,438 (Excavated)				
Lstr. minimum	13	41							
Lcurve minimum	83/R150	82/R280							
Bao Ha - Thai Van			35	45		53,915	349	105	52
Km 237+000 - Km 247+450									
Total Length (m)	10,450	10,229							
Rmin	150	170			120,869 (Fill)				
curve quantity	62	41			37,711 (Excavated)				
Lstr. minimum	17	38							
Lcurve	58/R100	106/R300							
L.Giang - Lao Cai			35	45		49,193	344	356	48
Km 282+772 - km 293+586									
Total Length (m)	10,814	10,638							
Rmin	100	200			97,659 (Fill)				
Curve quantity	69	28			142,253 (Excavated)				
Lstr. minimum	4	30							
Lcurve	58/R100	86/R500							

Table 2.2: Summary of key parameters for the section recommended realigned (Priority 1)

STT	Start Point	End Point	Length (m)	Volume		Existing Culverts (No.)	Existing Bridges			
				Fill m3	Excavation m3		Number	Name	Material	Span (m)
	Co Phuc Station Km165+110									
1	Km169+909	Km171+409	1,500	23,864	10,816	5	1	Dao Thinh	Steel	13.3
	Km172+336	Km173+809	1,473	16,531	14,165	4	1	Thac thu	Steel	4.78
	Sub Total		2,973	40,394	24,981	5	2			
	Lang Giang Station Km282+772									
2	Km283+550	Km284+078	528	14,289	1,261	2				
3	Km284+183	Km284+856	673	29,082	5,576	2	1	That Co	Steel	13.6
4	Km285+200	Km285+478	278	7,205	9,954	1				
5	Km285+519	Km286+761	1,242	11,726	62,110	6				
6	Km286+843	Km287+130	287	487	13,106	0	1	Quynh Sum	Steel	21.1
7	Km287+511	Km288+031	520	0	16,574	4				
8	Km288+131	Km288+407	276	0	4,053	1				
9	Km288+500	Km288+802	302	0	10,417	2	1	Arch Bridge	Reinforced Concrete	6
10	Km288+973	Km289+527	554	17,637	1,470	3				
11	Km289+665	Km290+077	412	4,788	6,761	3	1	Arch Bridge	Reinforced Concrete	6
12	Km290+764	Km291+116	352	4,184	1,767	0				
13	Km291+539	Km291+828	289	4,839	2,739	1				
14	Km291+957	Km292+317	360	3,422	6,467	0				
	Sub Total		6,073	97,659	142,253	25	4			
	Total		9,046	138,053	167,234	30	6			

2.5.2 Priority 2 works

The following sections should be treated as Priority 2. The Consultant considers that the realignment works listed below do not need to be carried out immediately. However Vietnam Railways may wish to consider implementing these works at some stage in the future, perhaps in five years time.

- Co Phuc–Ngon Hop – Km165+110 to Km170+110 & Km171+409 to km176+380
- Ngon Hop-Mau A - Km176+380 to Km186+593,
- Trai Hut–Lam Giang - Km 201+582 to Km 210+000, and
- Bao Ha–Thai van - Km 237+000 to Km 247+450.

The Consultant has completed the preliminary designs of the above Priority 2 sections. This horizontal and vertical re-alignment data will be submitted to the Executing Agency (RPMU) for reference and possible future implementation.

3 BRIDGE REHABILITATION

3.1 INTRODUCTION

A total of 154 existing bridges are located on the Hanoi-Lao Cai line. These structures are operated and maintained by the following four Rail Public Utility Companies (RPUC).

Table 3.1 : Rail Public Utility Company Responsibility for Bridges

Rail Public Utility Company	Number of bridges
Ha Thai	1
Vinh Phu	30
Ha Lao (main line)	117
Pho Lu - Xuan Giao (branch line)	6

3.2 BRIDGE CONDITION SURVEY

The line was opened at the start of the 20th century. It has been established that 54 bridges of the 154 existing bridges were improved and upgraded since 1992. These bridges are in good serviceable and able to carry the required load capacity train load T14. The remaining 100 bridges were therefore required to be analysed and assessed by the Consultant as part of this study.

The majority of the existing bridges are steel structures. However some of the short span bridges are made from reinforced concrete. All the existing bridges are single span, except the Bun Bridge (Km 232+6) which has two spans and a central pier. The abutments are generally formed of masonry or in-situ mass concrete and their foundations are normally of mass concrete. However piling solutions have been adopted at a number of locations.

A large number of the existing bridges and rail facilities have deteriorated for the following reasons:

- War damage,
- the aggressive environment (particularly the high level of humidity),
- steel fatigue,
- flood damage,
- weathering and severe corrosion,
- Scouring and erosion of adjoining river banks endangering the stability of the railway and bridges, and
- a lack of maintenance.

In addition the surrounding environment and ecological conditions have varied recently as a result of flooding, scouring of the river bed beneath bridges, collapse of the river bank at curves sections of the Red River endangering the railway line as well as the bridges.

The weakened state of the bridges has required the imposition of speed restrictions. This affects railway capacity and is a safety risk. Speed limits of 35 km/h are imposed on most bridges and 15 km/h in the vicinity of Yen Vien. Details are provided below.

Table 3.2: Bridges with Imposed Speed Restrictions

Bridge Name	Location (km)	Restriction (km/hr)
Man	145.2	30
Van Phu	148.9	35
Dao Thinh	171.4	35
Con Tran	174.0	35
Moc Thom	174.2	35
Dieu	179.3	35
Khe Se	209.3	30
Khe But	218.5	35
Bun	232.6	35
Khoai	241.7	35
Van	245.7	35
Nhai	250.4	35
My	265.8	30

The current poor bridge condition results in cracking and static vertical deflections (“bridge sagging”). When trains pass over these bridges excessive dynamic vertical deflections and horizontal oscillations are observed.

The Consultant has therefore assessed the current condition of 100 bridges and considered their requirement for reinforcement, strengthening or reconstruction. It should be remembered that a number of these structures were originally constructed almost a century ago.

The condition survey was targeted towards structures which were known to be in structural distress or where speed limits were currently in force as a result of the bridge’s current poor condition. In total 65 existing structures were identified as being at risk and in need of surveying and further investigation. These were selected based on the findings of numerous site visits which were carried out by our engineering staff. In addition detailed discussions were held with the staff from Vietnamese Railways who are very familiar with existing conditions along the alignment. The photos overleaf illustrate the poor condition of the existing steel structures.

Figure 3.1: Damaged Steel Pigeau Truss End Post**Figure 3.2: Strongly Corroded Bridge Cross-beam**

The bridge condition survey drawings include plan views, elevations and end views. Actual “as-built” dimensions are provided. The original design drawings have been consulted in order to establish the size and type of abutment foundations which were installed. Where available design loads and details concerning the existing ground conditions encountered during construction have been provided. In addition notable events, such as records of any particular war damage, have been noted. A copy of the bridge survey results has been forwarded under separate cover to the Executing Agency (RPMU). A summary of the bridge survey results are provided in Annex E.

It has been established that significant temporary bridgeworks were carried out during the war in order to repair significant bomb damage to the bridges. Temporary procedures, such as installing regular nuts and bolts, were adopted as a result of the difficult war conditions and limited availability of materials. These structures do not meet current technical standards.

For example High Tension Bolts (HTB) with gussets are required to be incorporated in new structures. Standard nuts and bolts are liable to become loose over time, particularly when the trains pass over the bridge and causes vibrations to be induced. In addition bomb attacks on bridges often resulted in the damaged girder falling into the Red River. Given the difficult war conditions at that time, and limited availability of

materials these girders were usually recovered from the river. Temporary and essential rapid repairs were carried out by the army as required prior to the girder being reinstalled on the repaired abutments. These girders are obviously at greater risk of corrosion damage.

3.3 LOADING REQUIREMENTS

The upgraded bridges are required to withstand the following train loads. Further details concerning the current design standards, codes and principles which should be adopted for this upgrade project are provided in Annex A.

Table 3.3: Bridge Load Requirements

Design Train Load	T14
Train speed	Max 80 km/h
Train load	Up to 1200T
Train length	Up to 400m

The majority of the existing bridges are steel with Pigeaud type trusses (French built), VN64-71, T66 or “I section” steel girders using riveted connections. These steel structures were originally designed to withstand with the equivalent train load of Micado+4.2 T/m or T13. This is a reduced capacity when compared with the Project design train load of T14. The train load comparison is shown below.

Table 3.4: Equivalent Train Loading Value (T/M)

Locomotive Length of Girder/truss	Doi moi + 4.2T/m	DFH21 + 4.2T/m	Micado + 4.2T/m	Belgium + 4.2 T/m	T10	T14
L= 1 m						
$\alpha=0.00$	27.20	29.00	24.8008	28.0000	22.000	30.8
$\alpha=0.25$	27.20	29.00	24.8008	28.0039	22.078	30.9092
$\alpha=0.50$	27.20	29.00	24.8047	19.6799	22.000	30.8
L=3 m						
$\alpha=0.00$	13.15	12.24	13.6399	13.1914	11.0005	15.4007
$\alpha=0.25$	11.48	9.88	11.5767	11.8267	9.7827	13.69578
$\alpha=0.50$	9.07	9.67	9.9207	9.3335	7.3337	10.26718
L=5m						
$\alpha=0.00$	10.93	9.10	11.90	11.26	9.24	12.936
$\alpha=0.25$	9.14	8.20	9.60	9.41	7.9209	11.08926
$\alpha=0.50$	9.14	6.52	9.60	9.41	7.9199	11.08786
L=9m						
$\alpha=0.00$	8.00	7.02	9.06	8.28	7.5156	10.52184
$\alpha=0.25$	6.94	5.76	8.13	7.17	6.6992	9.37888
$\alpha=0.50$	6.88	5.4	8.07	7.1	6.6664	9.33296
L=17m						
$\alpha=0.00$	6.54	5.8	7.23	6.82	5.9675	8.3545
$\alpha=0.25$	5.73	5.02	6.55	5.99	5.3923	7.54922
$\alpha=0.50$	5.27	4.89	6.14	5.56	5.1826	7.25564
L=20m						
$\alpha=0.00$	6.25	5.57	6.85	6.51	5.6565	7.9191
$\alpha=0.25$	5.48	4.85	6.26	5.72	5.1226	7.17164
$\alpha=0.50$	5.26	4.71	5.82	5.52	4.8306	6.76284
L=28 m						L=30 m
$\alpha=0.00$	5.74	5.19	6.17	5.95	5.0249	7.03486
$\alpha=0.25$	5.05	4.54	5.65	5.26	4.5278	6.33892
$\alpha=0.50$	5	4.37	5.19	5.19	4.1416	5.79824

3.4 CONSULTANT'S PRIORITISED RECOMMENDATIONS

As part of our Scope of works the Consultant is required to recommend a categorized approach to the required bridge upgrade works. This was confirmed during the ADB bank mission and subsequent meetings with RPMU.

The three categories which have been adopted are as follows :

Priority 1 works are those which the Consultant recommends that remedial works are carried out urgently if safety is to be ensured and disruptions to train services are to be minimized.

Priority 2 remedial works are those which should be carried out at some stage in the future. A five year timeframe is recommended.

Priority 3 works indicate that the bridges in this category are in a satisfactory condition and not currently giving cause for concern. Generally these bridges have had remedial works carried out on them during recent years. Future works should therefore be carried out during the routine maintenance cycles.

The Consultant's recommended technical interventions have been prepared based on the following activities:

- Numerous site visits and visual inspections by our engineering experts,
- Review of the Bridge survey results including information provided in design drawings.
- Information provided from RPMU and VNR staff who are familiar with the current condition of the railway line.

It should be noted that detailed modeling and computerized structural assessment of individual bridges was not carried out as this was beyond the Scope of this preliminary study.

In summary the rehabilitation of 40 existing bridges is recommended as Priority 1. In addition 6 new bridges are required to be constructed as a result of the required realignment works, detailed in Section 2 of this report.

The majority of the repair works involves replacement of the girders or trusses. Repair of girders was initially considered. However replacement is recommended as the quality of the materials and the repairs can be ensured.

Bridges which are known to have suffered significant war damage been recommended as Priority 1. Particularly if significant remedial works have not been carried out on these bridges since the Vietnamese army implemented their temporary repairs. In particular the age of these structures, the humid environment and the large number of train load cycles which have passed over the bridge have resulted in the poor current condition of the bridges.

The tables overleaf summarise the results of the bridge assessment and recommended prioritization approach.

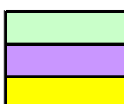
Figure 3.4: Summary of the Consultant's Bridge Assessment Exercise

Ref.				RPUC	Bridge Name	Km	Length of		Designed Train Load	Affected by War	Priority		
							Bridge	Girder			1	2	3
		1	1	HT	Dục Tú	14+850	29.62	13.60					3
		2	1	VP	Phĩ Trx	35+140	54.77	31.62					3
		3	2	VP	Thỉnh kỹ	42+272	102.83	92.00					3
		4	3	VP	H ơng canh	46+290	55.60	31.70					3
1		5	4	VP	Đầm Vạc	52+510	30.24	9.24	Mic+4.2T/m			2	
		6	5	VP	Đ á Lạn	54+500	30.21	9.21					3
		7	6	VP	Lĩ nh	56+210	31.30	17.30					3
2		8	7	VP	Mạ Giữa	60+152	18.05	9.26	Mic+4.2T/m			2	
		9	8	VP	Me	67+200	41.16	31.82					3
		10	9	VP	Việt Trì	71+341	372.88	352.00					3
		11	10	VP	Thanh Miếu	73+900	17.50	7.00					3
3		12	11	VP	Soan Đào	92+390	14.09	4.84	Mic+4.2T/m			2	
4		13	12	VP	Vạn Thắng	92+990	19.65	9.27	Mic+4.2T/m			2	
		14	13	VP	Bê Tông	95+352	5.00	3.32					3
5		15	14	VP	Diên Hồng	95+550	13.84	4.84	Mic+4.2T/m			2	
		16	15	VP	Phú Thọ	98+699	29.15	21.7					3
6		17	16	VP	Đồng Minh	99+730	19.16	4.84	Mic+4.2T/m			2	
7		18	17	VP	Đồng Miếu	100+387	18.18	4.84	Mic+4.2T/m			2	
8		19	18	VP	Chùa	108+872	21.70	13.31	Mic+4.2T/m			2	
9		20	19	VP	Sâm	110+900	16.25	7.02	Mic+4.2T/m			2	
		21	20	VP	Trầm Bông	112+900	12.60	2.74					3
		22	21	VP	Trầm H ơng	113+700	14.16	4.84					3
		23	22	VP	Mạ Lạn	115+556	30.74	21.58					3
10		24	23	VP	Vĩnh Chân	120+130	21.08	13.32	Mic+4.2T/m		1		
11		25	24	VP	Mai ô	122+990	22.08	7.02	Mic+4.2T/m			2	
		26	25	VP	Minh Hạc	129+075	24.82	17.2					3
12		27	26	VP	Ấm Th ơng	130+500	16.77	4.84	Mic+4.2T/m			2	
		28	27	VP	Lửa Việt	132+476	28.48	21.53					3
13		29	28	VP	Ngòi Lanh	134+004	19.1	13.4	Mic+4.2T/m		1		
14		30	29	VP	Ngòi Hiền	137+785	24.6	17.3	Mic+4.2T/m		1		
		31	30	VP	Đầm Hà	141+148	14.00	4.84					3
15		32	1	YL	Mấn	145+520	15.40	4.84	Mic+4.2T/m		1		
16		33	2	YL	Ngòi Sen	145+950	26.92	17.3	Mic+4.2T/m		1		
17		34	3	YL	Vân Phú	148+920	25.9	21.5	Mic+4.2T/m		1		
		35	4	YL		151+750	4.64	1.74					3
18		36	5	YL	Gia Đa	152+494	21.12	11.25	Mic+4.2T/m		1		
19		37	6	YL	Tuần Quán	152+550	32.68	26.50	Mic+4.2T/m		1		
20		38	7	YL	Trầm	153+450	17.69	9.15	Mic+4.2T/m			2	
		39	8	YL	Lâm Sinh	154+370	11.88	4.90					3
21		40	9	YL	Thủy Lợi	157+341	24.96	16.4	Mic+4.2T/m			2	
		41	10	YL	Xuân Lan	158+240	14.41	5.14					3
		42	11	YL	Nga Quán	162+692	40.7	35.80					3

	22	43	12	YL	Nghĩa Ph ơng	166+550	27.76	17.3	Mic+4.2T/m		1		
		44	13	YL	Từ M ẫu	168+850	28.00	28.00					3
1	23	45	14	YL	Đào Thịnh	171+414	22.3	13.3	Mic+4.2T/m		1		
2	24	46	15	YL	Thác Thủ	173+380	12.74	4.78	Mic+4.2T/m		1		
		47	16	YL	Con Tr ần	173+960	13.87	7.07					3
	25	48	17	YL	Móc t ơm	174+185	14.17	7.07	Mic+4.2T/m		1		
		49	18	YL	Đầm S ầu	174+430	11.74	2.80					3
		50	19	YL		174+960	4.55	1.7					3
		51	20	YL	Ngòi H ộp	176+619	52.40	42.50					3
	26	52	21	YL	Sung	177+176	29.95	13.28	Mic+4.2T/m		1		
	27	53	22	YL	Điêu	179+304	38.44	17.3	Mic+4.2T/m		1		
	28	54	23	YL	T ây	181+190	22.70	13.30	Mic+4.2T/m		1		
		55	24	YL		181+473	5.28	1.70					3
	29	56	25	YL	Khe Đ ỏi	182+520	29	17.3	Mic+4.2T/m				3
66*	57	26	YL	Trang	183+150	35.57	22.70	Mic+4.2T/m		1			
	30	58	27	YL	M ăng	183+960	34.02	17.3	Mic+4.2T/m		1		
	31	59	28	YL	Khe Nh âm	185+265	18.90	9.20	Mic+4.2T/m		1		
	32	60	29	YL	M ẫu A	188+050	32.50	21.50	Mic+4.2T/m		1		
		61	30	YL	Khe H ỏi	189+264	13.00	4.95					3
		62	31	YL		189+660	5.10	1.70					3
		63	32	YL	Quach	190+020	26.2	20					3
		64	33	YL	V ải	192+462	34.35	21.5					3
	33	65	34	YL	Mu ồng	194+470	17.89	7.02	Mic+4.2T/m			2	
	34	66	35	YL	Khai	195+394	30	21.5	Mic+4.2T/m		1		
	35	67	36	YL	M ời	197+850	29.5	21.5	Mic+4.2T/m		1		
		68	37	YL	L ầm	201+216	35.5	21.5					3
		69	38	YL		201+503	6.74	2.7					3
	36	70	39	YL	B ơm n ớc	201+635	19.20	9.20	Mic+4.2T/m		1		
	37	71	40	YL	Tr ần	203+150	19.63	9.20	Mic+4.2T/m		1		
	38	72	41	YL	Đ ền	204+064	20.20	9.20	Mic+4.2T/m		1		
	39	73	42	YL	Tr ỏ	204+815	35.9	21.5	Mic+4.2T/m		1		
		74	43	YL		205+813	6.74	2.80					3
		75	44	YL		206+044	6.74	2.74					3
	40	76	45	YL	Sau	206+243	16.84	7.02	Mic+4.2T/m			2	
	41	77	46	YL	N ớc ch ảy	206+630	9.62	7.02	Mic+4.2T/m		1		
	42	78	47	YL	B ảy	206+960	24.80	13.38	Mic+4.2T/m			2	
	43	79	48	YL	Tr ắc	207+572	20.20	9.46	Mic+4.2T/m		1		
	44	80	49	YL	M ăng	208+210	32.86	21.82	Mic+4.2T/m		1		
		81	50	YL		208+538	6.70	2.80					3
	45	82	51	YL	2 M	208+977	10.10	2.74	Mic+4.2T/m			2	
	46	83	52	YL	Khe S ẻ	209+705	26.08	17.3	Mic+4.2T/m		1		
		84	53	YL		211+522	4.00	1.70					3
	47	85	54	YL	C ải	212+540	38.50	28.42	Mic+4.2T/m		1		
	48	86	55	YL	Ph úc m inh	214+742	31	17.3	Mic+4.2T/m		1		
		87	56	YL		216+270	6.16	1.70					3
	49	88	57	YL	2 M	217+050	7.00	5.00	Mic+4.2T/m			2	
		89	58	YL	Tr ục	217+736	46.10	38.12					3
		90	59	YL		217+944	6.02	2.80					3
	50	91	60	YL	Khe B út	218+486	22.00	13.30	Mic+4.2T/m		1		
	51	92	61	YL	Lang Kh ạy	220+139	31.5	21.5	Mic+4.2T/m		1		
	52	93	62	YL	B ầu	221+953	23.50	13.30	Mic+4.2T/m			2	
	53	94	63	YL	C ỏp V ỏ	222+287	27.30	13.30	Mic+4.2T/m			2	
	54	95	64	YL	B ỏ	223+220	34.33	13.30	Mic+4.2T/m			2	
		96	65	YL		224+050	11.30	4.94					3
	55	97	66	YL	Ly	225+170	33.37	17.8	Mic+4.2T/m			2	
	56	98	67	YL	Lang Th ếp	228+030	34	21.6	Mic+4.2T/m		1		
		99	68	YL		228+560	4.80	1.70					3
	57	100	69	YL	B ả m ỡi	229+980	24.50	7.02	Mic+4.2T/m			2	

	58	101	70	YL	Khe Den	231+530	18.11	9.2	Mic+4.2T/m		1		
	59	102	71	YL	Bùn	232+612	55.66	43.2	Mic+4.2T/m		1		
		103	72	YL		233+530	12.20	4.94					3
		104	73	YL		235+540	6.54	2.80					3
		105	74	YL		235+940	8.92	1.70					3
	60	106	75	YL	l M	236+680	4.36	1.74	Mic+4.2T/m			2	
	61	107	76	YL	Bảo Hà	237+326	29.5	18.3	Mic+4.2T/m		1		
		108	77	YL		238+108	8.72	1.7					3
		109	78	YL		239+428	7.4	4.94					3
		110	79	YL	Khoai	241+710	32.6	17.4					3
		111	80	YL	Kíp	242+735	19.2	13.3					3
		112	81	YL		243+203	6.8	2.8					3
	67*	113	82	YL	M ề o	244+965	32	17.2	Mic+4.2T/m		1		
	68*	114	83	YL	V ậ n	245+735	42	26.5	Mic+4.2T/m		1		
	62	115	84	YL	4 M	247+595	10.5	4.95	Mic+4.2T/m			2	
	69*	116	85	YL	G ầ a	249+004	32	21.4	Mic+4.2T/m		1		
	63	117	86	YL	Nhai	250+412	47.5	26.5	Mic+4.2T/m		1		
	64	118	87	YL	Cháy	252+420	34	21.4	Mic+4.2T/m		1		
		119	88	YL		253+500	2.6	1.7					3
		120	89	YL	Nhò	253+750	44.5	26.5					3
		121	90	YL		257+175	4	1.7					3
		122	91	YL		257+410	4	1.7					3
	65	123	92	YL	Trì	258+050	26.7	13.3	Mic+4.2T/m			2	
		124	93	YL		260+720	10	10					3
		125	94	YL	Ngòi lu	261+040	40.15	21.6					3
		126	95	YL	My	265+775	38.3	21.7					3
		128	96	YL	Đền	266+007	11.43	7.07					3
		127	97	YL		266+537	10.5	5.2					3
		129	98	YL	Lạng	269+321	36.2	21.7					3
		130	99	YL	Cao	271+296	34.92	9.2					3
		131	100	YL	Đo	273+448	38.82	21.7					3
		132	101	YL	L ợt	274+648	31.4	17.5					3
		133	102	YL		275+733	18.24	18.24					3
		134	103	YL		276+007	22.31	22.31					3
		135	104	YL	Tây	276+265	6.84	1.8					3
		136	105	YL	Khe Quan	276+689	20.7	9.2					3
		137	106	YL	Khe dúng	279+417	25.7	13.6					3
		138	107	YL	Mức	280+742	25.4	13.6					3
		139	108	YL	Giàng	282+398	21.35	9.2					3
3		140	109	YL	Thất Cổ	284+388	27.1	13.6	Mic+4.2T/m		1		
4		141	110	YL	Quỳnh Sum	286+593	34.8	22.1	Mic+4.2T/m		1		
		142	111	YL		286+861	20.3	20.3					3
5		143	112	YL		288+732	15.8	6	Mic+4.2T/m		1		
6		144	113	YL		289+953	32.54	6	Mic+4.2T/m		1		
		145	114	YL	Sơn Mãn	291+167	23.48	9.2					3
		146	115	YL	V ườn rau	292+327	18.5	9.2					3
		147	116	YL	Chui	295+329	18.3	9.2					3
		148	117	YL	Hồ Kiều	296+050	70.53	60.67					3
TOTAL					Cộng :		3,822	2,366			46	26	76

KEY



Bridges surveyed (65No.)

Additional bridges proposed by the Consultant

New bridges required by realignment

3.5 PRELIMINARY DESIGN

Preliminary design drawings for the urgently required (Priority 1) works have been prepared based on typical bridge spans and structure. These drawings are presented separately in Technical Appendix E1, and the required scope of work for each bridge is shown in Annex E of this Technical Appendix. Details concerning the applicable codes, design standards and principles to be adopted for this study are provided in Annex A. Detailed design drawings will be prepared by the Consultant appointed to carry out the next phase of the project.

3.6 CONSTRUCTION METHODS

Access to a number of the bridge locations where remedial works are recommended, will be restricted and challenging. This is as a result of the existing railway line running alongside the Red River with the mountain range on the other side.

The majority of the upgrade works will be required to be carried out without disruption to the existing train services. The permitted working “window” is generally 4 hours long. If the planned bridgeworks cannot be carried out safely whilst the train services remain operational the Contractors will be required to request track possessions from Vietnam Railway. The unauthorized interruption of rail traffic is not permitted.

The safety of rail traffic, passengers and construction workers is of paramount importance at all times and safety considerations must take precedence over any and all other considerations. Where temporary works are required to be constructed the Contractor will ensure the quality of these temporary works so that the safety of trains and passengers is not affected.

Given the limited working space available at the majority of the bridge locations, The Consultant recommends that fabrication of the replacement steel girder be carried out in factory conditions rather than at the bridge location. This should ensure that the as-built quality of the structure is improved when compared with works which fabricated under site conditions at remote locations.

Once assembly is complete, the girders can be transported to the site by train. The girder will then be installed on temporary supports alongside the existing bridge. Once all the required preparations are completed, and the necessary possession arrangements have been agreed with the railway authorities, the existing girder can be removed and the new girder can be slid sideways and installed in its permanent location. The required modifications to the bridge bearings can then be completed.

4 STATIONS

4.1 INTRODUCTION

Thirty six (36) stations are located along the Hanoi to Lao Cai rail route. These include:

- 33 existing stations
- Cau Nho station is currently under construction by Vietnam Railways,
- Xuan Giao station is located at the end of the branch line from Pho Lu. This rail branch is used to carry apatite.
- The new station at Mai Tung forms part of the Consultant's recommendations for the current feasibility study. This station will be constructed as part of the next phase of this project.

4.2 OPERATIONAL ANALYSIS

During the course of this study the Consultant has attended numerous site visits and meetings with Vietnam Railways staff, the Executing Agency (RPMU) and other interested parties. In addition a detailed analysis of the current railway operations and future capacity requirements has been carried out. The Consultant has also carefully considered the Vietnam Railway correspondence (Letter No 2600/DS – RPMU dated November 2005 and No 2896/DS-RPMU dated 1st December 2005).

It is clear that daily operational problems occur on the track between Hanoi and Lao Cai which affect capacity. The detailed simulation of operations investigated the possibility and likely benefits resulting from the following upgrade works :

- Extending station siding loops to ensure an effective length $L \geq 400\text{m}$ in order to enable the use of longer and heavier trains
- Adding siding loops at several stations in order to provide greater operational flexibility and capacity,
- New stations are required at Cau Nho (currently under construction) and Mai Tung (to be implemented),
- Upgrading Van Phu station to become a rail freight station. This would provide increased capacity for the newly opened Van Phu industrial zone. It would also assist coordination of train movements with Yen Bai station.
- Upgrading the freight train area at Lao Cai station,

The results of the Consultant's interactive simulation of railway operations confirmed the need for station upgrades. The layout of the upgraded stations has been established according to the simulation results.

A key finding was that the stations and passing loops need to be upgraded to enable the operation of train loads of up to 1,200 Tonnes and train lengths up to 400 m. Accordingly the minimum length of the new passing loops is 450 metres.

It has been identified that the following nine stations along the route possess passing loops which have an effective length of less than 400 metres (Viet tri, Phu Duc, Co Phuc, Mau A, Lam Giang, Thai Van, Thai Nien, Yen Bai and Lao Cai). This results in the operational train length being limited which, in turn, reduces the traffic carrying capacity of the line.

In addition a further nine stations along the existing alignment do not have adequate rail siding loops for efficient and future planned traffic operation. (Lao Cai, Yen Bai ,Thach Loi , Huong Canh, Tien Kien, Chi Chu, Vu En, Mau Dong and Lang Thip).

4.3 RECOMMENDED TECHNICAL INTERVENTIONS

In order to improve operational flexibility and capacity the Consultant recommends that the following upgrade works are implemented.

4.3.1 New Station at Mai Tung (Km 124.2)

The distance between stations along the route is highly variable. For example there is a relatively large distance (14.2 km) between Pho Lu and Thai Van stations. In addition the distance between Vu En and Am Thuong stations is 12.8 kilometres. This compares with a short distance of 3.4 km between Co Loa and Dong Anh Stations.

The sections with a relatively long distance of single track between stations cause operational difficulties and reduce capacity. This is as a result of only one train being able to be on a section of track at any given time.

In order to reduce the operational difficulties and subsequent delays, Vietnam Railways are currently constructing a new station at Cau Nho (km 254), which will reduce headways on the Yen Bai to Lao Cai section. The signaling system is being modernized with Chinese assistance.

The Consultant therefore recommends that a new station is constructed at Mai Tung (Km 124.2), between Vu En and Am Thuong stations.

4.3.2 Yen Bai / Van Phu Station Upgrade

Yen Bai station requires additional loops to maintain operational capacity. However providing an extension to Yen Bai station is made difficult due to the presence of an adjacent residential area which will likely result in land acquisition and resettlement difficulties.

It has therefore been decided that the recommended solution is to upgrade Van Phu station (which is 7 kilometres from Yen Bai station) to become a freight station including marshalling yards. These two stations will coordinate closely. It is anticipated that the volume of freight and industrial material to be imported and exported from this station will be increase significantly as a result of the new Industrial Park which has been constructed close to Van Phu Station,.

4.3.3 Additional Siding Loops at Lao Cai Station

Lao Cai serves as a major distribution station for trains to and from China. During peak hours, freight trains arriving at Lao Cai station may have to be sent to Lang Giang Station, which is approximately 11 kilometers away, for shunting or to await train assembly. This causes numerous operational difficulties for train dispatching control at

Lao Cai Station. Improving station capacity by increasing the number of siding loops at Lao Cai station will ameliorate this situation.

In addition, as part of the recommended upgrade works, facilities will be provided such as stores, platform extensions, goods yard, a longitudinal drainage tunnel, extension to the horizontal culvert, fence and access to the goods yard.

4.3.4 Extending Existing Loops and the Provision of Additional Loops

The Consultant recommends that siding loops should be added at the following 9 stations:

- Thach Loi, Huong Canh, Tien Kien, Chi Chu, Vu En, Mau Dong and Lang Thip stations which all currently have 1 siding loop,
- Van Phu station which currently has 3 siding loops
- Lao Cai station which currently has 9 siding loops (as explained above))

The existing siding loops at the following 8 stations should be extended in order to ensure an effective length of at least 450 metres:

- Viet tri, Phu Duc, Co Phuc, Mau A, Lam Giang, Thai Van and Thai Nien stations – 1 loop should be extended at each station
- Xuan Giao – 3 loops should be extended,

The new station at Mai Tung station (Km 124+20) will incorporate 3 siding loops each of 500m length.

The station upgrade works will include the required modifications to local signalling, rail, sleepers, telecommunication and other related railway facilities.

The Consultant has prepared preliminary design and layout drawings concerning these upgrade works. These drawings are based on the topographic survey results. These drawings are presented separately in Appendix E1.

Table 4.1: Summary of the Recommended Station Passing Loop improvements

Km	Station	Works	Existing Tracks	Additional Loops	Additional Length (m)	Land Reqmt (sq m)
33.2	Thach Loi	New loop	3	1		212
47.5	Huong Canh	New loop	3	1		110
72.7	Viet Tri	Extension of passing loop	5		96	308
81.8	Phu Duc	Extension of passing loop	4		98	92
90.7	Tien Kien	New loop	6	1		139
108.2	Chi Chu	New loop	3	1		1,197
118.2	Vu En	New loop	3	1		935
124.2	Mai Tung	New station	1	2		29,641
148.4	Van Phu	New loops	4	3		7,042
165.1	Co Phuc	Extension of passing loop	3		56	849
186.3	Mau A	Extension of passing loop	3		110	769
194.8	Mau Dong	New loop	2	1		992
210.0	Lam Giang	Extension of passing loop	3		100	412
227.8	Lang Thip	New loop	2	1		1,957
247.5	Thai Van	Extension of passing loop	3		93	715
272.2	Xuan Giao	Extension of 3 passing loops	4		563	906
277.3	Thai Nien	Extension of passing loop	3		80	357
293.0	Lao Cai	9 new loops				15,754
	Totals		55	12	1,196	62,385

5 SLOPE STABILISATION WORKS

5.1 INTRODUCTION

The Yen Vien-Lao Cai rail line has been operating since the beginning of the 20th century. The majority of the existing slopes and embankments along the alignment are considered safe and stable. However a number of sections have suffered from instability and landslides. As part of this study the Consultant has prepared prioritised recommendations concerning slope stability and drainage improvement works which should be carried out in order to improve this situation.

The assessment and recommendations have been prepared based on reconnaissance site visits by the Consultant's Engineering staff. In addition the results of technical surveys, which have been carried out by the four Railway Public Utility Companies, were consulted. Meetings were also held with the relevant parties.

In addition to slope protection measures, drainage improvement works have been proposed in order to reduce the amount of standing water and saturated soil. The presence of excess or standing water frequently leads to slope instability as the ground becomes saturated.

A detailed topographical survey was carried out of the alignment and sections of track where rehabilitation or realignment works were required or planned to be carried out. In addition two boreholes were taken in order to establish the existing subsoil conditions in the areas concerned.

In order to improve the safety and reliability of railway operations, the Consultant has prepared technical interventions to improve the different types of slope stability or slippage problems found along the alignment. The quantity, location and cost of each recommended solution has been estimated. These preliminary designs will be developed into final detailed designs during the next phase of this project.

5.2 CRITERIA FOR PRIORITIZATION

The following criteria have been adopted for the Consultant's prioritised recommendations.

Priority No. 1 works are those where urgent slope stabilisation works are required due to the current poor slope condition which has a potential impact on safety or may affect train operations. Locations where frequent sliding or slippage are known to occur have been included within this category. In addition the new slope improvement works required as a result of the proposed realigned works are also categorised as Priority 1.

Priority No. 2 works are those which are not urgent and do not currently cause a safety risk or disturb train services. However works may need to be carried out at these locations in the future. Works in this category will not be carried out under this phase of the project.

Priority No. 3 works are minor works which should be carried out as part of Vietnam Railways' routine maintenance works. The majority of the existing slopes along the alignment are included in this category.

5.3 CURRENT CONDITION




The topography varies along the route from alluvial plains between Hanoi and Viet Tri to mountainous sections in the North-eastern provinces close to Lao Cai. The Northern section **of the route passes through the Con Voi mountain range between the Red River and the Chay River. The mountainous sections between Yen Bai and Lao Cai have elevations between 400m and 1,400m and are characterized by steep slopes. These can become unstable and cause landslides or slippages.**

A number of the slopes alongside the Red River have suffered from erosion which is mainly due to flooding and river action. In addition abandoned quarry sites and the uncontrolled dumping or disposal of materials from **previous projects** may also lead to increased slope instability.

Areas most likely to fail have been identified as those with a large angle of dip, and having relatively thick soil layers (ie. > 5m). Saturated soil conditions, caused by significant ground **water** infiltration, can trigger the deep landslides which can be witnessed on site. Vietnam Railways routinely carry out slope stabilisation and improvement works to the areas concerned.

Figure 5.1: Selection of Existing Slope Conditions at Various Locations Along the Alignment



	
<p>Km 273 where significant upper and lower slope stability problems have been encountered</p>	<p>Standing water near Lao Cai station. Drainage upgrade required.</p>
	

5.4 PROPOSED TYPES OF SLOPE AND DRAINAGE IMPROVEMENT WORKS

A series of different standard slope and embankment stabilisation works are recommended. These solutions have been modified in accordance with local conditions and requirements. Some of the technical solutions proposed by the Consultant have been adopted from standard solutions which are already applied at for similar locations in Vietnam.

A key requirement is to minimise the disturbance and excavation works to the existing slopes. The carrying out of excessive excavation works can lead to further instability. The solutions proposed can be implemented relatively rapidly which is an important requirement as disruption to train services is required to be minimised.

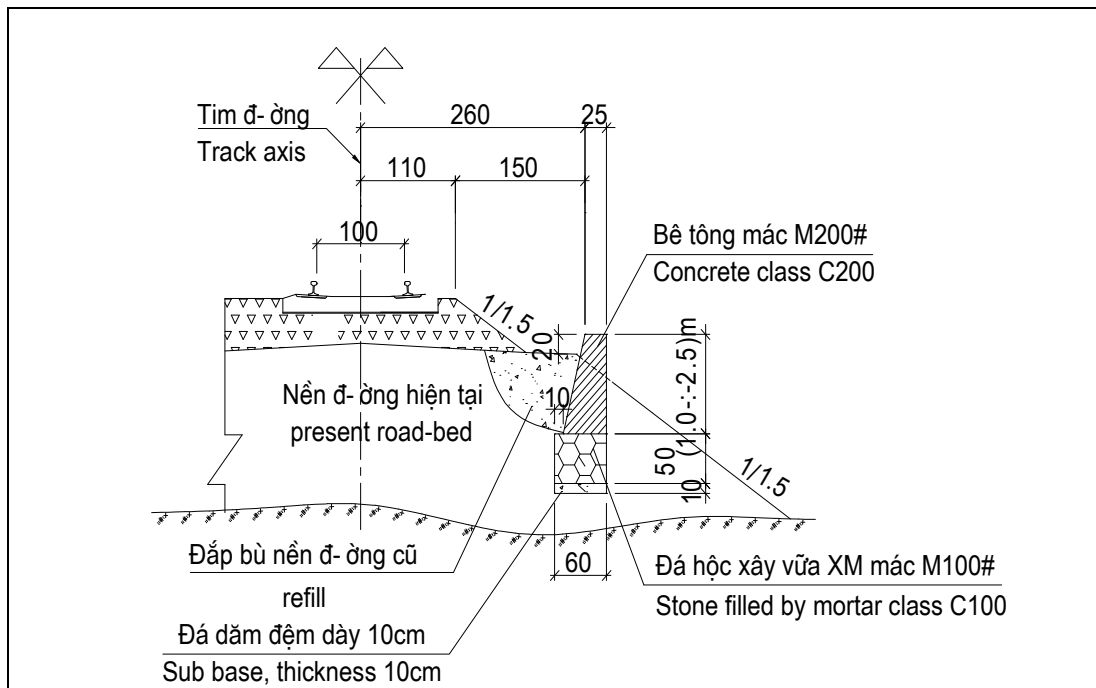
The types of slope and drainage improvement works proposed are summarised overleaf. Preliminary Design Drawings are also included separately in Technical Appendix E1.

5.4.1 Embankment Protection (Type SH01)

This type of protection will ensure the required width of the track and associated works are maintained. In addition it will minimise the permanent loss of ballast. This type of

protection consists of a small retaining wall from 1.0 to 2.5m high. This arrangement is suitable for protecting the edge of an embankment.

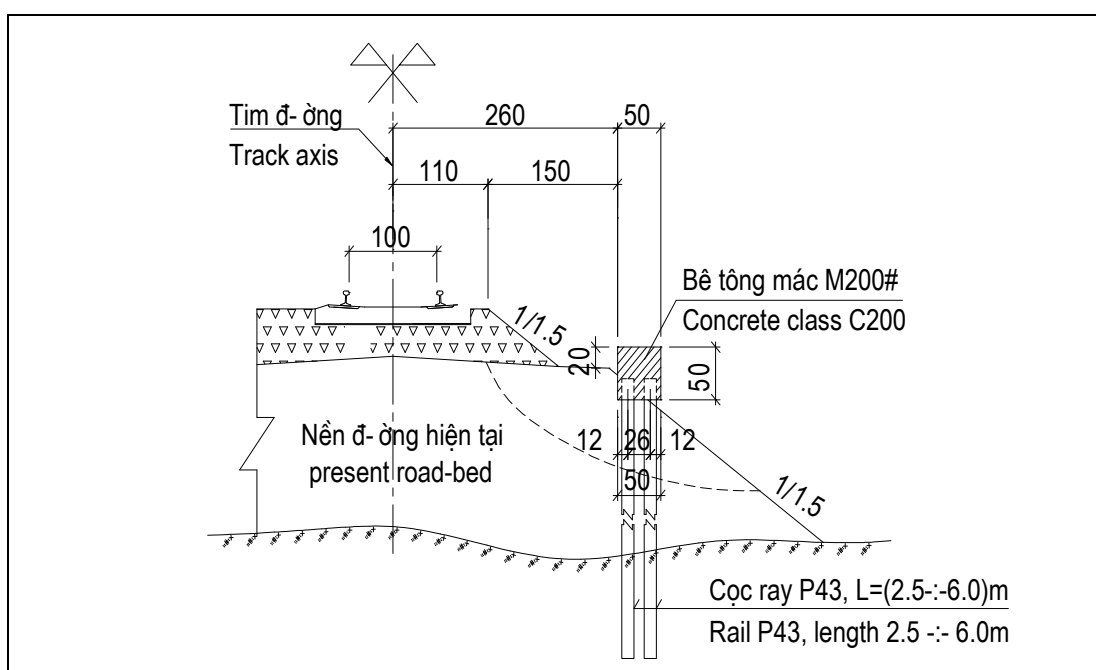
Figure 5.2: Embankment Protection – Type 1



5.4.2 Embankment Protection (Type SH02)

This type of protection is similar to SH01, however with the addition of short piles. This proposed solution is suitable for stabilising sections of embankment which are showing signs of minor slippage and erosion.

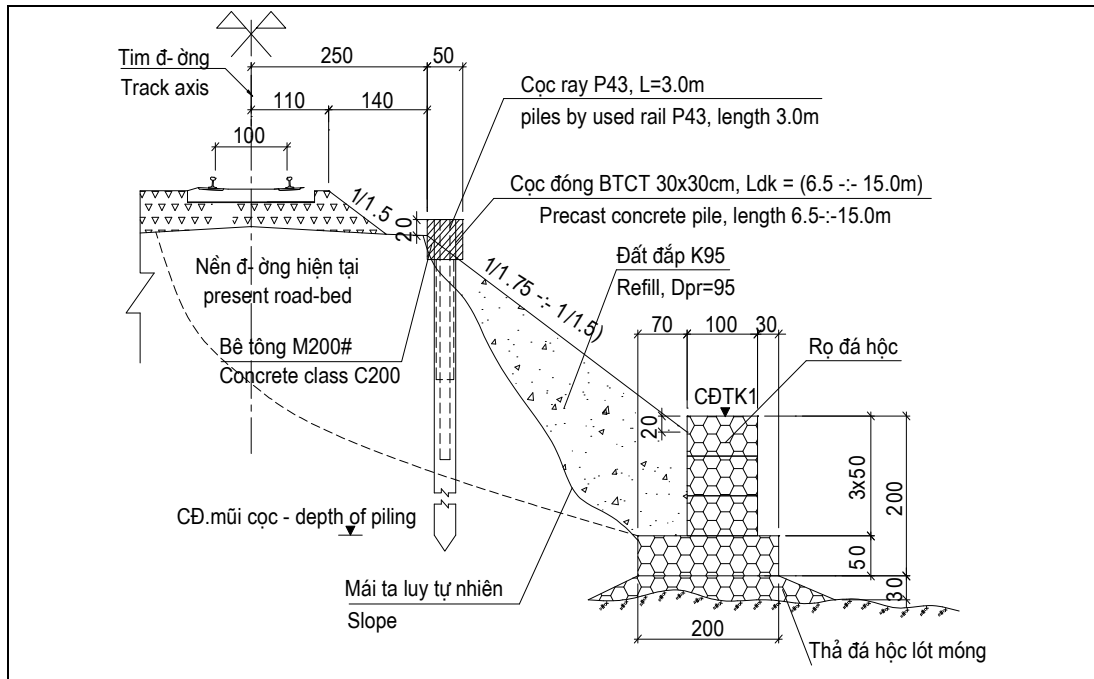
Figure 5.3: Embankment Protection – Type 2



5.4.3 Protection of Embankment Shoulder (Type SH03)

This type of protection is similar to SH02. However additional footing protection and a deep pile foundation are provided.

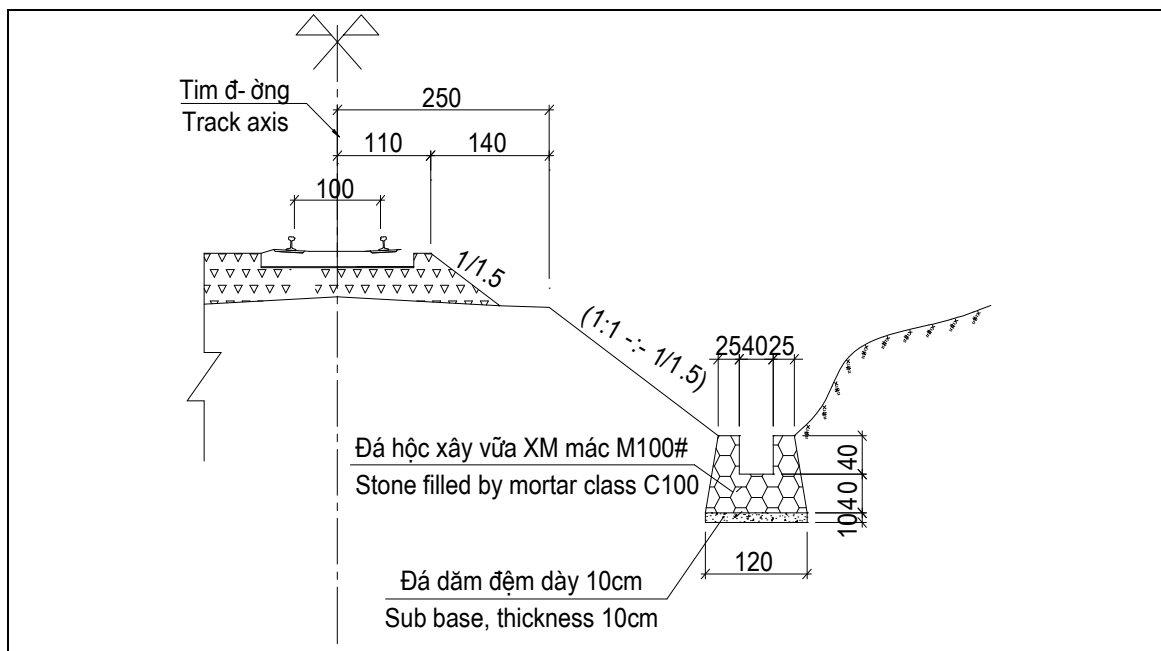
Figure 5.4: Embankment Protection – Type 3



5.4.4 Standard Drainage (Type DR01)

This is a standard lateral surface drainage improvement detail.

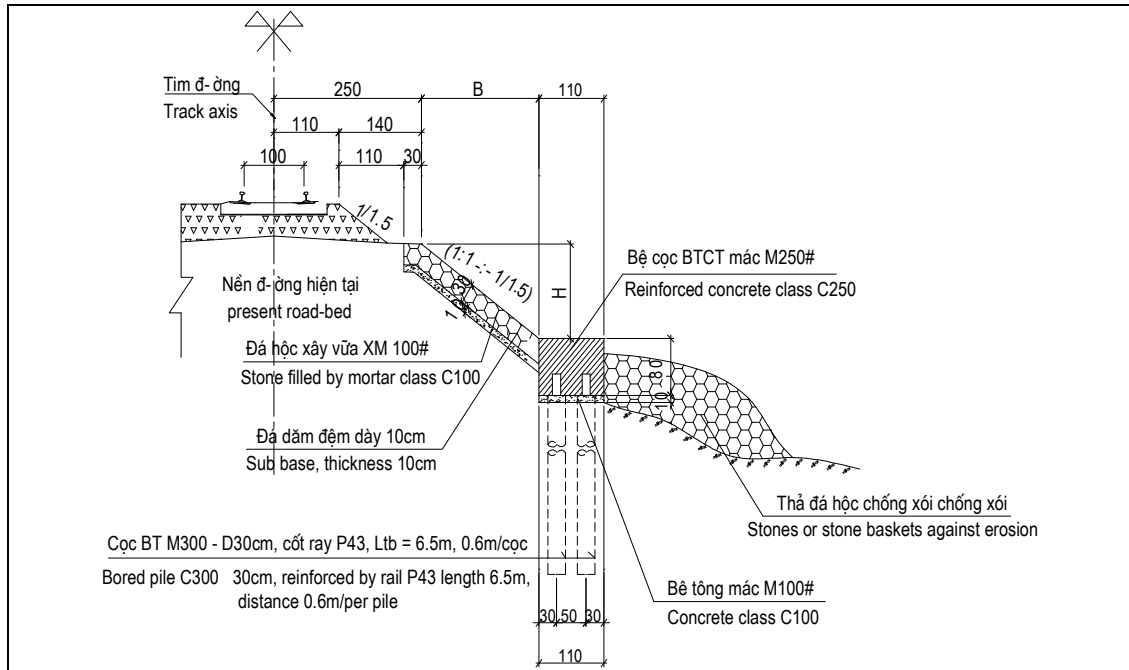
Figure 5.5: Lateral Drainage



5.4.7 Slope Protection Against Flooding (Type PF01)

This type of protection will be applied for slopes at the river edge. This proposal consists of a piling frame with concrete beam and surface protection. A layer of stone (approximately 3m³ per linear metre) is also applied to protect the footing beam from further erosion.

Figure 5.8: Slope Flooding Protection

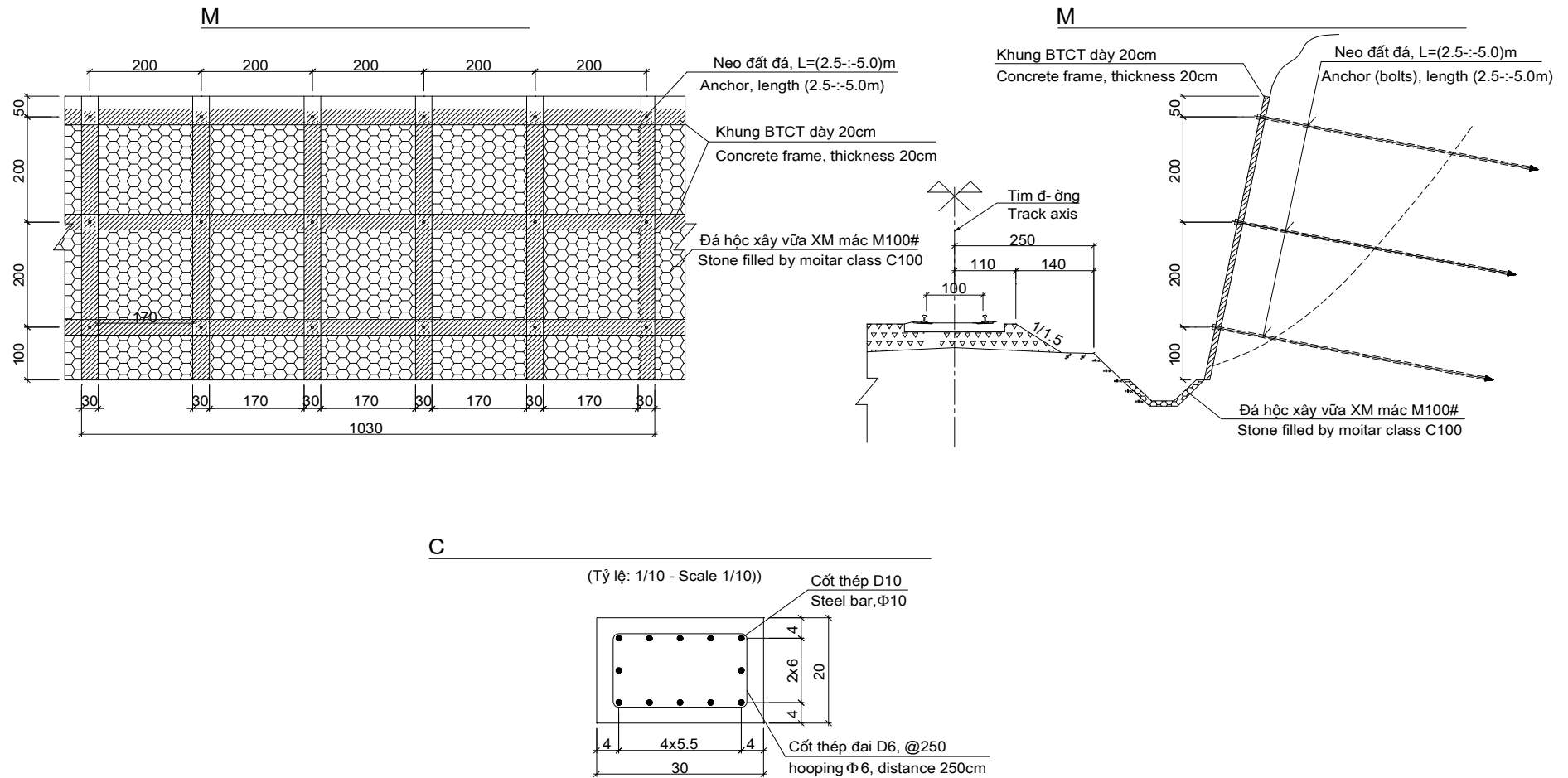


The following photograph shows a similar river slope stabilisation and protection arrangement under construction near the railway. The detail recommended for adoption by the Consultant provides additional rock protection at the base of the slope in order to minimise further erosion.

Figure 5.9: River Protection Works



Figure 5.10: Upper Slope Protection



5.4.8 Upper slope protection for mixed soil/rock (Type SL01)

This type of protection minimises the volume of material to be removed from the existing slope. This stabilisation solution consists of deep protection by bolts (5m long and in a 2m x 2m grid). A concrete frame is then installed and filled with stone and mortar. Alternatively shotcrete may be applied.

5.4.9 Recommended Solution

A summary of the type and quantity of slope stabilisation and drainage improvement works proposed to be carried out are shown below (Table 5.1). This includes Priority 1 works which should be carried out urgently and within the Scope of this project. The Consultant suggests that Priority 2 works are carried out at a later stage, perhaps within a 5 year timeframe. Further details concerning the location of the improvement works are provided overleaf.

Table 5.1: Summary of Slope Stabilisation and Drainage Works Recommended

Protection	Type	Priority 1 Length (m)	Priority 2 Length (m)
Surface drainage improvement	DR01		2,420
Embankment Improvement	DR02	1,500	4,550
Slope Drainage	DR03	500	
Shoulder protection – Embankment	SH01		1,200
Lower slope protection (Minor)	SH02		150
Lower slope protection (Major)	SH03	200	
Lower Slope Protection Against Flooding	PF01	2,400	2,400
Upper Slope Protection	SL01	600	3,920
Total		5,200	14,640

Table 5.2: Details Concerning the Railway Embankment Sections Required to be Improved (Priority 1, 2 and 3)

No.	Location	Characteristics of embankment	Priority No1 (Metres)	Priority No 2 (Metres)	VNR Routine maintenance	Comments
Ha Thai Railway Management Unit						
1	14+000 - 17+500	Weak embankment- subsided		1,000 (SH01)	2.500	Shoulder protection
2	17+100 - 17+300	Weak embankment		150 (SH02)		Deep shoulder protection
Vinh Phu Railway Management Unit						
1	29+000 - 33+000	Weak embankment- subsided			4,000	
2	36+000 - 36+300	Weak embankment- subsided			300	
3	39+800 - 39+900	Weak embankment- subsided			100	
4	45+300 - 45+400	Embankment is swelling			100	
5	47+900 - 48+100	Embankment is swelling			200	
6	61+175 - 61+212	Weak embankment			37	
7	64+200 - 64+800	Weak embankment - subsided			600	
8	69+400 - 69+600	Weak embankment – subsided			200	
9	70+000 - 70+100	Weak embankment – subsided and deformed			100	
10	96+200 - 96+400	Weak embankment – subsided			200	
11	103+300 - 104+200	High slope filling embankment			900	
12	106+425 - 106+575	Minor Slope collapse			150	
13	121+106 - 121+293	Minor Slope collapse			187	
14	123+496 - 123+600	Minor Slope collapse			104	
15	126+850 - 126+925	Minor Slope collapse			75	
16	126+987 - 127+000	Slope collapse			13	
17	127+350 - 127+365	Slope collapse			15	
18	136+800 - 137+300	Embankment subsided and deformed			500	
19	141+568 - 141+686	Minor Slippage			118	
20	142+703 - 142+975	Minor Slippage			272	

No.	Location	Characteristics of embankment	Priority No1 (Metres)	Priority No 2 (Metres)	VNR Routine maintenance	Comments
21	144+320 - 144+390	Upper slope cutting slope is not stable		70 (SL01-DR01)	70	Upper slope protection
Yen Lao Railway Management Unit						
1	146+250 - 146+350	Embankment is locally settling			100	
2	146+900 - 147+300	Landslide on cutting slope, underground water, soft ground			400	
3	150+300 - 150+450	Embankment is weak			150	
4	150+850 - 150+950	Landslide and covered embankment			100	
5	152+700 - 152+800	Culvert fundament is soft, unstable, flooded			100	
6	153+400 - 153+800	Landslide on cutting slope			400	
7	157+300 - 157+700	Landslide on cutting slope, drainage ditches are stagnant			400	
8	163+800 - 164+000	Embankment is locally settling			200	
9	165+100 - 165+400	Weak embankment , drainage ditches are stagnant			300	
10	166+300 - 166+500	Landslide on cut slope			200	
11	168+000 - 168+800	Landslide on cut slope, drainage ditches are stagnant			800	
12	169+800 - 170+900	Landslide on both cutting and filling slopes, embankment level is low and easy to be flooded			1,100	
13	173+100 - 173+350	Weak embankment are settling locally			250	
14	174+600 - 174+800	Weak embankment			200	
15	175+600 - 175+900	Drainage ditches are stagnant			300	
16	177+950 - 178+350	Landslide on cutting slope, embankment settled, underground water, weak ground			400	
17	178+400 - 178+500	Landslide on fill slope.			100	

No.	Location	Characteristics of embankment	Priority No1 (Metres)	Priority No 2 (Metres)	VNR Routine maintenance	Comments
18	184+400 - 184+700	Weak embankment- landslide- locally settled			300	
19	185+900 - 186+000	Weak embankment- landslide- locally settled			100	
20	188+000 - 189+000	Local landslide on cutting slope			1,000	
21	190+200 - 190+500	Weak embankment- locally settled and slide			300	
22	191+500 - 192+000	Landslide on fill slope, temporary slope protection is unstable			500	
23	194+650 - 195+200	Drainage ditches are stagnant			650	
24	195+900 - 196+300	Landslide on both cut and fill slopes, weak embankment- locally settled			400	
25	200+000 - 200+800	Underground water, drainage ditches are stagnant	500 (DR02)	300 (DR02)	800	Deep drainage
26	202+500 - 202+700	Weak embankment- partially settled			200	
27	203+100 - 204+000	Drainage ditches are stagnant			900	
28	204+000 - 204+800	Weak embankment, deformed, underground water, drainage ditches are stagnant			800	
29	205+000 - 206+000	Landslide covered embankment.			1,000	Local sliding upper Slopes/Adjustment
30	206+800 - 207+100	Landslide on filling slope, temporary slope protection is unstable			300	
31	207+200 - 207+700	Local landslide on cutting slope			500	
32	208+000 - 209+800	Landslide on both cutting and filling slopes, weak embankment, partially settled, drainage ditches are stagnant			1,800	
33	210+600 - 210+700	Landslide on both cutting and filling slopes, weak embankment, partially settled, drainage ditches are stagnant.			100	
34	211+800 - 212+100	Weak embankment- drainage ditches are stagnant.			300	
35	213+000 - 214+750	Local landslide, underground water, ditches are stagnant			1,750	

No.	Location	Characteristics of embankment	Priority No1 (Metres)	Priority No 2 (Metres)	VNR Routine maintenance	Comments
36	216+950 - 217+600	Underground water, ditches are stagnant due to aggradations		650 (DR02)		Deep drainage
37	218+000 - 218+800	Landslide on both cut and fill slopes.			800	
38	221+000 - 222+100	Embankment is close to river, land slid on both cutting and filling slopes, slope protector is unstable	300 (PF01+SL01)	800 (PF01+SL01 + DR01)		Flooding protect. lower slope +upper slope
39	222+100 - 224+000 222+000-222+200	Landslide on cut slope, drainage ditches are stagnant.		200 (SL01)	1,700	200m upper slope protection
40	225+000 - 225+800	Large scale landslide on cut slope.		500 (SL01)		Local sliding upper slope protection : Soil
41	227+000 - 227+400	Landslide on filling slope, drainage ditches are stagnant			400	
42	228+500 - 229+500	Local landslide			1,000	
43	230+300 - 230+600	Embankment is closed to river, landslide on filling slope, temporary slope protection is unstable			300	
44	230+800 - 232+500	Local landslide on cut slope			1,700	
45	233+200 - 233+500	Embankment settled, rock fall, underground water, drainage ditches are stagnant	300 (SL01+DR02+DR03)			Deep sliding observed
46	234+800 - 236+800	Local landslide on cut slope covering embankment			2,000	
47	Route No. 3 Bao Ha	Local landslide on cut slope covering embankment				
48	239+300 - 239+900	Landslide covers embankment, drainage ditches are stagnant			600	
49	242+200 - 243+300	Embankment is closed to river, landslide on cutting and filling slope	200 (PF01)	800 (SL01+DR01)		Temporary protection, 200m: flooding protect. lower slope; 900 upper slope
50	245+000 - 245+700	Embankment is close to river, landslide on cut and fill slope, underground water, drainage ditches are stagnant	700 (PF01)			Flooding lower slope protection; + upper slope

No.	Location	Characteristics of embankment	Priority No1 (Metres)	Priority No 2 (Metres)	VNR Routine maintenance	Comments
51	245+700 - 246+300	Embankment is close to river, landslide on filling slope, temporary slope protection is unstable			700	
52	248+800 - 250+000	Local land slide, drainage ditches are stagnant			200	
53	250+100 - 250+800	Local landslide on cut slope			700	
54	254+800 - 255+000	Embankment is close to river, landslide on filling slope, temporary slope protection is unstable			200	
55	255+000 - 256+200	Minor land slip, embankment is low and stagnant water present		1200 (DR02)		Deep drainage required
56	257+000 - 257+400	Drainage ditches are stagnant		400 (DR02)		Deep drainage required
57	258+300 - 258+700	Local landslide on cutting slope, covering embankment			400	
58	259+000 - 259+300	Drainage ditches are stagnant			300	
59	262+600 - 263+000	Weak embankment			400	
60	263+900 - 264+100	Embankment is close to river, land slid on filling slope, temporary slope protector is unstable, ditches are stagnant	400 (PF01)	550 (SL01+DR01)		400 flooding protect +550 upper slope; some cracks observed
61	265+000 - 265+700	Embankment is close to river, landslide on fill slope, temporary slope protection is unstable, two abutments of My bridge and adjacent railway are eroded by back flood of Red River.			700	Repair work
	265+700 - 266+300					Protection currently under construction
62	266+300 - 266+500			200 (PF01)		River flood protection
63	268+500 - 269+100	Embankment settled, landslide on fill slope in the North of section			600	
64	Siding loop No. 1 of	Embankment is close to river, land slide on fill slope, temporary slope protector is unstable				
	Lang station					
65	271+000 - 271+800	Landslide on fill embankment		800 (SL01)		Upper slope protection
66	272+000 - 273+300	Weak embankment - deformed, underground water, drainage ditches are stagnant		1300 (DR02)		

No.	Location	Characteristics of embankment	Priority No1 (Metres)	Priority No 2 (Metres)	VNR Routine maintenance	Comments
67	273+900 - 274+100	Embankment is close to river, large scale landslide on fill slope, temporary slope protection is unstable	200 (PF01+DR03+DR02+SH03)			Already affected by flooding; Temporary surface protection; require additional 200m flooding protection
68	275+500 - 275+700	Embankment is close to river, landslide on filling slope, temporary slope protection is unstable			200	
69	279+800 - 280+000	Embankment swelling, strongly deformed, temporary slope protection is unstable				Already protected, stable, cancelled 200m
70	281+300 - 281+500	Embankment deformed and sliding		200 (SH01)		
71	281+600 - 282+300	Underground water, drainage ditches are stagnant		700 (DR02)		
72	285+350 - 285+450	Landslide on cut slope	100 (PF01)			High erosion process observed in May 2006; 100m flood protection
	286+600 - 285+750	Embankment close to river ~50 metres temporary protection	150 (PF01)			Flood protection
73	286+000 - 286+200	Embankment is close to river, landslide on both sides filling and cutting slope, cracks appear on embankment	200 (PF01)			River flood protection
74	287+100 - 287+450	Embankment deformed, slope protection is unstable	150 (PF01)	200 (SL01+DR01)		
75	289+500 - 290+000	Highway culvert is higher than railway, causing erosion		500 (PF01)		Flooding protection
76	290+000 - 290+900	Embankment is close to river, landslide on fill slope, temporary slope protection is unstable		900 (PF01)		
77	294+600 - 295+100	Weak embankment ,no drainage, underground water present	500 (DR02)			Deep drainage required
		Sub Total (metres)	3,700	11,420	40,841	

6 TRACKWORK

6.1 INTRODUCTION

The existing railway track between Yen Bai and Lao Cai comprises non electrified, bolted track in 12 metre lengths of Grade 43 or Grade 38 steel. The majority of the alignment is 1000mm gauge. However there are some sections of dual (standard and metre) gauge and dual track near Hanoi.

The railway route is divided into four sections which are managed by four different Railway Public Utility Companies. In the past the quality of the maintenance works carried out and the quantity of rail which has been replaced has been limited and not consistent. The current poor condition of significant sections of the track limits operating speeds and increases the risk of derailments. Vietnam Railways has installed an additional guide rail in areas where derailment is most likely. These include:

- at the tightest curves, or
- on bridges which are in poor condition and subject to excessive vertical movement, or
- on sections of rail where the vertical or horizontal wear is excessive.

The amount of lateral wear to the railway track is partly related to the degree of curvature in the alignment. The large number of tight curves in the Northern section result in an increased rate of lateral rail wear and also an increased risk of train derailment.

There is considerable variation in the topography along the railway's existing alignment. It varies from broad plains from Hanoi to Viet Tri, narrow valleys in the midlands in Vinh Phuc and Phu Tho provinces and then high mountainous uplands between Yen Bai and Lao Cai. The existing railway line between Yen Vien and Lao Cai is characterised by numerous tight curves, some with a radii of only 100 metres.

In contrast the Southern section of the line has many less curves, apart from the section near Yen Bai. As a result the amount of rail wear in the Southern section is less than the Northern section.

6.2 INTERACTION OF THE TRACK WORK ELEMENTS:

Rail track work consists of the following four elements :

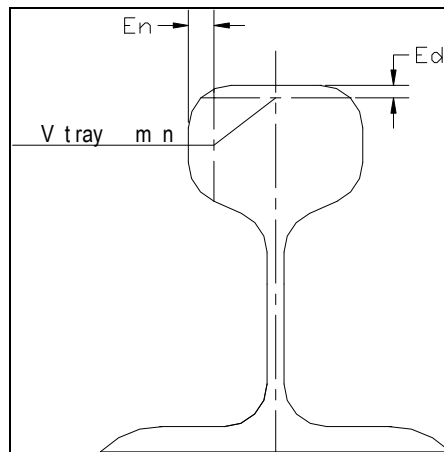
- Rail,
- Sleepers with fastening devices,
- Sub-ballast and Ballast, and
- Sub grade.

These four elements interact closely together. If one of these elements becomes significantly deteriorated (eg rail wear, sleeper damage, fixing breakage or crushed balast) this will affect the effectiveness of the other elements and jeopardise the safety of the rail operations.

6.3 CRITERIA FOR UPGRADE WORKS

According to Vietnamese standards, rail should be replaced when the amount of rail wear exceeds either or both of the following parameters :

- if the rail's vertical wear (Ed) exceeds 9 mm and/or,
- if the rail's lateral wear (En) exceeds 11 mm

Figure 6.1: Typical Rail Cross Section

Should the lateral rail wear exceed 11 mm there is a considerable increase in the risk of train derailment, particularly on winding track. In addition the existing track components, including transition length and cant, are below the current design standards. These non-standard sections accelerate the rate of rail wear.

The photograph below illustrates a severely worn section of the existing track. As shown a guide rail has been installed alongside the main rail in order to minimise the risk of derailment.

Figure 6.2: Photo illustrating the severely worn condition of the existing track.

6.4 CONSULTANT RECOMMENDATIONS

6.4.1 Track Replacement

As required within the Terms of Reference the Consultant has prioritised the recommended track replacement and upgrade works. The Consultant's recommendations have been prepared using the results of existing trackwork condition survey records provided by the relevant Railway Public Utility Companies (RPUC). In addition this data has been supplemented by information obtained during site visits.

Priority No. 1: If the level of wear and condition of the existing rail does not comply with the Vietnamese standards listed above (vertical wear >9mm and lateral wear >11mm) the Consultant has identified this as an urgent and top priority section to be replaced. This is due to the high risk of derailment or rail failure which may affect the safety of passengers and train operations. In addition a train derailment may cause significant damage to rail infrastructure such as sleepers, ballast and sub grade.

Priority No. 2: **The Consultant has categorised the rail as Priority No.2 if the level of wear is currently within the Vietnamese standards, but may be exceeded in the next 5 years. In addition the replacement of sections of non-mainline rail within stations, such as passing loops and sidings, are treated as priority No. 2.**

The following tables summarise the Consultant's recommendations concerning the amount of trackwork to be replaced. These recommendations have been divided according to the Railway Public Utility Company which is responsible for a particular section.

In summary the majority of the rails required to be replaced are located in the Northern section of the route where more curves are included in the alignment so rail wear is greatest. In addition numerous sections near Hanoi require replacement of the track (rail, sleepers, fixings and ballast) due to the high frequency of train operation near Hanoi. However the track condition in the southern section is generally better than in the northern mountainous areas.

It should be noted that the sections of realignment which we are recommending (see Section 2 of this report) will result in the number of curves being reduced and the minimum curve radius increasing. As a result the rate of future rail wear will decrease, and thus delay the need for future replacement.

Table 6.1: Track Renewal Priorities

PERMANENT TRACK WORK VOLUME – Quantity
Railway Public Utility Company RPUC HA HAI (Km10+900-Km14+000: 3,100m)

Rail	Mainline	Station	Trackwork condition	Priority 1	Priority 2	Comments
Chainage (Km)	Length (m)			Length (m)	Length (m)	
11+000-12+000	1,000		Excessive wear (vertical>9mm & lateral>11mm)	1000		Standard gauge
12+000-13+000	1,000		Excessive wear (vertical>9mm & lateral>11mm) and corroded	1000		Standard gauge
13+000-14+000	1,000		Excessive wear (vertical>9mm & lateral>11mm) and corroded	1000		Standard gauge
13+575-14+000	425		Excessive wear (vertical>9mm & lateral>11mm) and corroded	425		1000 mm gauge
Station Yen Vien South		8,904			8,904	50%; 50%
	3,425	8,904	SUBTOTAL (L=m)	3,425	8,904	
QUANTITY : Unit-Rail50 = 100T/Km (Tonne)				342.5	890.0	

Sleepers	Mainline	Station	Condition of sleepers	Priority 1	Priority 2	Comments
Chainage (Km)	Length (m)			Length (m)	Length (m)	
11+000-14+000	1,000		Cracks, damage > 35%, 45% & 65%	3,425		1,450 pieces/km
QUANTITY (Pieces)				3,425		

Ballast	Mainline	Station	Condition of ballast	Priority 1	Priority 2	Comments
Chainage (Km)	Length (m)			Length (m)	Length (m)	
11+000-12+000	910		Ballast broken and completely crushed due to low strength. The affect of weak ballast: intensive worn out of rail	910		1,500m3/1.65=~910m
12+000-13+000	305		Ditto + crushed fine material >50%	305		500m3/1.65=~305
13+000-14+000	610		Ditto + crushed fine material >50%	610		1000m3/1.65=~610
SUBTOTAL				1,825^{*)1}		

^{*)1} this is the minimum length; for cost estimate the same length for rail is considered

TURNOUTS		Station	Condition of turnouts	Priority 1	Priority 2	Comments
<i>Pieces</i>		18	Unsafe operation, wear grade >30%	18		

PERMANENT TRACK WORK VOLUME**Railway Public Utility Company RPUC HA THAI; (Km14+000-29+000: 15,000m)**

Rail	Mainline	Station	Trackwork condition	Priority 1	Priority 2	Comments
Chainage (Km)	Length (m)	Length (m)		Length (m)	Length (m)	
14+000-21+800	7,800		Excessive wear, vertical>9mm, lateral>11mm	7,800		Dual track
21+800-29+000	7,200		Ditto + corroded	7,200		1000mm gauge
Sta CoLoa-DongAnh		7,300	Ditto + corroded		7,300	Dual track
Bac Hong		1,200	Ditto + corroded		1,200	1000mm gauge
			SUBTOTAL	15,000	8,500	
			QUANTITY : Unit-Rail50=100T/Km (Tonne)	1,500.0	850.0	

Sleepers	Mainline	Station	Condition of sleepers	Priority 1	Priority 2	Comments
Chainage (Km)	Length (m)	Length (m)		Length (m)	Length (m)	
14+000-21+800	7,800		Cracks, damage > 35,45,65%	7,800		
21+800-29+000	7,200		Cracks, damage > 35,45,65%	7,200		
Sta CoLoa-DongAnh		7,300	Cracks, damage > 35,45,65%		7300	
Bac Hong		1,200	Cracks, damage > 35,45,65%		1200	
			SUBTOTAL	15,000	8 500	
			QUANTITY (Pieces)Kmx1760	40,656		

Ballast	Mainline	Station	Condition of ballast	Priority 1	Priority 2	Comments
Chainage (Km)	Length (m)	Length (m)		Length (m)	Length (m)	
14+000-21+800	7,800		Ballast broken and completely crushed due to low strength. Crushed grade>50%	7,800		Dual track
21+800-29+000	7,200		Ditto+crushed fine material>50%	7,200		1000mm gauge
Sta CoLoa-DongAnh		7,300	Ditto+crushed fine material>50%		7,300	Dual track
Bac Hong		1,200			1,200	1000mm gauge
	15,000	8,500	SUBTOTAL	15,000	8,500	

TURNOUTS	Mainline	Station	Condition of turnouts	Prio. No.1	Prio. No.2	Comments
Pieces		36	unsafe operation, wear >30%	36		

PERMANENT TRACK WORK VOLUME**Railway Public Utility Company RPUC - VINH PHU (Km29+000-km144+750=115,750m)**

Rail	Mainline	Station	Trackwork Condition	Priority 1	Priority 2	Comments
Chainage (Km)	Length (m)	Length (m)		Length (m)	Length (m)	
115+000-144+750	33,000	*)	~98% of total line due to numerous narrow curves rails excessive wear, vertical>9mm, lateral>11mm.	33,000		1000mm gauge
029+000-115+000	30,000	*)	Excessive wear under permiss. Value to be replaced within 5 years		30,000	
			SUBTOTAL	33,000	30,000	

*) reused rail from main line

QUANTITY : Unit-Rail50=100T/Km (Tonne)**3,300.0****3,000**

Sleepers	Main line	Station	Condition of sleepers	Priority 1	Priority 2	Comments
Chainage (Km)	Length (m)	Length (m)		Length (m)	Length (m)	
107+600-141+000	33,000		Cracks, damage > 45,65%	33,000		
29+000 - 107+600 & 141+000 - 144+750	7,000		Cracks, damage > 35%		7,000 *)	1,454 units/km
			SUBTOTAL	33,000	7,000 *)	

*) this is the minimum length; for cost estimate the same length for rail is considered

QUANTITY (Pieces)Kmx1450**47982****10178**

Ballast	Mainline	Station	Condition of ballast	Priority 1	Priority 2	Comments
Chainage (Km)	Length (m)	Length (m)		Length (m)	Length (m)	
108+000-144+750	9,200		need to add 11,000m3~9.2km	9,200		1m gauge
20+0-108+0 & stations	14,600		Need to add 17,500m3~14.6km		14,600	1m gauge
			SUBTOTAL	9,200 *)	14,600 *)	
			QUANTITY (m3)			

Turnouts	Mainline	Station	Condition of turnouts	Priority 1	Priority 2	Comments
Units		82	Unsafe operation, wear >30%	50	32	

PERMANENT TRACK WORK VOLUME**Railway Public Utility Company RPUC - YEN LAO (Km144+750-Km296+050: 151 300m) and (PhoLu-Xuan Giao:11,097m)**

RAIL	Mainline	Station	Condition of track works	Priority 1	Priority 2	Comments
Chainage (Km)	Length (m)	Length (m)		Length(m)	Length (m)	
YenVien-LaoCai: 144+750-296+050	148,652		~98% of total line due to numerous narrow curves rails excessive wear, vertical>9mm, lateral>11mm.	148,652		1000mm gauge YenBai-LaoCai
Stations		26,490	-/-		26,490	
PhoLu-XuanGiao: 261+534-272+631	10,719		-/- corrosive, eroded	2,500	8,219	1m gauge
Stations		1,347			1,347	Dual track
			SUBTOTAL	15,1152	36,056	
QUANTITY : Unit-Rail50=100T/Km (Tonne)				15115.1	3605.6	

Sleepers	Mainline	Station	Condition of sleepers	Priority 1	Priority 2	Comments
Chainage (Km)	Length (m)	Length (m)		Length(m)	Length (m)	
YenVien - LaoCai: 144+750-296+050	148,652		Cracks, damage > 35,45,65%	148,652		
Stations		26,489	Cracks, damage > 35,45,65%		26,490	
PhoLu - XuanGiao: 261+534-272+631	10,719		Cracks, damage > 35,45,65%	2,500	8,219	
Stations		1,347	Cracks, damage > 35,45,65%		1,347	
			SUBTOTAL	151,152	36,056	1454 units/km

Ballast	Mainline	Station	Condition of ballast	Priority 1	Priority 2	Comments
Chainage (Km)	Length (m)	Length (m)		Length(m)	Length (m)	
YenVien-LaoCai: 144+750-296+050	148,651		Ballast broken and completely crushed due to low strength. Crushed grade>50%	148,652		
Stations		26,489	Ditto& crushed fine material >50%		26,490	1000mm gauge
PhoLu-XuanGiao: 261+534-272+631	10,718		Ditto & crushed fine material >50%	2,500	8,219	
Stations		1,346			1,347	1000mm gauge
			SUBTOTAL	151,152	36,056	
QUANTITY (m3)						

Turnouts	Mainline	Station	Condition of turnouts	Priority 1	Priority 2	Comments
Pieces		54	Unsafe operation wear grade >30%	54		

Table 6.2: Summary of the Rail, Turnouts, Sleepers and Ballast Requirements (Priority 1) (including the PhoLu-Xuan Giao link)

From		To		Sec Len	Percent Replacement			Priority One Activities				Comments	Sleeper/km
	(km)		(km)	(km)	Rail	Sleepers	Ballast	Rail	Sleepers	Ballast	Turnouts		
								(m)	units	(m)	units		
Yen Vien	11.000		14.000	3.0	100	100	61	9,000	4,350	1,825	18	Dual gauge section	1450
	14.000		21.800	7.8	100	100	100	23,400	13,728	7,800	} 36	Dual gauge section	1760
	21.800		29.000	7.2	100	100	100	14,400	12,672	7,200			1760
	29.000		107.600	78.6	0	0	0	0	0	0	} 39		1454
	107.600		141.000	33.4	90	99	25	60,120	48,078	8,271			1454
	141.000		144.750	3.8	80	0	25	6,000	0	923			1454
	144.750		296.500	151.8	98	98	98	297,430	261,738	148,715	48	Turnouts inc. PL - XG	1760
Pho Lu	261.650	Xuan Giao	272.235	10.6	24	24	24	5,000	3,635	2,500			1454
		Totals		296.1				415,350	344,202	177,234	141		

6.4.2 Grade of Steel for Rail and Switches

The existing rails are formed from steel P43 or P38. The Consultant recommends that the new rails and switches should be formed from type P50 steel which is harder wearing and will result in reduced maintenance costs.

6.4.3 Rail Length

The existing rails are 12 metre in length. The Consultant recommends that, wherever possible, the replacement rail should be in 25 metre lengths. This will reduce the number of bolted joints and, as a consequence, produce the following benefits:

- reduce wear at the bolted joints and thus reduce maintenance costs and disruption to train services,
- reduce the noise levels produced as the train passes over the joint,
- reduce wear and tear to the rolling stock, and
- improve rider comfort.

6.4.4 Re-use of Used Rail in the Passing Loops

As detailed in Section 6.4.1 it is recommended that a significant length of the existing grade 38 and 43 rail is to be replaced. In order to minimize the investment cost the Consultant recommends that the rail sections which are in the least worn and damaged condition, be retained for re-use in the new or extended passing loops within the stations. Train safety and operational efficiency will not be compromised due to the reduced operating train speeds around the stations. In addition the track alignment in the station areas is generally straight, or on high radius bends, which minimises the risk of train derailment.

6.4.5 Ballast

The Consultant has recommended that ballast replacement works are carried out as Priority 1 works if the ballast crushing process has resulted in the loss of more than 50% of the required volume of ballast.

The works are classified as Priority No. 2 if the amount of ballast remaining exceeds 50% of the Vietnamese standards.

6.4.6 Replacement of the Existing Two Block Sleepers

The majority of the existing sleepers installed along the alignment are concrete two block sleepers (see photo overleaf).

Figure 6.2: Photo of the existing two block sleepers

As a result of the sleepers not being continuous, the pressure under each of the blocks as trains pass over them is more concentrated, and thus higher, than when compared with single unit sleepers. The additional load transmitted to the ballast by the two short concrete blocks accelerates the crushing process within the ballast layer or increases the amount of ballast which is pressed into the sub grade. As a result additional quantities of ballast are required to be continually added below the track in order to maintain performance.

The Consultant therefore recommends that where the existing track condition is poor and requires replacement, the existing two block sleepers and the fixings should be simultaneously replaced with single unit prestressed sleepers. The load transmission from the rail track to the single sleepers and ballast is more uniform. Therefore future railway maintenance requirements will be reduced. This will provide the following benefits:

- Increased operational time for the railway with less disruption on the rail line,
- Reduced amount of construction work on the track therefore less safety risk to the train (driver, passengers and maintenance workers), and
- Reduced maintenance costs (material, labour etc)

In addition where cracking in the existing two-block sleepers exceeds 35% the Consultant recommends that these sleepers be replaced by new single unit prestressed concrete sleepers.

6.5 PRELIMINARY DESIGN

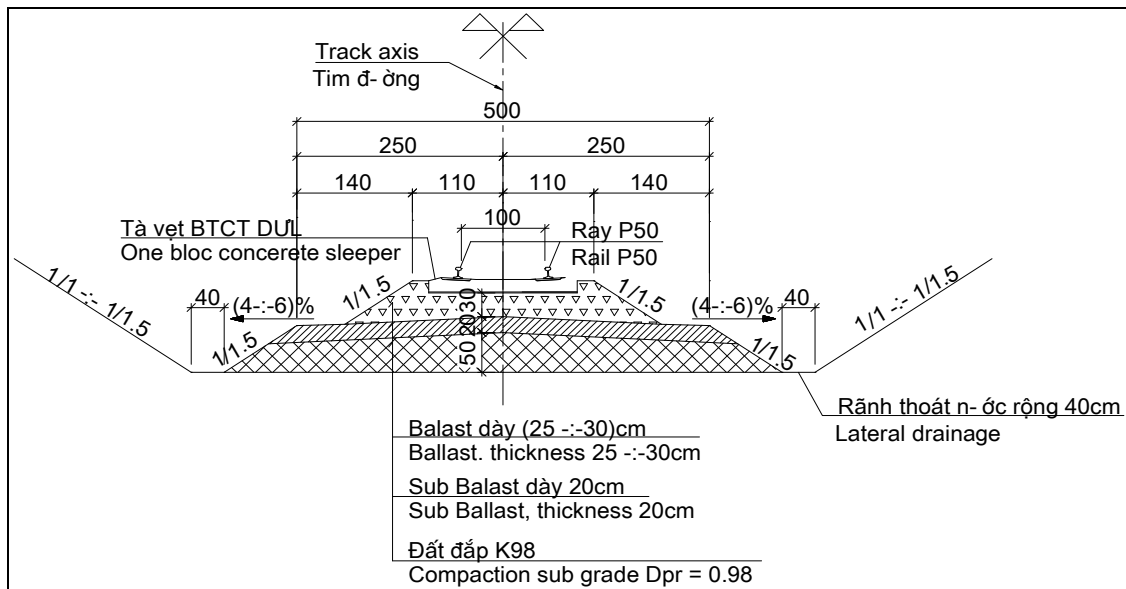
As detailed elsewhere in Section 6.4.1, the Consultant recommends that extensive sections of the existing track are replaced. In addition realignment of approximately 10 kilometres of track will be carried out.

The width of the existing rail embankments is 4.40 metres. For the planned track upgrade works, this dimension will remain unchanged. However the sections which are planned to be realigned will incorporate the current Vietnamese standard cross section (ie embankment width = 5.0m).

The following figures illustrate the typical cross sections for new and rehabilitated sections of track on embankments and in cutting.

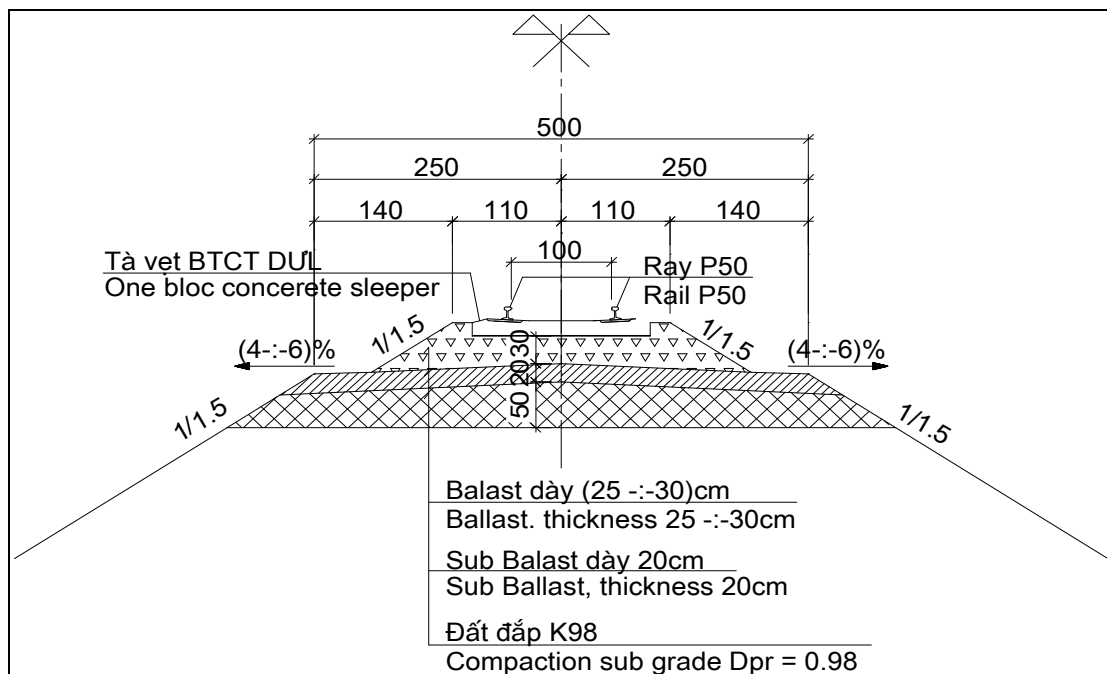
6.5.1 New Sections

Figure 6.3: Cut Section – New Trackwork (width of embankment=5.0 m)



Note –Dimensions in cm

Figure 6.4: Embankment Section – New Trackwork (width of embankment=5.0 m)



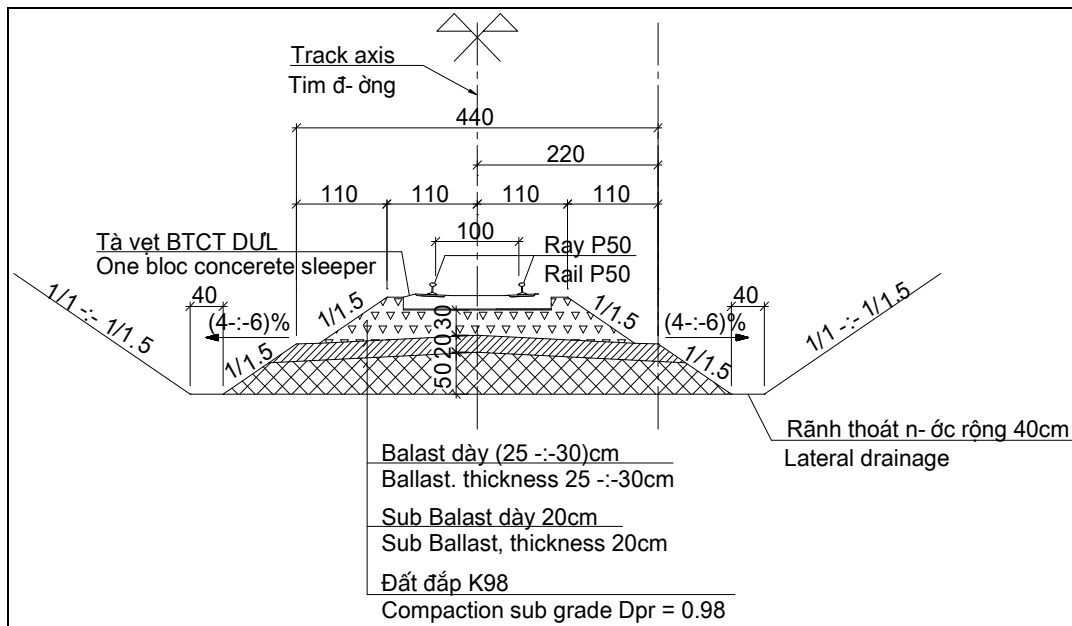
Note –Dimensions in cm

In order to ensure a stable sub grade, 50 cm of the existing layer will be removed and replaced by a compacted layer. The compaction requirement according to the Proctor test is $D_{pr} = 0.95-0.98$ (Vietnamese standard K95-K98).

The thickness of the sub-ballast and ballast layers will be 20 cm and 25-30 cm which conforms with Vietnamese requirements. A single prestressed concrete sleeper will be installed.

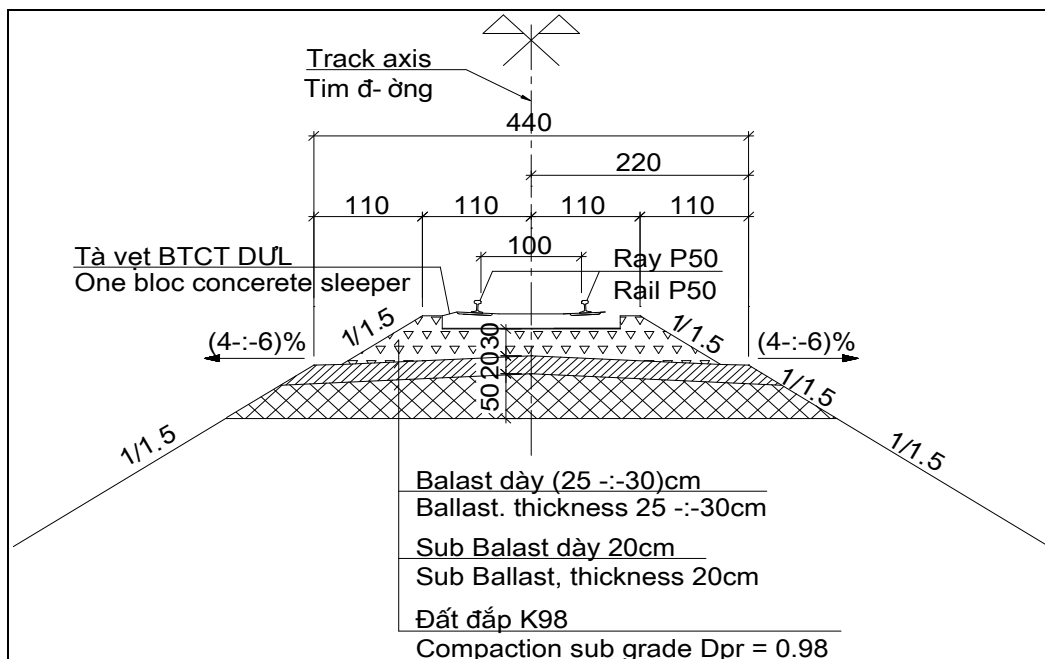
6.5.2 Refurbished Sections of Track

Figure 6.5: Cut section – Upgrading Existing Trackwork (embankment width = 4.40 m)



Note –Dimensions in cm

Figure 6.6: Embankment – Upgrading Track Work (width embankment 4.40 m)



Note –Dimensions in cm

Where the existing ballast is in conformance with Vietnamese Standards, the material will be reused and new ballast will be added to it in order to conform with the above detail and required layer thicknesses.

It is estimated that for sections of alignment which contain many curves, approximately $1.4 \text{ m}^3/\text{m}$ of ballast is required to provide the required layer thicknesses. Following a number of site visits it has been assumed that the existing alignment has an average of one cubic metre per linear metre ($1.0 \text{ m}^3/\text{m}$). Assuming that 50% of this material is “crushed” (i.e falls outside the required technical parameters), approximately $0.90 \text{ m}^3/\text{m}$ of ballast will need to be replaced on the sections to be refurbished.

7 SAFETY ISSUES

7.1 INTRODUCTION

There are 78 principle crossings on the Yen Vien - Lao Cai railway line. The following types of crossing can be found.

- **Manned Crossings (i.e. with gate-keeper)**
The current procedure at manned crossings is that a barrier is manually drawn across the road to prevent vehicles and passengers from crossing the railway track. A warning bell and signal warn the road traffic that the barriers will soon be, or are currently, being drawn across the road. The gatekeeper is in telephone contact with the station officer and is notified when a train is approaching.
- **Unmanned Crossing (ie without gate-keeper)**
At these unmanned crossings a warning sign and direction post are the only facilities provided. A list of the unmanned crossings is provided below.

Table 7.1: Summary of Existing Railway Crossing Locations with no Gate Keeper

Ref.	Location Km	RPUC	Actual Conditions	Width of crossing (m)
1	14+325	Ha Thai	Cummune crossing, no gate keeper, high volume of crossing traffic	12
2	16+250	Ha Thai	Cummune crossing, no gate keeper, high volume of crossing traffic	8
3	18+370	Ha Thai	Cummune crossing, no gate keeper, high volume of crossing traffic	10
4	20+210	Ha Thai	Cummune crossing, no gate keeper, high volume of crossing traffic	19
5	27+950	Ha Thai	Cummune crossing, no gate keeper, high volume of crossing traffic	8
6	28+350	Ha Thai	Cummune crossing, no gate keeper, high volume of crossing traffic	8
7	29+975	Vinh Phuc	Level crossing no gate keeper; crossing road to industrial zone "Quang Minh", high traffic volume	8
8	33+660	Vinh Phuc	Level crossing no gate keeper; crossing road to industrial zone "Quang Minh", high traffic volume	12
9	34+660	Vinh Phuc	Level crossing no gate keeper; crossing road to industrial zone "kim Hoa", high traffic volume	10
10	64+590	Vinh Phuc	Level crossing no gate keeper; connecting road between provinces, high traffic volume	12
11	66+860	Vinh Phuc	Level crossing no gate keeper; connecting road between province, high traffic volume	8
12	74+550	Vinh Phuc	Level crossing in Viet Tri, no gate keeper, high vehicle and pedestrian traffic	16
13	75+480	Vinh Phuc	Level crossing in Viet Tri, no gate keeper, high vehicle and pedestrian traffic	26
14	107+925	Vinh Phuc	cummune crossing, no gate keeper, crossing road to historical monument, high volume of crossing traffic	8
15	108+732	Vinh Phuc	Dense population, high traffic volume crossing	8
16	121+750	Vinh Phuc	Dense population, high traffic volume crossing	10
17	131+200	Vinh Phuc	Level crossing with no gate keeper, crossing road in the Ha Hoa district, high volume of crossing traffic	19
18	186+550	Yen Lao	Level crossing with no gate keeper, high volume of crossing traffic, dangerous condition	15

- **Automatic Crossings (with no gatekeeper)**
Two of the existing crossings (Km 131+230 & km 263+321) are equipped with automatic warning systems which activate automatically when trains approach. These automatic systems have only been installed relatively recently on the line and remain under assessment in Vietnam. Concerns exist regarding the level of traveller observance.
- **Unauthorised Crossings**
A large number of unauthorised crossings have been constructed by individuals living close to the alignment. These crossings are used to transfer bicycles, motorcycles and animals. In addition unauthorised and uncontrolled developments have been constructed which begin to encroach the area directly alongside the track.

The unofficial crossings are a significant risk to the safe operation of the railway. For example concrete slabs or gravel fill are placed between the tracks by unauthorised local residents. These objects have the potential to derail a train.

The photograph below illustrates one of these unauthorised crossings. It is noted that a wall has been constructed to prevent unauthorised access to or from the railway. However a ladder is used instead in order to gain access.



At each type of rail crossing there is a potential risk to train operations, passenger safety and vehicles or individuals attempting to cross the rail tracks. As a result of these known risks, the train's operational speed is reduced to approximately 15 kilometres per hour around the cities or densely populated urban areas such as Yen Vien or Dong Anh.

The accident figures for the line are summarised in the following table.

Table 7.2: Accident statistics for the line

Period	Number of human injury	Number of human death
2002 - 2006	103	25

Table Source: records of Rail Way Public Company Utilities

7.2 CONSULTANT RECOMMENDATIONS

The Consultant recommends the following actions in order to improve the current safety situation. Preliminary Design drawings have been prepared and are presented in Technical Appendix E1.

7.2.1 Flyover Construction at Dong Anh and Gia Cam

It has been noted that the volume of crossing traffic (cars, motorbikes, bicycles, trucks etc) is high at a number of the crossings along the route. This is particularly true at rapidly developing and busy urban centres such as Ha Noi and Vinh Phu. The existing rail crossings are therefore overloaded and need to be upgraded. The crossing traffic is delayed for approximately five minutes each time that a train passes a particular crossing and the barriers are closed.

In order to improve the safety situation, and reduce the delays to traffic on the crossing road, the Consultant has investigated the possibility of installing flyovers at three crossings with high crossing traffic levels.

A relatively high number of accidents have been recorded as occurring in the vicinity of Dong Anh. Providing a grade separated junction at this location should reduce the number of accidents occurring.

Table 7.3: Record of Accidents near Dong Anh (km 21.8)

Time	Accidents – reason
1985	Train collided cars and truck km 20+210
1995	Train collided motor bicycle: 1 dead 2 injured km 21+800
1995	Train hit pupils; 1 injured km 20+210
1999	Cars collided barrier; Rail guard personnel injured km 21+800
2003	Cars hit and collapsed signalling tower km 21+800
2003	Cars collided barrier; Rail guard personnel injured km 21+800
2004	Cars hit and collapsed signalling tower km 21+800
2004	Container trucks from station collided cars on National road No. 3 km 21+800
2004	Train collided motor bicycle: 1 dead 2 injured
2005	Cars collided barrier km 21+800

Table Source: records of Rail Way Public Company Utilities

In addition to Dong Anh, the Consultant has investigated the benefits and feasibility of installing flyovers at Gia Cam (km 76.5) and Yen Bai (km 155.9) which are both highly trafficked and located in urban areas. The Consultant has carried out traffic counts at the three proposed locations in order to establish whether there was sufficient traffic to economically justify the construction of grade separated junctions. These traffic counts recorded the numbers of different vehicle types crossing the railway. In addition the stoppage time due to trains passing was recorded.

The results indicated that flyovers were economically justified, and so should be recommended at Dong Anh and Gia Cam. The traffic counts also indicated that the level of road traffic crossing the railway at Yen Bai (km 155.9) is not currently high enough to economically justify the construction of a flyover.

7.2.2 Provide Gatekeeper at Unmanned Crossings

The Consultant recommends that gatekeepers should be employed at all the current unmanned crossings. In addition a hut with telephone should be provided. The manually operated barrier should be installed along with the necessary guideway being installed within the road pavement. In addition upgrade roads will be made to the road surfacing within the crossing to ensure smooth transit by all types of vehicles from motorbikes to heavy trucks.

7.2.3 Collecting Road to Replace Unauthorised crossings

In order to try and reduce the high number of dangerous and illegal crossings, it is recommended that a collector road (1.15 km long) is constructed near Km 22. This will consist of a 3 metre wide path parallel to the track and a fence. The road and fence will serve to minimise unauthorised access to the track by channelling the traffic towards the official crossing. Preliminary Design Details are provided in Technical Appendix E1.

7.2.4 Public Education Program

Given the planned and likely increase in the number of train operations, with a corresponding increase in speeds, it is recommended that a Public Education Program be prepared. This could form part of a National Road Safety Campaign in schools. In a leaflet distribution campaign could be targeted towards residents living adjacent to the line.

8 COST ESTIMATION

8.1 INTRODUCTION

The cost estimates presented by the Consultant have been prepared by a local Senior costing specialist with considerable relevant experience. Vietnamese procedures have been followed in order to prepare the rates for each item

In order to ensure that the estimated rates are realistic and comply with Vietnamese procedures, staff from the Executing Agency (RPMU) have been consulted and assisted with the Consultant's costing exercise using data and rates from recent Vietnam Railway projects. In addition the Consultant has compared the estimated rates with those for similar activities on relevant projects in Europe and the region.

Items such as taxes, transport, site installation and labour costs have been considered during the Consultant's costing exercise.

It should be noted that the cost data presented are estimated values based on the preliminary design prepared as part of this feasibility study. These estimates will be developed further during the next phase of this project once detailed designs are completed.

8.2 COSTING PROCEDURES

The cost estimates prepared by the Consultant are in conformance with the following procedures.

Ministry of Construction (MOC) procedures relating to unit cost for material and labour.

- No. 24/2005/QD-BXD dated 29/07/2005
- No. 33/2005/QD-BXD dated 04/01/2005
- No. 29/2000/QD-BXD dated 25/12/2000
- No. 06/2005/QD-BXD dated 15/04/2005

Salary procedures:

The cost estimates comply with the following salary requirements :

- Government Decree No. 205/2004/ND-CP dated 14/12/2004 regarding salary levels.
- Decree No. 118/2005/ND-CP dated 15/09/2005 regarding minimum salary rate adjustment 350.000 VND.
- Circular 05/2005/TT-BLDTBXH dated 05/01/2005 by Ministry of Labor, War Invalids and Social Welfare regarding per diem.

Materials and Transportation

The following assumptions have been made in preparing the cost estimates.

- All defected rails and switches under requirement will be replaced by rail P50-25m
- Damaged and cracked sleepers will be replaced by pre-stress concrete sleeper including elastic fastenings. In addition where rail replacement works are proposed the sleepers will be replaced at the same time.
- Track material, such as sleepers and spare parts, will be bought in Dong Anh.

- The required stone material will be bought in the Lam Giang borrow pit.
- Cement, gravel, sand and formwork will be purchased and transported to the site by truck.
- Most of construction material will be transported to the site by train and then conveyed manually within the construction site.
- The standard rates have been increased by 30% to reflect the difficult access conditions to some of the project locations, and the requirements to ensure that the railway remains operational,
- No. 1651/QD-DS dated 20/12/2005 by Vietnam Railway specifies the material transportation price carried by railway.
- The material prices are those issued for 2005,
- The price of rail and turnout assumes that these items are imported from overseas (France).
- Unit rates for locally sourced materials such as soil, sand, gravel, cement and machine rates are based on the unit price issued by Lao Cai province in accordance with Decision No. 369/2006/QD-UBND dated 16/2/2006.
- It is estimated that the value of the Detailed Design and Supervision of the works will be in the order of 8% of the estimated Construction Value.

Environmental Issues

The Contractor is required to implement numerous environmental mitigation measures during the Construction phase. The standard costing procedure adopted in Vietnam is that environmental mitigation measures are estimated to represent 1.5% of estimated rates. The mitigation measures concerned include :

- Proper disposal of solid and liquid wastes and excavated materials in order to avoid contamination to water sources,
- Protection of local flora and fauna,
- Rehabilitation of temporarily acquired lands and borrow areas,
- Maintain air quality by minimizing dust from construction activities and site vehicles.
- Minimise noise pollution, and
- Control works which are likely to cause vibrations, particularly near built-up areas.

Specific concerns were raised at the public consultations concerning possible, noise levels during the construction phase and the potential for noise and air pollution.

9 CONTRACT PACKAGING

9.1 INTRODUCTION

The estimated timescale for project implementation is as follows:

Mid – 2006	Mobilization of selected Consultant and start of detailed design works.
Mid – 2007	Completion of detailed design
Mid 2007 to end 2007	Select and appoint Contractors to carry out the works packages
2008 – 2010	Construction phase
End 2010	Project Completion

9.2 SOURCES OF PROJECT FUNDING

The proposed funding sources for the project are:

- Asian Development Bank (ADB),
- French Development Agency (AFD),
- General Department of Treasury and Economic Policy (DGTPE)

In conformance with ADB and AFD procedures, International Competitive Bidding (ICB) procedures will be adopted for this project. DGTPE plan to provide “tied aid” which requires the goods or services to be procured from France.

As a result of the combination of funding sources, the financial management and control aspects of the supervision phase for this project have the potential to become rather complicated.

The arrangement may be further complicated since the railway operation and maintenance works along the line are administered by four separate Rail Public Utility Companies (RPUC).

9.3 RISK

The type of risks involved in these types of infrastructure upgrade projects are :

- No conforming or competitive bids are received for a particular contract package,
- Delays occur in land acquisition,
- Delays occur in release of project funds,
- Appointed Contractors are not adequately experienced,
- Delays occur in the design process,
- Delays occur in the construction phase,
- Delays occur in the delivery of key materials (eg rails),
- Appointed Contractors become financially insolvent,
- Significant claims are received from the Contractor,
- Lack of relevant experience by the Executing Agency,
- Structural collapse occurs on site,
- Delays occur in the delivery of materials,
- Unforeseen ground conditions are encountered,

- Major train accidents occur, and
- Site accidents occur during construction.

9.4 PROPOSED CONTRACT PACKAGING

The following key issues should be considered when preparing the contract packaging strategy for project implementation.

- Divide the works into reasonable sized packages in order to ensure adequate interest from a number of bidders,
- The structure of the loan is potentially complex,
- The construction works are required to be carried out whilst trains remain operational,
- Works are carried out over a geographically wide area,
- The number of project interfaces should be minimised in order to assist effective management and control of the project,
- Interruptions to train operations are required to be minimized,
- Road access is not possible to a significant number of the planned work locations. The majority of the material required for the reconstruction works will therefore have to be delivered by rail.

One approach to Contract packaging which has been considered by the Consultant was to divide the works according to activity type. For example a separate contract would be prepared for activities such as bridges, railway realignment, slope protection and safety works. However we do not recommend this approach. Problems frequently arise when different Contractors work in the same location. For example claims may be submitted for disruption by one of the parties. One Contractor may also claim that some of his materials may be missing or have been stolen. Disruption may also occur to planned work methods as both Contractors may be planning to work simultaneously in the same area. A preferable approach is that a single Contractor is responsible for all the works in a particular work area.

The Consultant therefore strongly recommends that the works are divided into three separate works sections. A single Contractor is therefore responsible for all works carried out within a single Contract package. The Consultant believes that three packages is the optimum number. Too many packages creates a large number of interfaces which makes management of the project more challenging. Too few packages will generate a huge scope of work and reduce the ability of Vietnamese Contractors to submit competitive and conforming bids.

In order to simplify the implementation and management of the project we also suggest that the works are divided to ensure only one RPUC, or a maximum of two, is involved in any one contract. The Consultant's suggested division of the works is as follows.

Contract Ref	Chainage	RPUC
1	Km 10+900 - Km 144.750	Vinh Phu & Ha Thai
2	Km 144.75 - Km 225.000	Yen Lao
3	Km 225.000 – Km 296+050	Yen Lao

The proposed division of contract packages results in Contract packages 2 and 3 each containing a section of the two proposed realignment works. Given the anticipated difficult access and working conditions, combined with the requirement to minimize

disruption to rail services whilst the works are being carried out, dividing the realignment works between two contractors should ensure that the works can be implemented in a reasonable timeframe. The majority of the slope stabilization works and realignment are required in the North of the route. These three packages all contain slope stabilization, rail upgrade, bridgeworks and station improvement works.

The major engineering items required to be constructed (slope stabilization, bridge strengthening works etc) will likely be carried out by Vietnamese Contractors, who are familiar with local conditions. These activities are standard engineering items which are labour intensive and do not require specialist input. Local Contractors should be in a position to submit lower rates for the items. We therefore anticipate the majority of the bidders will comprise associations of local companies.

It is anticipated that International Contractors may be interested in the rail replacement activity. However the difficult and restricted access conditions, and the labour intensive bolted connection installation process, may limit their interest and result in their quoted costs being uncompetitive.

It is anticipated that all parties will review and comment on the proposed contract implementation arrangement. Further discussions may be carried out during the planned tripartite meetings. The design drawings and packages have been prepared so that the drawings and cost documents can be readily assembled into the agreed works packages.

9.5 CONSULTANCY SERVICES

The Consultant recommends that a single Consultant is appointed to complete the detailed design. This will be the single point of contact for the Executing Agency (RPMU). which will simplify the management and control of the project.

Due to the scale of the project, and the required extensive Scope of works it is anticipated that the appointed Consultant may be formed from an association including several local firms. This will depend on the experience and capacity of the local Consultants.

It is suggested that the lead Consultant is a suitably experienced International firm. As outlined above, a portion of the proposed funds for this project will be sourced from “tied aid”. Given this requirement for French sourcing, it may be possible to specify that only French Consultants are eligible. Firms from other nations may form an association. However the lead firm should be French. The one concern regarding this approach is that it may be against the International Competitive Bidding (ICB) of the other two proposed lenders (ADB and AFD).

The documents have been prepared in such a form that they can be easily divided into the three works packages proposed by the Consultant. This activity will be completed once comments are received to the Draft Final Report and the planned tri-partite meeting is held between the proposed lenders (ADB, AFD & DGTPE), the executing Agency (RPMU) and the Consultant.

9.6 RAIL PROCUREMENT

As mentioned previously the portion of the load proposed by DGTPE is “tied aid”. As a result it should be used to purchase French sourced goods or services.

There have been initial discussions concerning the possibility of using the DGTPE funds to procure French rail. We understand that the best way to accomplish this via a division of Vietnam Railways, or the Executing Agency (RPMU) procuring the rail. It would then be stored at a secure location, close to the existing Hanoi-Lao Cai railway. Security and careful stock control will be imperative.

Once the preferred Contractors have been selected and appointed they will be able to go and collect the rail they require for their section of works. The rail can then be transferred to the required work location by train.

A key requirement in order to ensure the success of this arrangement is that the rail must be delivered and available for the Contractors to collect. Significant delays and additional costs will be incurred if the Contractors have to await rail delivery.

The cost for rail storage, security and stock control could be included as a rate within the Contractor's Bill of Quantities.

The Consultant recognizes that the RPMU may not currently possess adequate resources or experience in order to be able to complete this important task. We therefore suggest that, as part of the Consultant services for the detailed design and supervision phases of the project, a suitably experienced international procurement expert is seconded into RPMU to prepare the necessary documents and complete the procurement task. The secondment should be carried once the technical parameters of the required rail and switches are finalized by the detailed design Consultant.

The other alternative procurement method is that the Contractors each purchase the rail required for their particular contract. We do not recommend this arrangement for the following reasons:

- There is the possibility for the leakage of funds,
- The appointed Contractors may ignore the DGTPE's strict loan requirements, and
- The Contractors may not all purchase exactly the same type of track

ANNEX A**Applicable Design Codes, Standards and Principles**

The following design codes, standards and principles are applicable for the upgrade works on the Yen Vien to Lao Cai Railway Line:

Table A.1: Design Codes and Standards

Ref	Applicable Standards	Code number
Investment		
1	Guidelines for preparing Investment Report and Investment Project for Transport Construction issued by MOT	22 TCN-2005
2	Environment Impact Evaluation Standards for preparing Project Feasibility Studies	22 TCN 242-98
Survey works		
1	Standards for preparing Topographical Maps	96TCN 43-90
2	Standards for establishing GPS Control points	
3	Standards for Survey of upgrading and newly constructed railway line and Decision of Vietnam Railway (Dec 2003)	QD 1105/QD-DS-KHCN
4	Standards for geological investigation boring holes	22TCN 259-2000
5	Standards for SPT testing	TCXD 226-1999
6	Soil testing	TCVN 5747-93,TCVN 4195-95 TCVN 4202-95,TCVN 4219-95
7	Testing water used for Construction	22 TCN 61-84
Track Design		
1	Railway Technical Standards (MOT – 1999)	22 TCN 240-99
2	Design Standards for Railways with a 1000m gauge	QD 433/QD-KT4
3	Provisional Standard for retaining wall design.	QP 23-65
4	Reinforced concrete Tube Culvert Technical Specifications	22 TCN 159-86
5	Technical Specifications for Design, Construction and Taking Over of Geo-Textile	22 TCN 248 – 98
6	Specifications for Supervision and Taking over Railway Embankment	TCVN 4054-05
Bridge Design		
1	Permissible State Design Standards for Bridge	22 TCN 18-79
2	Specifications for Bridge Design (MOT - 2005)	22 TCN-272-05
3	Technical Design Standards for Piles	TCXD 205-98/22 TCN 21-86
4	Technical Specifications for Welding Bridge Fabrication and Supervision	22 TCN 280-01
5	Paint used for Steel Bridges and Structures	22 TCN 235-97
6	Standards for Taking Over and Construction of bridges and culverts	22 TCN 266-2000
7	Standards for Taking Over and Construction of Bored Piles	22 TCN 257-2000
8	Technical Standards for Steel Bridge Design	TCVN 5575-91
9	Technical Standards for Concrete Bridge Design	TCVN 5574-91
10	Standards for Steel Structure Design	TCVN 5573-91
Maintenance		
1	Vietnam Railway Technical Standards	22TCN 240-99
2	Railway Maintenance Standards (MOT – 12 March 1981)	396/DS/PC
Signal and Telecommunication		
1	Standards for Railway Signal	981/QD-DSVN
2	Standards for telecommunication used optical cable	TCN 68-139-95
3	Standards for Electronic Exchange with small scale	TCN 68-146-95
4	Optical Cable-Technical Specifications	TCN 68-160-96
5	Warning System No 7- Technical Specifications	TCN 68-163-97
6	Warning System R2 - Technical Specifications	TCN 68-169-98
7	Standards For Railway Telecommunication Design of RPC	TB 10006-99

Ref	Applicable Standards	Code number
8	Standards For Railway Signal Design of RPC	TB 10007-99
9	Standards For Railway Telecommunication Construction of RPC	TB 10250-99
10	Standards For Railway Signal Construction of RPC	TB 10206 -99
Others		
1	Calculation of water flow characteristics	
2	Transportation in seismic areas	
3	Suitable International Transport Engineering Construction Design	
Material		
1	Standards for Cement and Concrete Testing	22 TCN 59-94 22 TCN 68-84
2	Standards for Testing physical characteristics of Stone	22 TCN 57-84
3	Standards for Cement	TCVN 4029-85/4202-85 TCVN 4787-89
4	Standards for sand, rubble stone, gravel used for construction	TCVN 1770-86/1772-86 TCVN 139-91 TCVN 337-86/346-86 TCVN 4376-86
5	Standards for water used in concrete and grout production	TCVN 4506-87 22TCN 61-64
6	Standards for soil used in construction	TCVN 2683-91 TCVN 4195-86/ 4202-86
7	Standards for Testing soil aggregate	22TCN 66-84
8	Standards for testing humidity of soil	22 TCN 67-84
9	Standards for Rubber Bridge Bearing	22 TCN 217-94
10	System of Criteria for Steel Structures	TCVN 4059-85
11	Fabrication and Taking over of Steel Structures	TCVN 170- 89

Table A.2: Track Design Parameters

ITEM	VALUE
Railway gauge	1000 mm- Non electrified
Train operation	
Design Train Load	T14
Train speed	Max 80 km/h
Train load	Up to 1200T
Train length	Up to 400m
Alignment	
Critical vertical gradient	9‰
	12‰ (descending direction)
Minimum Length of straight segment between 2 inverse curves	L= 25 m
	L= 15 m (specific case)
Minimum radius	R=150 m
Minimum Transition Curve length	L= (20~30) m
	L= 20 m (specific case)
Embankment	
Width of embankment	5.0 m (new realignment)
	4.4 m (upgrading existing line)
Track	
Thickness of ballast under sleeper	30 cm
Rail Type	P50 with elastic fastening
Sleeper Type	Mono-block pre-stressed concrete sleeper
Stations	
Minimum effective length of passing loops	450 m

In addition the following principles have been followed:

Station

- Railway Station Design shall be subject to Article 24~50 incorporated in the Railway Design with a gauge of 1000 mm.

Bridges

- Soffit level should be the same as the existing bridges
- Rail top level: could be shifted up an inappreciable amount on the condition that the width of adjacent embankment will not be increased.
- Welded Steel Through Girder/Truss with high tensile bolt connection will be adopted.
- Composite concrete steel girder may be installed.

Materials

- The material used for bridges (steel, concrete, wood works) and railway bed (earthworks, geotextile) shall be subject to National Standards (TCVN)
- The material used for permanent track (rail, switches, sleeper, fastening, ballast) shall be subject to Approval of Vietnam Railway
- The material and equipment of Railway Signal and Telecommunication shall be subject to National Standards (TCVN, TCN) and the standards from the People's Republic of China (PRC).

Applicable Standards: To be subject to Design Standard of 1000 mm railway of MOT dated 1976

Horizontal Layout

Curve and straight rail segments shall be connected by a transition curve with lengths as shown in the table below:

Table A.3: Transition Curves

Radius of curve (R) (m)		Transition curve (L _{trans})-m-	
		Principal line	Secondary line
1	900~1000	30-20	
2	700~800	40-30-20	
3	550~600	50-40-30	
4	500	60-50-40	20-10
5	300~450	60-50-40	30-20
6	250	60-50-40	40-30
7	200	50-40-30	40-30
8	150	40-30	40-30

Cant (super elevation between 2 rails in curves) declination shall not be allowed to exceed the gradient of $i = 0.25\%$. If cant $h = 10$ mm, then cant cannot be applied.

Minimum length of curve between 2 transition curves shall not be less than 14m.

The length of straight segment (Lst) between 2 curves shall be as shown in the table below:

Table A.4: Length of Straights between Curves

Category of Rail line	Length of straight segment between 2 curves Lstr.(m)	
	2 inverse projection curves	2 same projection curves
Principal	45	60
Secondary	30	30

In specific cases the Lstr could be 15 m and 20 m depending on the line category. For rehabilitation of an existing line Lstr = 30 m (Specific cases only).

Elevation of outer rail in curves (cant)

Elevation of outer rail is subject to Decision No 364/HTCS dated April 24,1999 issued by Vietnam Railways

Applicable Formula: Cant $h = 5.4 \frac{V^2_{\max}}{R}$

$$V_{\max} = 4.1 \sqrt{R}$$

$$V_{\max} = 50 \text{ km/h} \quad h_{\max} = 90 \text{ mm}$$

General regulation: Cant will be reduced with a gradient of $i = 0.1\%$ from the beginning and the end points of curve (TD,TC) towards transition curve. The minimum length of curve with invariable cant and the length of the straight segment between two curves without cant shall be at least 15 m.

Regulation applied for specific cases : (short transition curve is not sufficient for cant reduction with $i=0.1\%$ or no transition curve or the minimum length of curve with invariable cant and the length of straight segment between 2 curves without cant is less than 15 m) the following will be applied:

a. Cant reduction can be carried out inside curve on the condition that the cant critical value at TD,TC points shall not exceed:

- 8 mm (with train speed higher 60 km/h)
- 10 mm (with train speed from 0 to 60 km/h)
- 12 mm (with train speed less than 30 km/h)

b. the gradient of cant declination will be higher than 0.1% when:

- the train speed higher than 40 km/h - $i \leq 0.2\%$
- 30~40 km/h $i \leq 0.25\%$

- less than 30 km/h $i \leq 0.3\%$

c. cant reduction can be carried out on straight segment on the condition that the cant critical value at ND, NC points are ≤ 20 mm

d. The minimum length of curve with invariable value cant and the length of straight segment between 2 curves without cant shall be 12 m.

In conformity with the two said applicable Standards, the design of railway realignment of Yen Vien – Lao Cai railway line will be subject to the following regulations :

- Category of the railway line: Secondary
- Regulation applied for rehabilitation railway line
- Minimum Radius of curve $R \geq 150$ m
- The length of transition curve (Ltrans) applied Standard 1976 of MOT and Regulation of VR, 1999:
- Ltrans.= 30 m (for curves with radius $R < 650$ m)
- Ltrans.= 20 m ($R \geq 650$ m)
- Cant declination gradient $i = 0.1\%$
- In the case of curve radius $R \geq 650$ m, Ltrans= 20 m is sufficient to cover cant declination.

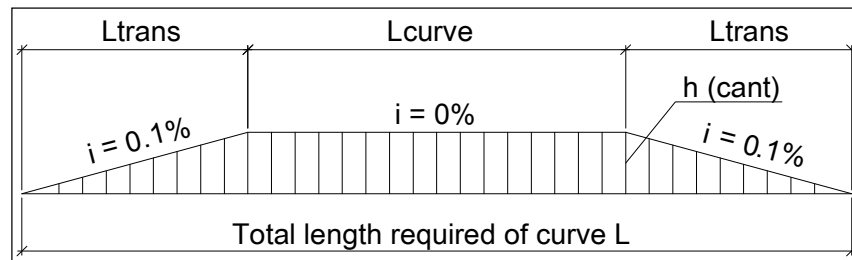
In the case of the curve radius $R < 650$ m, the length of transition curve Ltrans= 30 m is not sufficient to cover cant declination which will be carried out from the beginning points of transition curve towards inside curve.

The minimum length of curve will be sufficient to compromise the cant inside its transition and curve on the condition that the remaining length of curve with invariable cant will be at least 15 m. So the length of curve including transition curve (KT) is as shown in the table below:

$$L_{\text{curve required}} (\text{m}) = 2 h (\text{mm}) + 15 (\text{m})$$

Table A.5 Radius, Cant and Curve Length Requirements

Radius R(m)	Cant h(mm)	Lcurve required(m)
150	90	195
180	75	165
200	68	150
250	54	123
300	45	105
350	39	92
400	34	83
450	30	75
500	27	69
550	25	64
600	23	60
650	21	57
700	19	54
750	18	51
800	17	49
850	16	47
900	15	45
950	14	43
1000	14	42
1100	12	40
1200	11	38
1300	10	36



Vertical profile

The minimum length of vertical profile is of 150 m and generally the length is not less than half a train length that means the minimum length of vertical profile will be: 200 metres. Algebraic differences between 2 consecutive gradient is of: 1/2 critical gradient, that means 0.475 %

The current vertical profile of the railway is not suitable for an increase of train speeds due to:

- the length of steep gradient is short (minimum length of gradient)
- section is 100 m as regulated in Technical Standards)
- continuously descending and ascending gradient
- critical gradient not to exceed 9%
- 12% (descending gradient direction)

In case of a reduction of a steep gradient turns out to be feasible, the existing railway bed should be downgraded.

ANNEX B

Summary of Surveys Carried Out

Surveys were carried out at the locations listed below. The topography work is carried out according to the Vietnamese survey standard No. 1105/QD-DS-KHCN

TOPOGRAPHY

MAINLINE ALIGNMENT

Topographical surveys have been carried out along the centreline (Total length 81,9km) and 30 meters each side of the railway centreline.

Station

Surveys were carried out at the following 16 stations. The existing passing loops and topographic layout of the stations was surveyed.

- Stations: Thach Loi, Huong Canh, Viet Tri, Tien Kien, Chi Chu, Vu en, Mau Dong, Lang Thip, Phu Duc, Co Phuc, Mau A, Lam Giang, Thai Van, Thai Nien
- 1 Station Xuan Giao on the line Pho Lu to Xuan Giao
- 1 New station Mai Tung - a 2000m x 400m (equivalent to $800,000 \text{ m}^2 = 80 \text{ ha}$) has been surveyed.

Flyover bridge survey

Topographical survey work was carried out at the level crossing between the railway and National road No. 3 of $0,6 \text{ km} \times 0,2 \text{ km} = 0,012 \text{ km}^2$ (12 ha). The scale has been defined as 1:1,000.

Land slides zones:

Survey has been carried out at the following locations and 150 metres each side.

- Location km 233 + 400: $0,075 \text{ km}^2$
- Location km 273 + 900: $0,06 \text{ km}^2$

Existing construction survey for bridges

Number of surveyed bridges = 65

Geological survey

For rail realignment work the ground conditions were investigated. Along the planned realignment sections (length 82km), 82 bore holes of 7m depth have been carried out. The structure and a brief description of the sub ground has been summarised.

For planned slope protection locations boreholes were carried out at the following locations. Laboratory tests were carried out on samples.

- Km 233+400 : 3 boreholes, each 20 m depth
- Km 273+900 : 3 boreholes, each 20 m depth

Boreholes were sunk at the following bridge locations:

Tu Mau km 168+850, Mau A km 188+050, Vai km 192+462, Phuc Ninh km 214+742 and Quynh Sum km 286+593

Summary of Survey Locations

The following table summarises the survey works which were carried out.

Table B.1: Survey Location

UPGRADE WORKS	LOCATION
TOPOGRAPHIC SURVEYS	
Station Upgrade	Thach Loi - Km 33+170 Huong Canh - Km 47+510 Viet Tri - Km 72+710 Tien Kien - Km 90+700 Phu Duc - Km 81+770 Chi Chu - Km 108+150 Vu En - Km 118+170 Cổ Phúc - Km 165+110 Mẫu A - Km 186+593 Mẫu Đông - Km 194+840 Lâm Giang - Km 210+000 Lang Thíp - Km 227+803 Thái Văn - Km 247+450 Xuân Giao - Km 272+235 Thái Niên - Km 277+840 Mai Tùng (New station) - Km124+200
Railway Realignment	Km 166+000 - Km 174+000 Km 177+800 - Km 182+400 Km 184+000 - Km 186+000 Km 194+000 - Km 206+600 Km 208+000 - Km 221+000 Km 221+000 - Km 246+016 Km 246+000 - Km 247+549 Km 276+200 - Km 277+800 Km 278+900 - Km 279+400 Km 280+200 - Km 280+600 Km 283+700 - Km 295+800
GEOLOGICAL BOREHOLES AND INVESTIGATIONS	
Bridges (5 No.)	Từ Mẫu Km - 168+850
	Mẫu A - Km 187+910
	Vải - Km 192+300
	Phúc Ninh - Km 214+810
	Quỳnh Sum - Km 286+570
Railway Realignment	1 borehole at each of 82 kilometers of realignment works being investigated
Slope Stabilisation Works	Km 233+400 - Km 233+550
	Km 273+900 - Km 274+000
CONDITION SURVEYS OF 65 EXISTING BRIDGES – between Km 52+510 (Bridge Đầm Vạc) to Km258+050 (Bridge Trì)	

ANNEX C

Main Geological and Hydrological Characteristics

The 285 kilometre long Yen Vien - Lao Cai railway line crosses various landforms including high mountains, deep streams, low hills, valleys and plains. From Yen Vien to Viet Tri the line crosses the plains area which has been developed into rice and dry crop cultivation zones.

From Viet Tri to Lao Cai the line runs along the North-east side of the Red river. In order to reduce the volume of cuts and fills, the old railway alignment closely follows the natural landscape. As a result the line has many curved sections, some of which have very small radii.

The terrain which the railway passes through varies significantly. As a result some sections are built on deep cuts and high fills, others on shallow cuts and low fills and other sections have no cut or fill. The valleys through which the route passes are usually narrow and most have been developed into cultivation land. The mountain slopes are covered with lush and dense forests.

Topographic and Geologic Characteristics of the Railway Line

The Yen Vien - Lao Cai railway line crosses the following types of landform:

Sedimentary Plains are found on the section between Yen Vien to Viet Tri. The elevation of the route varies from 15m to 25 m, and tends to decrease from the North West to the South East.

These plains are formed from mainly clay, sandy clay, clayey sand, sand and gravel aged Quaternary layers (QII - QIV) and partly conglomerate, gravelite, sandstone aged Neogene layers (N). The land surface is relatively flat.

Low hills and folded block landform consists of individual hills composed of claystone, siltstone, sandstone, underlain by bed rocks which were formed during the Cenozoic to Proterozoic periods. This type of landform is distributed mainly from Viet Tri to Phu Tho and in the South-East of Yen Bai province. The elevation varies from 100m to 200 m and the slope angle is 20-35°. The weathering process is highly developed resulting in the crust being 3m to over 10m thick. The hill surface is used for planting fruit and timber trees.

The medium sized mountain block folding landform occurs from the south of Yen Bai province to Lao Cai. The land surface is dissected by rivers and streams. The ground generally slopes towards the Red river. Numerous v-shaped erosion gullies are formed on the mountain side as a result of deforestation.

These mountains are composed mainly of claystone, siltstone, granite and gneiss, which were formed during the Middle Devonian, Early Cambrian and Proterozoic periods. The crest line usually coincides with the axis of the NW - SE, trending fold. The height of this section varies between 300m and 500m and the slope angle is between 30 - 50°. The vegetation cover on the slopes is lush and dense.

The accumulation valley landform is formed by Quaternary sediments. The upper part consists of fine sediments such as clay, clayey silt and sandy silt. The lower part consists of coarse sediments such as sand, gravel, cobble and boulders. These valleys are usually extensive, confined between mountain slopes and their surface is generally inclined towards the Red River. Most of these valleys have been developed for cultivation, either as flat rice field with small inclination, or as terraced field.

The alluvial accumulation landform has been built up by recent river bed and flood plain alluvial deposits forming flood plains and terraces along both banks of the Red river.

The flood plains and terraces consist of sand, pebbles and cobbles which are mixed with clay and angular rubbles in some areas. There is no vegetation on the river plains and poorly developed vegetation on the terraces.

Tectonic characteristics

Urban geology surveys conclude that the urban areas of Lao Cai town, Yen Bai town and Viet Tri cities are located along the Song Hong (Red River) fault zone, which shows evidence of strong activities during the neotectonic stage. The Red river metamorphic zone has been studied by many specialists including Tectonicians and Petrologists. Most geologists consider that it is an old metamorphic zone, from the Proterozoic age, which were reactivated during the Paleozoic, Mesozoic and Cenozoic ages. Tectonicians consider the Song Hong metamorphic zone as a multi-phase active fault zone and note the difference in geologic structure between the NW and SE regions of Vietnam.

Hydrologic and Climate characteristics

Yen Bai and Lao Cai are located in Vietnam's North-West climate region which is affected by mountainous topography. Typically, there is a considerable amount of rain, high moisture and quite low vaporization. The rainy season is generally between April and October, with particularly heavy rain in June, July and August. On average there are 132 rainy days. Typical weather statistics are summarized below :

- Annual average rainfall = 2,110mm.
- Annual average temperature = 23,8⁰C with a maximum of 32,7⁰C in June and minimum of 13,1⁰C in January.
- Annual relative moisture = 88%, with a maximum of 91% and a minimum of 85%.
- Wind direction is mainly northern west, at average speed of 1,6m/s, at max. speed of 20m/s.

The following annual weather data has been obtained from Yen Bai's observation station :

Table C.1: Climatic Conditions – Yen Bai

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Monthly average rainfall (mm) between 1915–1944 and 1957–1964</i>											
30,1	51,4	77,6	122,4	224,6	304,2	381,3	400,3	284,3	164,4	52,4	26,4
<i>Number of rainy days per month between 1915 – 1944 .and 1957 – 1964</i>											
9	12	15	15	13	13	16	17	12	9	6	6
<i>Monthly average vaporization (mm) between 1943 – 1944.and 1959 – 1964</i>											
40,8	33,2	37,4	47,6	77,7	75,6	65,5	61,2	64,5	64,4	54,1	45,8

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Average relative moisture per month (%) between 1942 – 1944.and 1957 - 1963</i>											
89	90	91	90	86	87	88	88	86	86	87	88
<i>Monthly average temperature (°C)</i>											
15,4	16,3	20,1	23,4	26,8	28,0	27,5	27,4	26,4	24,0	21,4	17,2

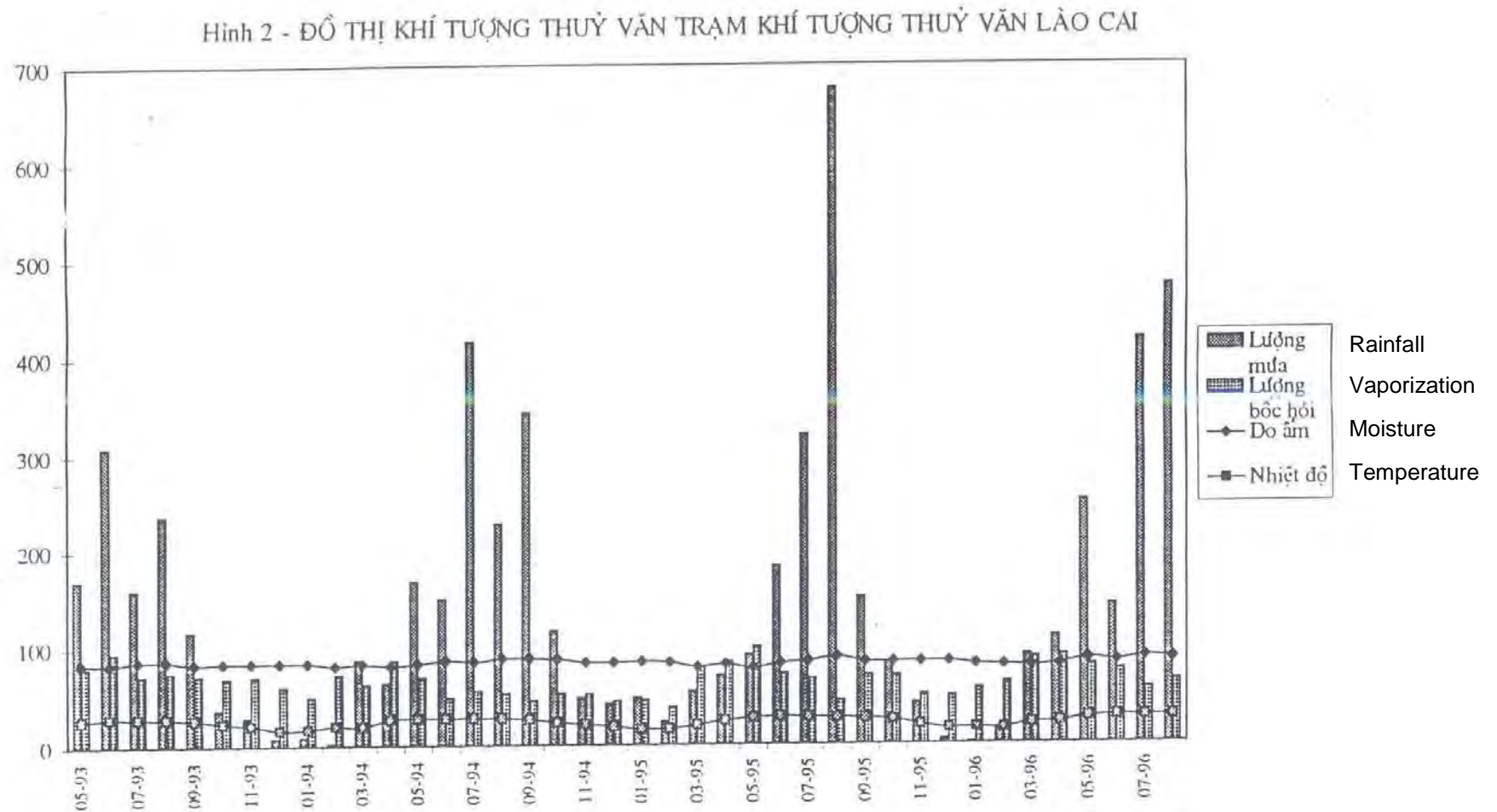
The records from Lao Cai's weather observation station, between 1993 and 1996, indicate that the water level was at its lowest level of 74,45m in May 1994 and at the highest level of 81,02m in August 1995. On average the water level generally varies between 5.45 and 6.40m. the maximum variation was 12,40 m in 1971. The minimum river flow is 90m³/s, and the maximum is 3,810m³/s. During the flood season (June to September) the river water is very opaque. Average sediment levels in the river are 5kg/m³ during the flood season and 150g/m³ in dry season.

The recorded water level (mm depth) in the Hong river (Red River) between 1993 and 1995 is summarized below:

Table C.2: Water Levels in the Red River

Month	1993			1994			1995		
	Hmin	Htb	Hmax	Hmin	Htb	Hmax	Hmin	Htb	Hmax
Jan		7521	7589	7489	7501	7538	7533	7529	7597
Feb		7518	7584	7472	7497	7579	7502	7549	7558
Mar	7460	7494	7522	7464	7484	7628	7476	7489	7502
Apr	7450	7491	7592	7453	7484	7571	7472	7508	7509
May	7470	7535	7699	7445	7533	7739	7466	7642	7642
Jun	7517	7575	7669	7511	7701	7990	7558	7621	7888
Jul	7540	7624	7717	7646	7751	7892	7608	7760	7989
Aug	7662	7705	7817	7675	7722	7989	7652	7821	8102
Sep	7635	7729	8007	7669	7718	7823	7732	7679	7882
Oct	7583	7605	7710	7588	7661	7735	7616	7676	7728
Nov	7543	7578	7683	7552	7575	7659	7602	7654	7794
Dec	7509	7516	7322	7548	7586	7662	7561	7509	7635

Figure C.1: Lao Cai Weather Station Records



Hydro-Geological Conditions

The route of the railway has a very complicated geological development history with the accumulation of thick sediments. Groundwater mostly occurs in tectonic and weathering fractures and some in the unconsolidated Quaternary sediments. Based on the water bearing capacity, hydrogeological and lithologic characteristics the following hydrogeological features can be identified.

Groundwater in Quaternary unconsolidated sediments (Q_{IV}) The water bearing formation is composed mainly of: unconsolidated cobbles, pebble, sand and alluvial, eluvial and deluvial clays with thickness varying between 2.5m and 8m. Pore spaces form within these sediments which collect groundwater during the rainy seasons. Water springs may then form. The water has pH value from 7 (neutral) to 5 (weakly acidic), and is commonly soft and medium hard.

The chemical composition of the groundwater is mainly of sodium-potassium hydrocarbonate-chloride and sodium-potassium chloride-hydrocarbonate types. The groundwater is mostly recharged by rain water infiltrating from the surface and from other water bearing units which are adjacent to it.

The groundwater in the Quaternary unconsolidated sediments offers limited capacity for water supply, but it is likely to affect engineering structures including the existing railway line.

Water bearing complex in the Triassic sediments (T) The water bearing sediments consist of quartz conglomerate, gravelite, sandstone, tuff, rhyolite tuff and silty sandstone. These deposits are strongly weathered and fractured. The occurrence of two joint systems in the rock (one perpendicular and the other one parallel with the bedding planes in the rocks) has created favorable conditions for increasing the water bearing capacity of the sediments. The well discharge rate reaches 0.1 – 0.2 l/s. The groundwater occurring in the silty sandstone formation usually has a discharge of 0.1 l/s. The water is generally clear, colorless, odorless, fresh tasting with a pH of 7 – 8, i.e. neutral to weakly alkaline. The total dissolved solid content is 0.05 – 0.2 g/l. The groundwater is recharged mainly by rainwater falling within the outcrop area and the water from the other adjacent water bearing units having hydraulic relationship with this water bearing complex.

Water bearing complex in the Carboniferous–Permian(C-P) and Devonian (D) sediments. The water bearing sediments are mainly limestone, sandstone and siltstone which are weathered and fractured. The discharge of wells varies between 0.2–0.3 l/s. The water is generally clear, colorless, odorless and fresh tasting. It is of calcium-sodium-potassium hydrocarbonate-chloride and calcium-sodium-potassium hydrocarbonate type. The pH value is 6–6.5, i.e. weakly acidic. The total dissolved solid content is 0.1 – 0.3 g/l. The groundwater is discharged into the local erosion network. It is recharged by rain water and the water from the adjacent hydraulically connected water bearing units.

Fractured water bearing complex in Proterozoic metamorphic rocks The water bearing rocks in this water bearing complex are composed of fractured clay schist and quartz-mica schist. The groundwater discharge is 0.01–0.10 l /s. The water is clear, colorless, odorless and fresh tasting. The pH value is 6–6.5 i.e. weakly acidic. In some places the springs have a pH of 8, i.e. weakly alkaline. The total dissolved solid content is less than 0.1 g/l. The groundwater is discharged into the local drainage network. It is recharged by rain water and the groundwater from adjacent water bearing units having a hydraulic relationship with this water bearing complex.

Table C.3: Average values of the physico-mechanical parameters for non-cohesive sedimentary soils

Soil groups	Soil type	Particle size distribution (P%)							Angle of repose		Maximum void ratio ε max	Minimum void ratio ε min	Compaction coefficient D
		>2 mm	2-1 mm	1-0.5 mm	0.5-0.25 mm	0.25-0.1 mm	0.1-0.05 mm	< 0.05 mm	Dry α (°)	Wet α (°)			
Alluvial	Gravelly sand	34	10	18	23	10	4	1					
	Fine sand			6	19	51	16	8					
	Medium sand	7	45	24	11	13			35	29	1.12	0.49	0.59
Marine	Silty sand			2	15	58	17	8	34	28	1.44	0.63	0.56
	Medium sand			2	53	25	14	6	35	30	1.28	0.54	0.57

Physico-Mechanical Characteristics of the Soils and Rocks

The soils and rocks occurring along the Yen Vien - Lao Cai railway line are very diversified and relatively complicated. The physico-mechanical parameters of the eluvial deluvial, alluvio-marine soils and some typical rocks along the railway line are summarized below.

Average values of physico-mechanical parameters of cohesive sedimentary soils in the mountainous areas.

Table C.4: Physico-Mechanical Parameters – Sedimentary Salts

Parameters	Average values	
	Clay	Sandy clay
Water content (w%)	28	24
Bulk density γ (g/m ³)	19	1.96
Dry density γ_d (g/m ³)	1.48	1.58
Specific gravity Δ	2.72	2.70
Porosity n%	46	42
Degree of saturation G%	90	80
Liquid limit W_L %	45	36
Plastic limit W_P %	26	23
Plasticity index $W_P - W_L$ %	19	13
Consistency B	0.11	0.08
Internal friction angle Φ (°)	17	22
Coherence C (Kg/cm ²)	0.5	0.37
Compressibility coefficient	0.26	0.21
Permeability coefficient K (cm/s)	2.3×10^{-7}	2.6×10^{-7}

Table C.5: Physico-Mechanical Parameters of Eluvial and Deluvial Cohesive Soils

Bedrock groups Parameters	Clastic		Clastic - maffic extrusive		Maffic extru- sive	Metamorphic		Bio- chemical (Lime- stone)
Water content %	24	21	32	17	37	31	25	39
Bulk density γ_w (g/m ³)	1.88	1.85	1.72	1.74	1.64	1.78	1.82	1.70
Dry density γ_c (g/m ³)	1.51	1.51	1.30	1.48	1.19	1.36	1.45	1.22
Specific gravity Δ	2.72	2.70	2.72	2.70	2.80	2.74	2.72	2.79
Degree of saturn G%	82	74	80	56	76	82	77	85
Liquid limit W_L %	47	40	52	37	56	54	211	58
Plastic limit W_P %	25	25	30	23	36	33	26	40
Plasticity index $W_L - W_P$ %	22	15	22	14	20	21	15	18
Consistency B	-0.07	-0.27	-0.09	-0.5	-0.07	-0.09	0.07	-0.05
Internal frict angle Φ (°)	19	2.2	19	23	20	20	22	23
Coherence C (Kg/cm ²)	0.5	0.29	0.39	0.20	0.30	0.38	0.21	0.38
Compressibility coefficient a_{1-2} (cm ² /Kg)	0.019	0.018	0.026	0.02	0.039	0.026	0.02	0.045

Table C.6: Average Values of Physico-Mechanical Parameters for Rocks

Rock type	Bulk density γ_w (g/m ³)	Dry density γ_c (g/m ³)	Porosity n%	Compressive strength R _n		Edh*10 ⁴ (Kg/cm ²)
				Dry (Kg/cm ²)	Saturated (Kg/cm ²)	
Granite	2.65 – 2.76	2.51 – 2.69	0.1 - 3	970 - 2307	570 - 790	25 - 70
Diorite	2.67 – 2.86	2.53 – 2.75	0.1 - 5	1050 - 2560	520 - 913	36 - 78
Gabbro	2.85 - 3.30	2.65 – 3.04	0.05 - 6	1340 - 3170	705 - 2380	63 - 117
Rhyolite	2.62 – 2.71	2.35 – 2.60	1.3 - 9	980 - 2560	591 - 750	34 - 72
Tuff	2.66 – 2.81	2.38 – 2.54	-	-	-	-
Quartzite	2.64 – 2.93	2.54 – 2.80	5 – 3.6	1613 - 3950	420 - 2080	40 - 90
Conglo- merate	2.62 – 2.70	2.44 – 2.56	4.2 – 10.9	350 - 1200	-	
Sandstone	2.64 – 2.73	2.31 – 2.65	1.6 - 15	470 - 1760	190 - 685	26 - 73
Siltstone	2.65 – 2.71	2.30 – 2.65	2 - 17	240 - 1500	-	-
Shale	2.69 – 2.80	2.43 – 2.58	2.4 - 11	274 - 1500	-	-
Claystone	2.68 – 2.74	2.28 – 2.50	5 - 20	50 - 900	-	-
Limestone	2.69 – 2.75	2.50 – 2.66	2.5 – 12.6	580 - 1920	198 - 1250	40 - 75

Engineering Geodynamic Phenomena and Processes in the Study Area

Many phenomena and processes along the railway line causing damaged to the railway track, resulting in service suspension or train speed reduction especially during the flood season.

According to the report of Vietnam Railway Corporation No 2896/DS – RPMU dated 01 December 2005, on the Yen Vien – Lao Cai railway line the following phenomena have occurred.

Landslides

Fifty two landslides have occurred in the three mountainous provinces (Phu Tho, Yen Bai and Lao Cai). Large landslides can affect thousands of cubic metres of material and endanger train safety. They may block the line or require the introduction of train speed limits.

Landslides are generally caused by rain collecting in the void spaces within soil and rocks. This increases the weight of the rock and soil masses on the hill top or slope. Once the soil becomes soft, weak and saturated with water the material's coherence and internal friction angle are reduced. When a train passes it produces vibrations, which may cause the rock and soil mass on the slope to become unstable, causing a landslide or collapse.

Subsidence or Heaving of Material has occurred at forty (40) locations along the railway. Fourteen of these were within the Vinh Phu railway management section and the other twenty-six in the Yen Lao section. The subsidence has extended up to four kilometers (e.g. Km 29+00 – Km 33+00)

The causes of the subsidence or heaving may include:

- The foundation material contains soil which shrinks or swells when it comes into contact with water,
- Poorly controlled compaction during the construction phase which results in uneven settlement,
- The alignment has been used for many years which may result in some surface sections becoming deformed and irregular,
- Due to the constant presence of groundwater, the subgrade is almost continuously soaked with water which affects the performance. When a train passes over the section concerned, a down ward force results in the soil heaving up on both sides of the track.

Gullies generally start at the top of slopes and run down to the valleys. The gullies are usually V-shaped and are generally formed by excessive rainwater collecting in the many depressions on the slope surface. Deforestation, when the vegetation cover on the slope is destroyed, increases the quantities of surface run-off and the amount of slope erosion.

River bank erosion occurs mainly on the two sides of the Red river during the flood season. During the flood, the water level and speed of river flow increase which destroys the river banks, particularly in the curved sections. This causes damage and instability to protective structures such as revetments and retaining walls.

Constant wetting of cut slopes and the subgrade can be observed in some areas. This is caused by a constant seepage of groundwater on the slope and accumulation of water in the drainage channel. The cut subgrade is subject to local subsidence in the areas concerned. This can occur all year due to the continued action of the groundwater.

Tract Flooding occurs in some filled sections of line. According to the report from the Vinh Phu Railway Management Company a 4 kilometre long section (between km 93+65 and km 98+65) can be affected particularly when heavy rain occurs. This can lead to flooding up to half a metre deep. Obstacles, such as bridges, prevent free and rapid drainage of the upstream waters which results in flooding of the tract.

Construction materials

The section from Viet Tri to Lao Cai passes through a mountainous area, therefore suitable filling material is abundant. This consists of mainly of eluvial - deluvial sediments: clay, sandy clay mixed with gravel and rubble. However the transportation of large quantities of these materials is relatively difficult due to access problems. It is recommended that the railway is used for mass transportation of materials whenever possible.

Large quantities of sand and gravel deposits can be found along both sides of the Red River. In particular two large **sand and gravel** deposits are being extracted at the following locations:

- Soi Lam sand deposit (Coordinates : 22°26'30" & 104°02'00")
- Giang Dong sand deposit (Coordinates : 22°27'43" & 104°00'30")

These two sand deposits have extensive good quality reserves. Conditions are favourable for rapid extraction and transportation of the material by land routes and also via the Red River. The shape and size of these sand and gravel deposits is variable due to river action. The sand and gravel are composed mainly of quartz with various particle sizes from coarse to fine.

The following **stone quarries** are currently being extracted along the Lao Cai to Viet Tri railway line:

- Son Vi limestone quarry, Phu Tho,
- Nui Song amphibolite and marble quarry, Phu Ninh, Phu Tho,
- Cam Duong limestone quarry (Coordinates 22°55'00" & 104°02'00"), and
- Coc Xan Dolomite Quarry (Coordinates 22°27'37" & 103°56'44")

The stones are being extracted to serve the construction projects in the area. These quarries have large reserves of good quality stone. Road transport is the best method of transporting the extracted material.

ANNEX D**Preliminary Design Details Concerning The Realignment Works****Table D.1: Realignment Design Detail**

Stations and Bridges	Start KM	End KM	Radius	Lcurve	Lstra.	Totals			Remarks
			(m)	(m)	(m)				
Co phuc St. Km 165+110									
	166+055	166+314			259	314			35m Overlap Existing
	166+314	166+628	200	314		314			
Tu mau culvert	Total			314	259	628	887		Tu mau Cul.- 16.0 Up
	167+109	167+267			158	158			
	167+267	167+486	200	219		219			
	167+486	167+550			64	64			
	167+550	167+811	200	261		261			
	167+811	167+881			70	70			
	167+881	168+170	200	289		289			
	168+170	168+215			45	45			
	168+215	168+385	200	170		170			
	168+385	168+429			44	44			
	168+429	168+705	200	276		276			
	168+705	168+777			72	72			
	168+777	169+100	200	323		323			
	169+100	169+120			20	216			196m Overlap Existing
	Total			1538	473		2,207		
	169+909	170+110	500	201		201			
	170+110	170+110	500	0		0			
	170+110	170+380			270	270			
	170+380	170+763	400	383		383			
	170+763	170+902			139	139			170+600~171+300
	170+902	171+151	300	249		249			Rail submerged 30cm
	171+151	171+193			42	42			
Dao thinh Br 171+414	171+193	171+409	200	216		216			Rotation
	Total			1049	451		1,500		
	172+336	172+376			40	40			
	172+376	172+628	400	252		252			
	172+628	173+007			379	379			
	173+007	173+207	250	200		200			
	173+207	173+300			93	93			
Thac thu Br 173+380	173+300	173+591	400	291		291			Thac Thu br.- 33.0 Up
	173+591	173+677			86	86			
	173+677	173+800	400	123		123			
	173+800	173+809			9	143			134m Overlap Existing
	Total			866	607		1,607		
Ngoi Hop St. Km 176+380								6,201	
	177+812	177+947	400	135		135			
	177+947	178+019			72	72			
	178+019	178+217	200	198		198			
	178+217	178+258			41	41			
	178+258	178+433	400	175		175			
	178+433	178+602			169	391			222m Overlap Existing
	Total			508	282		1,012		
	178+821	179+131	340	310		310			
	Total			310			310		
	179+496	179+641	250	145		145			
	179+641	179+692			51	51			
	179+692	179+895	200	203		203			
	179+895	179+971			76	109			33m Overlap Existing
	Total			348	127		508		
	180+000	180+215	200	215		215			
	180+215	180+288			73	73			
	180+288	180+481	200	193		193			
	180+481	180+527			46	46			
	180+527	180+655	400	128		128			
	Total			536	119		655		

	180+800	180+907			107	330		
Tay Br. - 181+119	180+907	181+180	250	273		273		Tay br.-Up 12.5m
	181+180	181+270			90	90		
	181+270	181+354	500	84		84		
1m Bridge	181+354	181+409			55	157		Rotation, 102m Overlap Existing
	Total			357	252		934	
	182+044	182+161	300	117		117		
	182+161	182+271			110	110		
	182+271	182+440	300	169		169		
	Total			286	110		396	
	184+844	184+955	300	111		111		
	184+955	185+111			156	156		
Nham Bridge	185+111	185+298	200	187		187		Nham Br - Down 18.4m
	185+298	185+333			35	35		
	185+333	185+577	250	244		244		
	185+577	185+626			49	49		
	185+626	185+900	300	274		274		
	185+900	186+005			105	105		
	Total			816	345		1,161	
Mau A St. km 186+593								4,976
Trai Hut St.km 201+582	201+229	201+238			9	60		51m Overlap Existing
	201+238	201+346	300	108		108		
Bom Nuoc Bridge	201+346	201+403			57	57		Bom Nuoc Br.-14.0m Up
	201+403	201+508	300	105		105		
	201+508	201+608			100	207		107m Overlap Existing
	Total			213	166		537	
	202+140	202+284	300	144		144		
	202+284	202+366			82	82		
	202+366	202+523	250	157		157		
	202+523	202+589			66	66		
	202+589	202+701	350	112		112		
	202+701	202+742			41	41		
	202+742	202+869	200	127		127		
Tran Bridge	202+869	202+895			26	226		Rotation Bridge, and 200m Overlap Existing
	Total			540	215		955	
Den Bridge	203+670	203+907	300	237		237		Den Br.-2m Down
	203+907	203+955			48	48		
	203+955	204+325	300	370		370		
	204+325	204+358			33	89		56m Overlap Existing
	Total			607	81		744	
	204+604	204+608			4	91		87m Overlap Existing
	204+608	204+951	500	343		343		
	204+951	204+990			39	395		365m Overlap Existing
	Total			343	43		829	
	205+363	205+518	300	155		155		
2m Br - 205+533 (new)	205+518	205+587			69	69		2m br. 13.7 m down
	205+587	205+704	300	117		117		
	Total			272	69		341	
	206+068	206+172	300	104		104		
	206+172	206+213			41	41		
Nuoc Chay Br - .206+334	206+213	206+371	200	158		158		Rotation
	206+371	206+402			31	53		22m Overlap Existing
	Total			262	72		356	
Lam Giang St. 210+000								3,762
Bao Ha St km 237+000	237+538	237+577			39	55		16m Overlap Existing
	237+577	237+726	1000	149		149		
	237+726	237+761			35	35		
	237+761	237+916	650	155		155		
Bao Ha Bridge	237+916	238+195			279	279		Bao Ha Br. - 10.5m Up
	238+195	238+446	300	251		251		
	238+446	238+600			154	154		
	238+600	238+757	650	157		157		
	238+757	238+887			130	146		16m Overlap Existing
	Total			712	637		1,381	
	239+240	239+272			32	47		
4m Bridge	239+272	239+470	300	198		198		4m Br. 10m Up
	239+470	239+510			40	198		158m Overlap Existing
	Total			198	72		443	

	239+970	240+176	300	206		206		
	240+176	240+715			539	539		
	240+715	240+943	300	228		228		
	Total			434	539		973	
	241+018	241+143	300	125		125		
	241+143	241+252			109	109		
	241+252	241+439	200	187		187		
	241+439	241+493			54	54		
Khoai Bridge	241+493	241+669	170	176		176		Rotation
	Total			488	163		651	
	241+749	241+858	200	109		109		
	241+858	241+930			72	72		
	241+930	242+080	300	150		150		
	242+080	242+112			32	32		
	242+112	242+252	250	140		140		
	242+252	242+680			428	573		145m Overlap Existing
	Total			399	532		1,076	
	243+587	243+736	200	149		149		
	243+736	243+774			38	38		
	243+774	243+928	200	154		154		
	Total			303	38		341	
	244+405	244+640	400	235		235		
	244+640	244+697			57	57		
	244+697	244+859	200	162		162		
	Total			397	57		454	
	245+452	245+579	200	127		127		
	245+579	245+619			40	40		
	245+619	245+746	200	127		127		
	Total			254	40		294	
Thai Van St. 247+450								5,613
Lang Giang St. 282+772	283+550	283+619			69	69		
Survey km 276- 295	283+619	283+764	300	145		145		
	283+764	283+820			56	56		
	283+820	283+938	400	118		131		
	283+938	284+078			140	224		84m Overlap Existing
	Total			263	265		625	
	284+183	284+338	300	155		155		
That Co Br. 284+388	284+338	284+398			60	60		That Co br. - 5.0 m Up
	284+398	284+544	200	146		47		
	284+544	284+624			80	80		
	284+624	284+749	300	125		32		
	284+749	284+856			107	107		
	Total			426	247		673	
	285+200	285+290			90	429		339m Overlap Existing
	285+290	285+478	500	188		188		
	Total			188	90		617	
	285+519	285+657	300	138		138		
	285+657	285+694			37	37		
	285+694	285+852	350	158		158		
	285+852	286+066			214	214		
	286+066	286+226	400	160		160		
	286+226	286+263			37	37		
	286+263	286+477	250	214		214		
	286+477	286+519			42	42		
	286+519	286+608	330	89		89		
	286+608	286+646			38	38		
Quynh Sum br 286+593	286+646	286+761	200	115		115		Rotation
	Total			874	368		1,242	

Vom br. 286+861	286+843	286+970			127	210		Vom br, 83m Overlap Existing
	286+970	287+106	500	136		136		
	287+106	287+130			24	197		173m Overlap Existing
	Total			136	127		543	
	287+511	287+662	500	151		151		
	287+662	287+793			131	131		
	287+793	288+001	400	208		208		
	288+001	288+031			30	124		94m Overlap Existing
	Total			359	131		614	
	288+131	288+249	300	118		81		
	288+249	288+294			45	120		
	288+294	288+407	350	113		107		
	Total			231	45		276	
	288+500	288+530			30	30		
	288+530	288+616	500	86		86		
	288+616	288+706			90	90		
Vom Br. - 288+732	288+706	288+802	500	96		185		Vom br. Down, 89m Overlap Existing
	Total			182	120		391	
	288+973	289+061	350	88		88		
	289+061	289+118			57	57		
	289+118	289+226	300	108		108		
	289+226	289+288			62	62		
	289+288	289+527	300	239		239		
	Total			435	119		554	
	289+665	289+892	500	227		227		
	289+892	289+941			49	49		
	289+941	290+050	350	109		109		
	290+050	290+077			27	135		108m Overlap Existing
	Total			336	76		520	
	290+764	290+789			25	129		104m Existing Overlap
	290+789	291+056	200	267		267		
	291+056	291+119			63	145		82m Existing Overlap
	Total			267	88		541	
	291+359	291+633	400	274		274		
	291+633	291+688			55	55		
	291+688	291+828	300	140		140		
	Total			414	55		469	
	291+957	292+121	200	164		164		
	292+121	292+179			58	58		
	292+179	292+317	250	138		138		
	Total			302	58		360	
Lao Cai St. 293+586							7,425	
Section Total							27,977	27,977

ANNEX E**Summary Of Existing Bridge Condition And Recommended Upgrade Works (Priority 1)**

Ref	Name	Location Km	Length (m)		Existing Status		Recommended Technical Intervention	
			Bridge	Girder	Superstructure	Substructure	Superstructure	Substructure
1	Vinh Chan	120+130	21.14	13.50	French girder. Strong corrosion	Hanoi abutment was destroyed during war and repaired after war from top of footing. Top of Lao Cai abutment was repaired.	Replacement of girder	Repairing bearing beds for new girder.
2	Ngoi Lanh	134+004	20.20	13.50	Temporary girder	Lao Cai abutment was destroyed by war and was repaired after the war from top of footing. Top of Hanoi abut was repaired. Mass foundations were used.	Replacement of girder	Repairing bearing beds for new girder.
3	Ngoi Hien	137+785	24.70	17.4	Temporary girder. Strong corrosion	Two abutments were displaced and damaged during the war. After the war they were reinforced by placing stone rip rap.	Replacement of girder	Repairing bearing beds for new girder.
4	Man	145+520	4.90	15.4	French girder. Strong corrosion	Not affected by the war. Clip joint of abutment masonry was weathered.	Replacement of girder	Sealing existing masonry cracks with mortar. Repairing bearing beds for new girder.
5	Ngoi Sen	145+950	26.58	17.30	Temporary girder. Strong corrosion	The bridge was completely destroyed in the war. Two abutments were repaired from top of footing. No scouring occurs.	Replacement of girder	Repairing bearing beds for new girder.
6	Van Phu	148+920	30.01	21.5	Temporary girder. Strong corrosion	Lao Cai abutment was destroyed during the war. Repaired by building temporary structures	Replacement of girder	Rebuilding the LaoCai abutment using the existing foundations to protect scouring

Ref	Name	Location Km	Length (m)		Existing Status		Recommended Technical Intervention	
			Bridge	Girder	Superstructure	Substructure	Superstructure	Substructure
7	Gia Da	152+494	21.12	11.25	Temporary girder. Strong corrosion	Hanoi abutment destroyed during war and moved towards the river (36cm). Diaphragm wall of Lao Cai abutment was damaged. After the war the wing wall of Hanoi abut was rebuilt and the diaphragm wall of Lao Cai abut was rebuilt	Replacement of girder	Rebuild Hanoi using the existing foundations.
8	Tuan Quan	152+550	31.66	26.50	Temporary girder. Strong corrosion	Hanoi abutment was destroyed in the war. A temporary one was constructed behind the old one	Replacement of girder	Rebuild Hanoi abutment using existing foundations
9	Nghia-Phuong	166+550	27.76	17.30	Temporary girder. Strong corrosion	French girder was replaced by a temporary one	Replacement of girder	Repairing bearing beds for new girder.
10	Dao Thinh	171+414	22.30	13.36	French girder. Strong corrosion	Not affected by war. The bridge becomes submerged under flood. The bridge needs to be elevated by 80 cm	Replacement of girder	The level of the two abutments will be elevated by 80cm
11	Thac Thu	173+380	12.82	4.70	French girder. Strong corrosion	Not affected by the war. The bridge needs to be relocated due to the planned realignment	New steel girder	New abutment required
12	Moc Tom	174+184	14.00	7.02	French girder. Strong corrosion	Not affected by the war.	Replacement of girder	Repairing bearing beds for new girder
13	Sung	177+176	29.95	13.28	Temporary girder. Strong corrosion	Hanoi abutment was destroyed. Repaired from top of footing. Lao Cai abutment is cracked	Replacement of girder	Rebuilding Hanoi abutment based on existing foundations. Lao Cai abutment to be sealed by mortar. Repair bearing beds
14	Dieu	179+304	38.44	17.30	Temporary girder. Strong corrosion	Not affected by the war. Abutment masonry deteriorated due to weathering. Cracks are present and scouring occurs	Replacement of girder	Seal abutment cracks with mortar and install reinforced concrete. Scour protection at Lao Cai side.
15	Tay	181+190	22.70	13.30	French girder. Strong corrosion	Not affected by the war	Replacement of girder	Repair bearing beds for new girder
16	Trang	183+150	35.57	22.70	Temporary girder. Strong corrosion	Two abutments repaired after war	Replacement of girder	Repair bearing beds for new girder

Ref	Name	Location Km	Length (m)		Existing Status		Recommended Technical Intervention	
			Bridge	Girder	Superstructure	Substructure	Superstructure	Substructure
17	Mang	183+960	34.02	17.30	Temporary girder. Strong corrosion	Not affected by the war. Abutment masonry has deteriorated due to weathering, cracks appear.	Replacement of girder	Seal existing cracks with mortar. Repair bearing beds for new girder
18	Khe Nham	185+262	18.90	9.20	French girder. Strong corrosion	Lao Cai abutment was destroyed. Repairs carried out at top of footing, Cracks appearing on Hanoi abutment	Replacement of girder	Seal cracks with mortar. Repair bearing beds for new girder
19	Mau A	188+050	33.84	21.42	French truss. Strong corrosion	Lao Cai abutment was damaged by a wartime bomb. Repaired by rubble and stone riprap behind abutment.	Replacement of girder	Reinforce Lao Cai abutment with concrete piles. Repair bearing beds for new girder
20	Khai	195+394	30.00	21.50	Temporary girder Strong corrosion	Hanoi abutment destroyed in the war. Repairs were carried out based on existing structure.	Replacement of girder	Repair bearing beds for new girder
21	Muoi	197+850	30.24	21.49	Temporary girder Strong corrosion	Two abutments were repaired after war. Scouring occurs	Replacement of girder	Repair bearing beds for new girder
22	Bom nuoc	201+635	19.40	9.20	Temporary girder Strong corrosion	Two abutments were destroyed. Repairs were carried out from the top of the footing	Replacement of girder	Repair bearing beds for new girder
23	Tran	203+150	20.16	9.22	French girder. Strong corrosion	Not affected by the war	Replacement of girder	Repair bearing beds for new girder
24	Den	204+064	20.11	9.22	French girder. Strong corrosion	Not affected by the war	Replacement of girder	Repair bearing beds for new girder
25	Tro	204+815	35.04	21.59	Temporary girder Strong corrosion	Hanoi abutment was destroyed Repaired from top of footing. Lao Cai abutment was damaged and the remained part repaired.	Replacement of girder	Repair bearing beds for new girder
26	Nuoc chay	206+630	10.00	7.00	French girder. Strong corrosion	Not affected by the war	Replacement of girder	Repair bearing beds for new girder
27	Trac	207+572	22.02	9.52	Temporary girder Strong corrosion	Lao Cai abutment was destroyed and a temporary one built. Partial repairs to Hanoi abutment.	Replacement of girder	Rebuild Lao Cai abutment and repair bearing on Hanoi abutment for new

Ref	Name	Location Km	Length (m)		Existing Status		Recommended Technical Intervention	
			Bridge	Girder	Superstructure	Substructure	Superstructure	Substructure
								girder.
28	Mang	208+210	33.06	21.82	French truss. Strong corrosion	Lao Cai abutment was destroyed, and repaired from the top of the footing. Hanoi abutment was damaged and repaired.	Replacement of girder	Rebuild Lao Cai abutment and repair bearing beds of Hanoi abutment for new truss
29	Khe Se	209+705	26.08	17.30	Temporary girder Strong corrosion	Not affected by the war.	Replacement of girder	Repair bearing beds for new girder. Scouring protection
30	Cai	212+540	38.58	28.25	Temporary girder Strong corrosion	Lao Cai abutment destroyed. Repaired from the top of footing. Hanoi abutment damaged and repaired..	Replacement of truss	Repair bearing beds for new girder
31	Phuc Minh	214+742	30.75	17.30	Temporary girder Strong corrosion	Hanoi abutment was destroyed in war then repaired from top of footing	Replacement of girder	Repair bearing beds for new girder
32	Khe But	218+846	23.12	13.22	French truss. Strong corrosion	Not affected by the war. Scouring occurs	Replacement of girder	Repair bearing beds for new girder. Install scour protection at both abutments
33	Lang Khay	220+139	31.02	21.59	Temporary girder Strong corrosion	Hanoi abutment was destroyed during war and rebuilt from the bottom of foundation. Lao Cai abutment was partially repaired. Scouring occurs	Replacement of girder	Repair bearing beds for new girder. Install scour protection at two abutments.
34	Lang Thip	228+030	33.99	21.79	Temporary girder Strong corrosion	Hanoi abutment destroyed during the war and repaired from the bottom of footing. Lao Cai abutment was repaired from the top of foundation level.	Replacement of girder	Repair bearing beds for new girder
35	Khe Den	231+530	18.11	9.2	Temporary girder Strong corrosion	Not affected by the war	Replacement of girder	Repair bearing beds for new girder
36	Bun	232+612	55.45	2x 21.60	Temporary girder Strong corrosion	Two abutments and pier destroyed. Both abutment repaired from top of footings. The majority	Replacement of girder	Rebuild new pier and Hanoi abutment. Repair Lao Cai

Ref	Name	Location Km	Length (m)		Existing Status		Recommended Technical Intervention	
			Bridge	Girder	Superstructure	Substructure	Superstructure	Substructure
						of the original pier remains.		abutment
37	Bao Ha	237+326	28.90	17.50	Temporary girder Strong corrosion	Hanoi abutment was destroyed and repaired from the top of footing. Some repairs to Lao Cai abutment.	Replacement of girder	Repair bearing beds for new girder
38	Meo	244+965	32.00	17.20	French truss. Strong corrosion	Not affected by the war	Replacement of truss	Repair bearing beds for new truss
39	Van	245+735	42.00	26.5	French truss. Strong corrosion	Not affected by the war	Replacement of truss	Repair bearing beds for new truss
40	Gia	249+004	32.00	21.40	French truss. Strong corrosion	Not affected by the war	Replacement of truss	Repair bearing beds for new truss
41	Nhai	250+412	47.80	26.40	French truss. Strong corrosion	Both the Hanoi and Lao Cai abutments were repaired after war. Scouring occurs	Replacement of truss	Repair bearing beds for new truss. Install scour protection
42	Chay	252+420	47.80	26.40	French truss. Strong corrosion	Hanoi and Lao Cai abutments were repaired after war. Scouring occurs	Replacement of truss	Repair bearing beds for new truss. Install scour protection
43	That Co	284+388	27.10	13.60	N/A	New bridge structure required due to realignment works	New girder	Construct new abutments and associated works
44	Quynh Sum	286+593	34.80	22.10	N/A	New bridge structure required due to realignment works	New girder	Construct new abutments and associated works
45	RC Culvert	288+732	15.8	15.8	N/A	New bridge structure required due to realignment works	New girder	Construct new abutments and associated works
46	RC Culvert	289+953	32.54	32.54	N/A	New bridge structure required due to realignment works	New girder	Construct new abutments and associated works

ANNEX F**Record Of Accidents On The Yen Vien – Lao Cai Railway: Jan 2002 – May 2006**

No.	Date	Start km	End km	Accid km	Location / Station		Reasons	Consequences				
					From	To		Stopping time/Delay of train(min.)	Loss in property	Injuries	Deaths	Total Casualty
	3-Dec-02	21.2	26.8	21.3	Dong Anh	Bac Hong	Crash	18/0	0	1	0	1
	18-Oct-03	26.8	33.2	27.8	Bac Hong	Thach Loi	Hit against a man	5/0	0	1	0	1
	24-Oct-02	26.8	33.2		Bac Hong	Thach Loi	Hit a motorized barrow	19/0	1	1	0	1
	24-Jan-02	39.0	39.0		Phuc Yen	Phuc Yen	Hit against a man driving his mortobike	37/9	0	1	0	1
9	15-Mar-03	47.5	47.5	47.5	Huong Canh	Huong Canh	Hit against an old person on the by-pass	0/12			1	1
	14-Mar-02	47.5	53.5		Huong Canh	Vinh Yen	A man rushed into train (suicide)	20/0	0	1	0	1
	17-Oct-03	47.5	53.5		Huong Canh	Vinh Yen	Hit against a man driving motorbike trying to pass by	15/78	0	1	0	1
	15-Aug-02	53.5	62.9		Vinh Yen	Huong Lai	Hit against a man	26/0	0	1	0	1
	20-Dec-02	53.5	62.9		Vinh Yen	Huong Lai	Hit against a motorized barrow	10/10	0	1	0	1
	9-May-02	62.9	62.9		Huong Lai	Huong Lai	Hit against a child	0/5	0	1	0	1
75	20-Nov-04	62.9	68.7	62.4	Huong Lai	Bach Hac	Crashed into a man on his motorbike crossing the railway	14/14	A motobike was broken		1	1
34	10-Feb-04	68.7	72.7	71.5	Bach Hac	Viet Tri	Run over a woman crossing the railway	16/0			1	1
	12-Dec-02	68.7	72.7	72.1	Bach Hac	Viet Tri	Crash	16/0	0	1	0	1
	22-Nov-03	68.7	72.7	72.8	Bach Hac	Viet Tri	Hit against a man	13/0	0	1	0	1
	23-Nov-02	68.7	72.7		Bach Hac	Viet Tri	Hit against 2 women driving on mortobike	18/0	0	0	2	2
	13-Jun-02	68.7	72.7		Bach Hac	Viet Tri	Hit against a man	10/0	0	1	0	1
	15-Dec-03	72.7	81.8	75.0	Viet Tri	Phu Duc	Hit against a man	24/1	0	1	0	1
	27-Dec-02	72.7	81.8	75.3	Viet Tri	Phu Duc	Hit against a motorbike	8/0	Motorbike damaged	1	0	1
	28-Sep-03	72.7	81.8		Viet Tri	Phu Duc	Hit against a woman	15/0	0	1	0	1
36	26-Mar-04	81.8	90.7		Phu Duc	Tien Kien	Hit against 3 man on a motorbike intentionally crossing the railway	70/0	A motorbike was broken	2	1	3
8	13-Mar-03	81.8	90.7	86.8	Phu Duc	Tien Kien	Hit against a man driving motorbike on the by-pass	12/0			1	1
	30-Mar-02	81.8	90.7		Phu Duc	Tien Kien	Hit against a boy	5/0	0	1	0	1
	30-Dec-02	81.8	90.7		Phu Duc	Tien Kien	Hit against a woman on her bike	8/0	Bike damaged	1	0	1
	30-Sep-03	81.8	90.7		Phu Duc	Tien Kien	Hit against a man driving motorbike trying to pass by	11/20	0	1	0	1
	27-May-02	90.7	99.2		Tien Kien	Phu Tho	Hit against 3 people on motorbike	13/0	0	1	2	3
	11-Apr-02	99.2	99.2		Phu Tho	Phu Tho	Hit against a woman	0/12	0	1	0	1
	19-Nov-02	108.2	118.2		Chi chu	Vu En	Hit against a man	50/162	0	1	0	1
	21-Dec-03	118.2	131.0	128.7	Vu En	Am Thuong		16/6	0	2	0	2

No.	Date	Start km	End km	Accid km	Location / Station		Reasons	Consequences				
					From	To		Stopping time/Delay of train(min.)	Loss in property	Injuries	Deaths	Total Casualty
11	6-Jul-05	131.0	140.5		Am Thuong	Doan Thuong	2 men on motorbike crossing the railway	20/20	A motobike was broken		2	2
	16-Oct-03	118.2	140.5		Vu En	Doan Thuong	Crashed into a motorized barrow trying to pass by	13/0	1	1	0	1
	6-Nov-03	140.5	148.4	142.1	Doan Thuong	Van Phu	Hit against a man	20/7	0	1	0	1
	22-Apr-02	140.5	148.4		Doan Thuong	Van Phu	Run over an old woman	15/0	0	0	1	1
5	23-Mar-06	154.9	154.9	154.9	Yen Bai	Yen Bai	A woman crashed herself into train	33/33			1	1
	9-Apr-02	155.6	165.1		Yen Bai	Co Phuc	Hit against a man	40/0	0	1	0	1
27	3-Nov-05	165.1	176.8	106.9	Co Phuc	Ngoi Hop	Hit against an old man crossing the railway	40/59			1	1
22	7-Jun-03	176.8	176.8	176.8	Ngoi Hop	Ngoi Hop	Hitting against a 80 year old man	0/80			1	1
	26-Jan-02	176.8	186.6		Ngoi Hop	Mau A	Hit against a man	5/0	0	1	0	1
	4-Jul-02	176.8	186.6		Ngoi Hop	Mau A	A man fell out of the train	25/04	0	1	0	1
	24-Jul-02	186.6	194.8		Mau A	Mau Dong	Crashed into a child	21/0	0	0	1	1
	29-Jan-02	186.6	194.8		Mau A	Mau Dong	Hit against a man	20/0	0	1	0	1
	5-Jul-02	194.8	194.8		Mau Dong	Mau Dong	Hit against a woman	0/15	0	1	0	1
	7-Nov-02	194.8	201.8		Mau Dong	Trai Hut	Hit against a man	12/22	0	1	0	1
39	16-Apr-04	201.8	210.0	209.5	Trai Hut	Lam Giang	Hit against 2 man crossing the railway	10/107		1	1	2
72	5-Nov-04	210.0	218.8	215.5	Lam Giang	Lang Khay	Crashed into a woman crossing the railway	39/39			1	1
	9-Oct-03	218.8	227.8		Lang Khay	Lang Thip	Hit against a man	50/66	0	1	0	1
	15-Nov-03	227.8	237.0	231.7	Lang Thip	Bao Ha	Hit against an old person	20/0	0	1	0	1
18	25-May-03	237.0	237.0	237.0	Bao Ha	Bao Ha	Hit against a man	0/33		1	1	2
24	23-Jun-03	237.0	247.5	245.8	Bao Ha	Thai Van	Hit against a woman	43/43			1	1
29	14-Dec-05	247.5	261.7	253.7	Thai Van	Pho Lu	Hit against a farmer and his cow	13/13	A cow was died		1	1
25	19-Oct-05	247.5	261.7	256.8	Thai Van	Pho Lu	Hit against a man lying on the railway	85/210			1	1
	4-Sep-03	261.7	261.7	261.5	Pho Lu	Pho Lu	Hit against a pedestrian	0/27	0	1	0	1
10	17-Mar-03	261.7	270.2		Pho Lu	Lang	Hit against an old person and a child along the by-pass	46/6		1	1	2
	23-Dec-02	261.7	270.2		Pho Lu	Lang	Hit against a person	0/0	0	1	0	1
	3-Dec-03	261.7	272.8	263.6	Pho Lu	Xuan Giao	Hit against an old person	20/0	0	1	0	1
24	3-Oct-05	282.8	282.8	293.5	Lang Giang	Lao Cai	Hit against to an old man crossing the railway	23/23			1	1
5	1-Mar-03	277.3	293.5		Thai Nien	Lang Giang	Run over a woman	4/0			1	1
									Totals	41	25	66

ANNEX G**Cost Estimates For Each Proposed Work Element**

NEW RAIL - ESTIMATED UNIT PRICE FOR 1 Km TYPE P50 AND PRESTRESSED CONCRETE SLEEPER					
NO	ITEM	UNIT	QUANTITY	UNIT	AMOUNT (VND)
	Superstructure				
1	Construction of 1m gauge, railP50-25m - upgrading	km	1		
1	Materials				3,249,671,947
	Soil filling	m3	1,563.0	54,000	84,402,000
	Subballast	m3	1,320.0	200,177	264,233,640
	Ballast	m3	900.0	193,922	174,529,800
	P50 rail, L=25m	bar	80.0	19,285,231	1,542,818,480
	Prestress concrete sleeper + fastenings	bar	1,600.0	806,364	970,182,400
	Connecting point	pair	81.0	642,102	52,010,262
	Connecting screw	pc	486.0	13,887	6,749,082
	Other materials	%	5 %	3,094,925,664	154,746,283
2	Workman				547,805,868
	Demolition of the existing sleepers and rails	m	575.0	63,363	36,433,725
	Excavating the existing balast to manually sieve	m3	2,607.0	52,844	137,764,308
	Manually excavating soil and ballast embankment	m3	1,502.0	52,844	79,371,688
	Sieving ballast for 50% reusage	m3	1,200.0	52,844	63,412,800
	Manually filling embankment	m3	1,027.2	52,844	54,281,357
	Subballast filling	shift	662.7	63,363	41,990,660
	Construction of ballast	shift	822.0	63,363	52,084,386
	Installing rail	shift	1,301.5	63,363	82,466,945
	Cost (T)				3,797,477,816
	Other costs (TT) = (T) * 1.5%				56,962,167
	Amount (T) = (TT) + (T)				3,854,439,983
	General cost (C) = 5.3% T				204,285,319
	Cost price (Z) = (T) + (C)				4,058,725,302
	Income before tax (TL) = 6% Z				243,523,518
	Construction value before tax (G) = (Z) + (TL)				4,302,248,820
	Costruction value after tax = (G) + (G)*10%				4,732,473,702
	Construction cost = Construction value after tax(1 + 2%)				4,827,123,176
	Difficult factor = construction cost x 30%				1,448,136,953
	Estimated Construction Cost				6,275,260,129

DUAL GAUGE CONSTRUCTION - 1 Km LENGTH P50-25m - DUAL CONCRETE SLEEPER					
NO	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT (VND)
	1 km dual gauge track				
1	Materials				4,426,275,288
	Rail	bar	120	15,083,426	1,810,011,120
	Concrete sleeper + fastenning	bar	1,616	970,000	1,567,520,000
	Connecting point	couple	122	642,010	78,325,220
	Ballast	m3	1,200	193,922	232,706,400
	Other materials	%	20 %	3,688,562,740	737,712,548
2	Manwork				202,614,990
	Installing track	shift	1,882.5	54,972	122,309,790
	Ballast	m3	1,200.0	86,921	80,305,200
	Direct cost (T)				4,628,890,278
	Other direct cost (TT) = (T) * 1.5%				69,433,354
	Total amount of direct cost (T) = (TT) + (T)				4,698,323,632
	General cost (C) = 5.3% T				249,011,153
	Cost price (Z) = (T) + (C)				4,947,334,785
	Income before tax (TL) = 6% Z				296,840,087
	Construction value before tax (G) = (Z) + (TL)				5,244,174,872
	Construction value after cost = (G) + (G)*10%				5,768,592,359
	Construction cost = Construction value after tax (1 + 2%)				5,883,964,206
	Difficult factor = Construction cost x 30%				1,765,189,262
	Estimated Construction Cost				7,649,153,468

ESTIMATED COST OF NEW (REALIGNED) EMBANKMENT					
NO	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT (VND)
	Embankment				
	New realigned embankment	km	9.046		
1	Excavating soil level, 30% manually	m3	50,170	67,798	3,401,425,660
2	Excavating soil level 3, 70% by machine	m3	117,064	12,007	1,405,587,448
3	Filling soil level, 30% manually	m3	41,416	110,252	4,566,196,832
4	Filling soil level 3, 70% by machine	m3	96,638	11,813	1,141,584,694
5	Purchasing soil, transporting to site by 7-tons truck within 20km distance (30% of quantity)	m3	24,550	54,000	1,325,700,000
6	Purchasing soil, transporting to site by train within 30km average distance (70% of quantity)	m3	57,284	44,000	2,520,496,000
	Cost (T)				14,360,990,634
	Other costs (TT) = (T) * 1.5%				215,414,860
	Amount (T) = (TT) + (T)				14,576,405,494
	General cost (C) = 5.3% T				772,549,491
	Cost price (Z) = (T) + (C)				15,348,954,985
	Income before tax (TL) = 6% Z				920,937,299
	Construction value before tax (G) = (Z) + (TL)				16,269,892,284
	Construction value after tax = (G) + (G)*10%				17,896,881,512
	Construction cost = Construction value after tax(1 + 2%)				18,254,819,142
	Difficult factor = construction cost x 30%				5,476,445,743
	Estimated Construction Cost				23,731,264,885
Remark: - Reusing 40% of excavated soil to fill: 40% x 167,234m ³ = 66,894m ³ → Purchased soil = 71,160 x 1.15 = 81,834m ³ - Transporting purchased soil by 02 means of transport: By truck (30%) = 24,550m ³ By train (70%) = 57,284m ³					

ESTIMATED COST FOR EMBANKMENT PROTECTION						
Code	Item	Quantity (m)		Unit Price for 10m length	Amount (VND)	
		Priority 1	Priority 2		Priority 1	Priority 2
DR01	Surface drainage by vertical ditch	0	2,420	8,834,012	0	2,137,830,961
DR02	Deep drainage ditch	1,500	4,550	23,746,087	3,561,913,097	10,804,469,727
DR03	Deep drainage solution	500	0	455,734,248	22,786,712,378	0
SH01	Protection of slope and embankment shoulder - SH01	0	1,200	16,035,281	0	1,924,233,685
SH02	Protection of slope and embankment shoulder - SH02	0	150	117,638,303	0	1,764,574,539
SH03	Protection of slope and embankment shoulder - SH03	200	0	75,078,077	1,501,561,546	0
PF01	River bank slope protection	2,400	2,400	171,418,712	41,140,490,994	41,140,490,994
SL01	Slope protection by anchor	600	3,920	194,300,946	11,658,056,737	76,165,970,679
	Total				80,648,734,752	133,937,570,586

ALTERNATIVE DR01 - SURFACE DRAINAGE BY VERTICAL DITCH (10M LENGTH) - REF. DR01										
Code	Item	Unit	Quantity	Unit Price			Combination Price			Amount (Combination Price x (1+1.5%))
				Material	Labor	Machine	Material	Labor	Machine	
	Macadam	m3	1.20	194,000	30,509		232,800	36,611		273,452
	Mortar Stone Cement M100 *	m3	7.48	218,406	92,328		1,633,677	690,613		2,359,155
	Soil Excavation	m3	15.00		57,327		0	859,905		872,804
	Back Filling k=0.95	m3	7.50	103,000	30,509		772,500	228,818		1,016,337
	Construction Amount (20% total)									304,349
				Total Cost (T) =						5,426,097
				General Cost (C) = (T) x 5.3% =						287,583
				Total (Z) = (T) + (C) =						5,713,680
				Income before tax (TL) = (Z) x 6% =						342,821
				Construction Value before tax (G) = (Z) + (TL) =						6,056,501
				VAT = (G) x 10% =						605,650
				Construction Estimation after tax (G_{xd}) = (G) + VAT =						6,662,151
				Construction Estimation = (G_{xd}) + (G_{xd}) x 2% =						6,795,394
				Difficulty Factor = Construction Estimation x 0.3 =						2,038,618
				Cost Estimate = Construction Estimation + Difficulty Factor						8,834,012

UNDERGROUND DRAINAGE - REF DR02										
Code	Item	Unit	Quantity	Unit Price			Combination Price			Amount (Combination Price x (1+1.5%))
				Material	Labor	Machine	Material	Labor	Machine	
	Pile Culvert D30 (temporary)	m	10.00	90,000			900,000	0	0	913,500
	Concrete M200 [#]	m3	1.20	400,942	129,591	109,954	481,130	155,509	131,945	780,113
	Concrete M150 [#]	m3	0.60	421,967	63,044	12,179	253,180	37,826	7,307	302,789
	Rock 3 - 6cm	m3	9.00	194,000	63,343		1,746,000	570,087	0	2,350,828
	Geotextile	m2	60.00	55,000			3,300,000	0	0	3,349,500
	Mortar Stone Cement M100 [#]	m3	7.48	218,406	92,328		1,633,677	690,613	0	2,359,155
	Soil Excavation	m3	20.00		57,327		0	1,146,540	0	1,163,738
	Construction Amount (30% total)									3,365,887
Total Cost (T) =										14,585,510
General Cost (C) = (T) x 5.3% =										773,032
Total (Z) = (T) + (C) =										15,358,542
Income before tax (TL) = (Z) x 6% =										921,513
Construction Value before tax (G) = (Z) + (TL) =										16,280,054
VAT = (G) x 10%										1,628,005
Construction Estimation after tax (G _{XD}) = (G) + VAT =										17,908,060
Construction Estimation = (G _{XD}) + (G _{XD}) x 2% =										18,266,221
Difficulty Factor = Construction Estimation x 0.3										5,479,866
Cost Estimate = Construction Estimation + Difficulty Factor										23,746,087

UNDERGROUND DRAINAGE COMBINED WITH SURFACE DRAINAGE (10M TYPICAL LENGTH) - REF. DR03										
Code	Item	Unit	Quantity	Unit Price			Combination Price			Amount (Combination Price x (1+1.5%))
				Material	Labor	Machine	Material	Labor	Machine	
	Pile Culvert D30 (temporary)	m	345.00	90,000			31,050,000	0	0	31,515,750
	Concrete M200 [#]	m3	12.00	400,942	129,591	109,954	4,811,304	1,555,092	1,319,448	7,801,132
	Concrete M150 [#]	m3	6.00	421,967	63,044	12,179	2,531,802	378,264	73,074	3,027,887
	Macadam at top of culvert (3 - 6cm)	m3	280.00	194,000	63,343		54,320,000	17,736,040	0	73,136,881
	Geotextile	m2	1,000.00	55,000			55,000,000	0	0	55,825,000
	Mortar Stone Cement M100 [#]	m3	75.00	218,406	92,328		16,380,450	6,924,600	0	23,654,626
	Soil Excavation	m3	350.00		57,327		0	20,064,450	0	20,365,417
	Construction Amount (30% total)									34,598,008
Total Cost (T) =										279,924,699
General Cost (C) = (T) x 5.3% =										14,836,009
Total (Z) = (T) + (C) =										294,760,708
Income before tax (TL) = (Z) x 6% =										17,685,643
Construction Value before tax (G) = (Z) + (TL) =										312,446,351
VAT = (G) x 10%										31,244,635
Construction Estimation after tax (G _{XD}) = (G) + VAT =										343,690,986
Construction Estimation = (G _{XD}) + (G _{XD}) x 2% =										350,564,806
Difficulty Factor = Construction Estimation x 0.3										105,169,442
Total Cost Estimation = Construction Estimation + Difficulty Factor										455,734,248

ESTIMATED COST FOR STRENGTHENING AND WIDENING OF EMBANKMENT (10M) - REF SHO1										
Code	Item	Unit	Quantity	Unit Price			Combination Price			Amount (Combination Price x (1+1.5%))
				Material	Labor	Machine	Material	Labor	Machine	
AB11713	Soil Excavation + Transportation	m3	24.75		57,327		0	1,418,843	0	1,440,126
AB13313	Back Filling (purchase + transportation) k = 0.95	m3	11.32	103,000	30,509		1,165,960	345,362	0	1,533,992
	Macadam	m3	0.66	194,000	30,509		128,040	20,136	0	150,399
AE11923	Mortar Stone M100 [#]	m3	3.30	218,406	92,328		720,740	304,682	0	1,040,804
AG11112	Concrete M200 [#]	m3	8.25	399,878	60,137	22,737	3,298,994	496,130	187,580	4,042,445
	Construction Amount (20% total)									1,641,553
Total Cost (T) =										9,849,317
General Cost (C) = (T) x 5.3% =										522,014
Total (Z) = (T) + (C) =										10,371,331
Income before tax (TL) = (Z) x 6% =										622,280
Construction Value before tax (G) = (Z) + (TL) =										10,993,611
VAT = (G) x 10%										1,099,361
Construction Estimation after tax (G _{XD}) = (G) + VAT =										12,092,972
Construction Estimation = (G _{XD}) + (G _{XD}) x 2% =										12,334,831
Difficulty Factor = Construction Estimation x 0.3										3,700,449
Cost Estimate = Construction Estimation + Difficulty Factor										16,035,281

ESTIMATED COST FOR STRENGTHENING AND WIDENING OF EMBANKMENT (10M) - REF SH02										
Code	Item	Unit	Quantity	Unit Price			Combination Price			Amount (Combination Price x (1+1.5%))
				Material	Labor	Machine	Material	Labor	Machine	
AB11713	Soil Excavation + Transportation	m3	5.00		57,327		0	286,635	0	290,935
AB13313	Back Filling (purchase + transportation) k = 0.95	m3	5.00	103,000	30,509		515,000	152,545	0	677,558
	Concrete M250 [#]	m3	2.75	453,468	60,137	22,737	1,247,037	165,377	62,527	1,497,065
	Driving old rail pile P43, pile length = 6m	pile	40.00	1,339,500	60,137	22,737	53,580,000	2,405,480	909,480	57,748,384
	Construction Amount (20% total)									12,042,788
				Total Cost (T) =						72,256,730
				General Cost (C) = (T) x 5.3% =						3,829,607
				Total (Z) = (T) + (C) =						76,086,337
				Income before tax (TL) = (Z) x 6% =						4,565,180
				Construction Value before tax (G) = (Z) + (TL) =						80,651,517
				VAT = (G) x 10%						8,065,152
				Construction Estimation after tax (G _{XD}) = (G) + VAT =						88,716,669
				Construction Estimation = (G _{XD}) + (G _{XD}) x 2% =						90,491,002
				Difficulty Factor = Construction Estimation x 0.3						27,147,301
				Cost Estimate = Construction Estimation + Difficulty Factor						117,638,303

ESTIMATED COST FOR STRENGTHENING AND WIDENING OF EMBANKMENT (10M) - REF SH03										
Code	Item	Unit	Quantity	Unit Price			Combination Price			Amount (Combination Price x (1+1.5%))
				Material	Labor	Machine	Material	Labor	Machine	
	Concrete Pile M300 [#]	m3	7.20	592,392	115,838	24,698	4,265,222	834,034	177,826	5,356,238
	Concrete Pile M250 [#]	m3	8.75	453,468	30,137	22,737	3,060,909	405,925	153,475	3,674,613
	Using old rail P43, pile length = 3m	pile	25.00	869,750	30,068		16,743,750	751,700	0	17,757,882
	Cobble Stone	m3	34.00	150,000			5,100,000	0	0	5,176,500
	Rock Gabion	pc	25.00	125,000			3,125,000	0	0	3,171,875
	Soil Excavation	m3	10.00		57,327		0	573,270	0	581,869
	Back Filling k=0.95	m3	20.00	103,000	30,509		2,060,000	510,180	0	2,710,233
	Construction Amount (20% total)									7,685,842
				Total Cost (T) =						46,115,051
				General Cost (C) = (T) x 5.3% =						2,444,098
				Total (Z) = (T) + (C) =						48,559,149
				Income before tax (TL) = (Z) x 6% =						2,913,549
				Construction Value before tax (G) = (Z) + (TL) =						51,472,698
				VAT = (G) x 10%						5,147,270
				Construction Estimation after tax (G _{XD}) = (G) + VAT =						56,619,968
				Construction Estimation = (G _{XD}) + (G _{XD}) x 2% =						57,752,367
				Difficulty Factor = Construction Estimation x 0.3						17,325,710
				Cost Estimate = Construction Estimation + Difficulty Factor						75,078,077

COST ESTIMATE FOR 10M REVETMENT DRIVING RAIL CONCRETE PILE - REF PF01										
Code	Item	Unit	Quantity	Unit Price			Combination Price			Amount (Combination Price x (1+1.5%))
				Material	Labor	Machine	Material	Labor	Machine	
AB11713	Foundation Excavation + Transportation	m3	10.00		57,327		0	573,270	0	581,869
AB13313	Back Filling (purchase + transportation) k = 0.95	m3	10.00	103,000	30,609		1,030,000	306,090	0	1,356,131
	Sand layer	m3	0.50	120,000	30,509		60,000	15,255	0	76,383
	Macadam	m3	3.75	194,000	30,509		727,500	114,409	0	854,537
AE11923	Mortar Stone M100 [#]	m3	30.50	218,406	92,328		6,661,383	2,816,004	0	9,619,548
AE12120	Cobble Rock put into toe of slope	m3	30.00	177,000	55,853		5,310,000	1,675,590	0	7,090,374
	Plastic pile D50	m	10.00	7,000			70,000	0	0	71,050
	Geotextile	m2	20.00	50,000			1,000,000	0	0	1,015,000
	Old rail (221m)	kg	9,868.00	5,000			49,340,000	0	0	50,080,100
AG11114	Rail pile concrete M300	m3	15.61	488,316	60,137	22,737	7,622,613	938,739	354,925	9,050,020
AG11113	Pile platform concrete M250	m3	2.50	453,468	60,137	22,737	1,133,670	150,343	56,843	1,360,968
AF42114	Concrete pad M100	m3	0.50	252,838	14,863	31,782	126,419	7,432	15,891	151,988
	Steel of different types	kg	275.50	7,500	15,000		2,066,250	4,132,500	0	3,291,731
	Steel welding h = 6mm	m	7.00	5,000	15,000		35,000	105,000	0	142,100
	Construction Amount (20% total)									17,548,360
				Total Cost (T) =						105,290,159
				General Cost (C) = (T) x 5.3% =						5,580,378
				Total (Z) = (T) + (C) =						110,870,538
				Income before tax (TL) = (Z) x 6% =						6,652,232
				Construction Value before tax (G) = (Z) + (TL) =						117,522,770
				VAT = (G) x 10%						11,752,277
				Construction Estimation after tax (G _{XD}) = (G) + VAT =						129,275,047
				Construction Estimation = (G _{XD}) + (G _{XD}) x 2% =						131,860,548
				Difficulty Factor = Construction Estimation x 0.3						39,558,164
				Total Cost Estimation = Construction Estimation + Difficulty Factor						171,418,712

DETAILED ESTIMATION COST FOR 10M REVETMENT - REF SL01										
Code	Item	Unit	Quantity	Unit Price			Combination Price			Amount (Combination Price x (1+1.5%))
				Material	Labor	Machine	Material	Labor	Machine	
AB11713	Foundation Excavation + Transportation	m3	5.00		57,327		0	286,635	0	290,935
AB13313	Back Filling (purchase + transportation) k = 0.95	m3	5.00	103,000	30,509		515,000	152,545	0	677,558
AG11113	Concrete M250	m3	0.22	453,468	60,137	22,737	99,763	13,230	5,002	119,765
	Macadam	m3	5.50	194,000	30,509		1,067,000	167,800	0	1,253,321
AE11923	Mortar Stone M100 [#]	m3	18.00	218,406	92,328		3,931,308	1,661,904	0	5,677,110
AE11112	Frame concrete M200	m3	4.00	399,878	60,137	22,737	1,599,512	240,548	90,948	1,959,973
	Reinforce processing D6, D10	kg	611.00	7,500	15,000		4,582,500	9,165,000	0	13,953,713
	Reinforce processing D22, L = 5m	kg	224.00	9,000	17,000		2,016,000	3,808,000	0	5,911,360
AL51110	Boring hole for deeply concrete injection ≤ 10m	m	160.00		57,884	370,752	0	9,261,440	59,320,320	69,610,486
	Construction Amount (20% total)									19,890,844
				Total Cost (T) =						119,345,066
				General Cost (C) = (T) x 5.3% =						6,325,288
				Total (Z) = (T) + (C) =						125,670,354
				Income before tax (TL) = (Z) x 6% =						7,540,221
				Construction Value before tax (G) = (Z) + (TL) =						133,210,576
				VAT = (G) x 10%						13,321,058
				Construction Estimation after tax (G _{XD}) = (G) + VAT =						146,531,633
				Construction Estimation = (G _{XD}) + (G _{XD}) x 2% =						149,462,266
				Difficulty Factor = Construction Estimation x 0.3						44,838,680
				Cost Estimate = Construction Estimation + Difficulty Factor						194,300,946

ESTIMATED COST OF CHAY BRIDGE CONSTRUCTION (KM 252+420)					
NO	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT
I. Superstructure					
1	Steel girder	ton	38.52	43,773,668	1,686,030,370
2	Plugging girder	m	21.70	2,421,463	52,545,747
3	Shifting girder	m	21.70	377,531	8,192,423
4	Lifting and putting down girder	m	21.70	284,854	6,181,332
5	Bearing of steel girder	pc	4.00	25,262,571	101,050,284
6	Ballast concrete M300	m3	17.50	2,152,855	37,674,963
7	Putting rail on the bridge	km	0.025	3,500,000,000	87,500,000
8	Construction of substructure (20% substructure)				395,835,024
II. Substructure					
1	Concrete M250 [#]	m3	95.50	804,513	76,830,992
2	Concrete M200 [#]	m3	10.50	685,473	7,197,467
3	Cement mortar M100 [#]	m3	4.00	548,868	2,195,472
4	Rock constructed by mortar M100 [#]	m3	90.00	551,988	49,678,920
5	Rock with mortar line M100 [#]	m3	420.00	323,585	135,905,700
6	Macadam levelling	m3	130.00	183,000	23,790,000
7	Excavated soil	m3	100.00	95,040	9,504,000
8	Filled soil	m3	100.00	137,505	13,750,500
9	Demolition of the existing concrete	m3	35.00	114,048	3,991,680
10	Rail pile P24-5m	pile	90.00	110,240	9,921,600
11	Construction of substructure (10% substructure)				33,276,633
III. Railway in two ends of bridge					
1	Re-installing railway in two ends of bridge	km	0.05	4,500,000,000	225,000,000
2	Construction of railway in two ends of bridge (5% railway in two ends of bridge)				11,250,000
IV. Difficult factor (30% of total)					
Total					3,870,494,037

ESTIMATED COST OF DAO THINH BRIDGE (KM 171+414)					
NO	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT
I. Superstructure					
1	Steel girder	ton	11.425	43,773,668	500,114,157
2	Plugging girder	m	13.28	2,421,463	32,157,029
3	Shifting girder	m	13.28	377,531	5,013,612
4	Lifting and putting down girder	m	13.28	284,854	3,782,861
5	Steel bearing	pc	4.00	25,262,571	101,050,284
6	Ballast concrete M300	m3	25.00	2,152,855	53,821,375
7	Putting rail on the bridge	km	0.025	3,500,000,000	87,500,000
8	Construction of substructure (20% substructure)				156,687,863
II. Substructure					
1	Concrete M250 [#]	m3	75.00	804,513	60,338,475
2	Concrete M200 [#]	m3	10.50	685,473	7,197,467
3	Cement mortar M100 [#]	m3	5.00	548,868	2,744,340
4	Rock constructing with mortar M100 [#]	m3	85.00	551,988	46,918,980
5	Rock with mortar line M100 [#]	m3	360.00	323,585	116,490,600
6	Macadam levelling	m3	130.00	183,000	23,790,000
7	Excavated soil	m3	50.00	95,040	4,752,000
8	Demolition of the existing concrete	m3	40.00	114,048	4,561,920
9	Rail pile P24-5m	pile	64.00	110,240	7,055,360
10	Construction of substructure (10% substructure)				27,384,914
III. Railway in two ends of bridge					
1	Excavating total embankment in two ends of bridge	m3	275.00	95,040	26,136,000
2	Filling embankment	m3	565.00	137,505	77,690,325
3	Subbase	m3	75.00	190,089	14,256,675
4	Re-installing railway in two ends of bridge	km	0.05	4,500,000,000	225,000,000
5	Construction of railway in two ends of bridge (10% railway in two ends of bridge)				34,308,300
IV. Difficult factor (30% of total)					
					485,625,761
Total					2,104,378,297

ESTIMATED COST OF LY BRIDGE (KM 225+170)					
NO	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT
	I. Superstructure				
1	Steel girder	ton	32.54	43,773,668	1,424,395,157
2	Plugging girder	m	17.60	2,421,453	42,617,573
3	Shifting girder	m	17.60	337,531	5,940,546
4	Lifting and putting down girder	m	17.60	284,854	5,013,430
5	Steel bearing	pc	4.00	25,262,571	101,050,284
6	Ballast concrete M300 [#]	m ³	16.49	2,152,855	35,500,579
7	Putting rail on the bridge (wooden sleeper)	km	0.05	3,500,000,000	175,000,000
8	Construction of substructure (30% substructure)				536,855,271
	II. Substructure				
1	Concrete M250 [#]	m ³	12.94	804,513	10,410,398
2	Concrete M200 [#]	m ³	2.10	685,473	1,439,493
3	Cement mortar M100 [#]	m ³	4.13	548,868	2,266,825
4	Rock paving without mortar	m ³	170.00	323,585	55,009,450
5	Rock constructed by mortar M100 [#]	m ³	115.00	551,988	63,478,620
6	Macadam levelling	m ³	55.00	183,000	10,065,000
7	Excavated soil	m ³	275.18	95,040	26,153,107
8	Filled soil	m ³	470.37	137,505	64,678,227
9	Demolition of the existing concrete	m ³	11.23	114,048	1,280,759
10	Erosion protection				
	a. rail pile (used P24)	kg	5,000.00	4,333	21,665,000
	b. rock gabion	m ³	30.00	385,240	11,557,200
	c. Piling rail pile linking with rock gabion	pile	42.00	110,240	4,630,080
11	Construction of substructure (10% substructure)				27,263,416
	III. Railway in two ends of bridge				
1	Re-installing railway in two ends of bridge, putting rail P50 prestressed concrete sleeper for each end	km	0.05	4,500,000,000	225,000,000
2	Construction of railway in two ends of bridge (5% railway in two ends of bridge)				11,250,000
	IV. Difficult factor (30% of total)				858,756,124
	Total				3,721,276,539

ESTIMATED COST OF KHE NHAM BRIDGE (KM185+262)					
NO	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT
	I. Superstructure				
1	Steel girder	ton	11.145	43,773,668	487,857,530
2	Plugging girder	m	9.00	2,421,463	21,793,167
3	Shifting girder	m	9.00	377,531	3,397,779
4	Lifting and putting down girder	m	9.00	284,854	2,563,686
5	Bearing of steel girder	pc	4.00	25,262,571	101,050,284
6	Bare bridge desk	m	9.00	7,915,673	71,241,057
7	Putting rail on the bridge (wooden sleeper)	m	12.50	2,700,000	33,750,000
8	Construction of substructure (20% substructure)				144,330,701
	II. Substructure				
1	Concrete M300 [#]	m3	2.50	2,152,855	5,382,138
2	Concrete M250 [#]	m3	95.00	804,513	76,428,735
3	Concrete M200 [#]	m3	10.00	685,473	6,854,730
4	Cement mortar M100 [#]	m3	1.00	548,868	548,868
5	Rock constructing with mortar M100 [#]	m3	85.00	551,988	46,918,980
6	Rock with mortar line M100 [#]	m3	216.00	323,585	69,894,360
7	Macadam levelling	m3	98.50	183,000	18,025,500
8	Excavated soil	m3	50.00	95,040	4,752,000
9	Filled soil	m3	50.00	137,505	6,875,250
10	Demolition of the existing concrete	m3	15.00	114,048	1,710,720
11	Construction of substructure (10% substructure)				23,739,128
	III. Railway in two ends of bridge				
1	Re-installing railway in two ends of bridge	m	50.00	4,500,000	225,000,000
2	Construction of railway in two ends of bridge (5% railway in two ends of bridge)				11,250,000
	IV. Difficult factor (30% of total)				409,009,384
	Total				1,772,373,996

ESTIMATED COST OF MOC TOM BRIDGE (KM174+184) ALTERNATIVE 1 - STEEL GIRDER					
NO	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT
	I. Superstructure				
1	Steel girder	ton	9.461	43,773,668	414,142,673
2	Plugging girder	m	7.00	2,421,463	16,950,241
3	Shifting girder	m	7.00	377,531	2,642,717
4	Lifting and putting down girder	m	7.00	284,854	1,993,978
5	Bearing of steel girder	pc	4.00	25,262,571	101,050,284
6	Bare bridge desk	m	7.00	7,915,673	55,409,711
7	Putting rail on the bridge (wooden sleeper)	m	12.50	2,700,000	33,750,000
8	Construction of substructure (20% substructure)				125,187,921
	II. Substructure				
1	Concrete M300 [#]	m3	2.50	2,152,855	5,382,138
2	Concrete M250 [#]	m3	35.00	804,513	28,157,955
3	Concrete M200 [#]	m3	10.00	685,473	6,854,730
4	Cement mortar M100 [#]	m3	1.00	548,868	548,868
5	Rock constructing with mortar M100 [#]	m3	128.00	551,988	70,654,464
6	Rock with mortar line M100 [#]	m3	135.00	323,585	43,683,975
7	Rock gabion	gabion	350.00	275,000	96,250,000
8	Macadam levelling	m3	65.00	183,000	11,895,000
9	Excavated soil	m3	200.00	95,040	19,008,000
10	Filled soil	m3	100.00	137,505	13,750,500
11	Demolition of the existing concrete	m3	10.00	114,048	1,140,480
12	Construction of substructure (10% substructure)				29,732,611
	III. Railway in two ends of bridge				
1	Re-installing railway in two ends of bridge	m	25.00	4,500,000	112,500,000
2	Construction of railway in two ends of bridge (5% railway in two ends of bridge)				5,625,000
	IV. Difficult factor (30% of total)				358,893,374
	Total amount				1,555,204,619

ESTIMATED COST FOR MOC TOM BRIDGE (KM174+184) ALTERNATIVE 2 - CONCRETE GIRDER					
NO	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT
I. Superstructure					
1	Reinforced concrete M300 [#]	m3	11.43	2,152,855	24,607,133
2	Moving girder into its location	m	7.00	429,135	3,003,945
3	Putting rail on ballast	m	12.50	3,500,000	43,750,000
4	Tconstruction of superstructure (30% superstructure)				21,408,323
II. Substructure					
1	Concrete M250 [#]	m3	35.00	804,513	28,157,955
2	Concrete M200 [#]	m3	10.00	685,473	6,854,730
3	Cement mortar M100 [#]	m3	50.00	548,868	27,443,400
4	Rock constructing with mortar M100 [#]	m3	128.00	551,988	70,654,464
5	Rock with motar line M100 [#]	m3	135.00	323,585	43,683,975
6	Macadam levelling	m3	65.00	183,000	11,895,000
7	Rock garbion	garbion	350.00	275,000	96,250,000
8	Excavated soil	m3	200.00	90,040	18,008,000
9	Filled soil	m3	100.00	137,505	13,750,500
10	Demolition of the existing concrete	m3	10.00	114,048	1,140,480
11	Construction of substructure (20% substructure)				63,567,701
III. Railway in two ends of bridge					
1	Re-installing railway in two ends of bridge	m	25.00	4,500,000	112,500,000
2	Construction of railway in two ends of bridge (5% railway in two ends of bridge)				5,625,000
IV. Difficult factor (30% of total)					
					177,690,182
Total					769,990,787

ESTIMATED COST OF BUN BRIDGE (KM 232+612)					
NO	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT
I. Superstructure					
1	Steel girder	ton	99.18	46,842,958	4,645,884,574
2	Concrete girder M300 [#]	m3	38.63	2,152,855	83,164,789
3	Cement mortar M100 [#]	m3	7.11	548,868	3,902,451
4	Plugging girder	m	55.85	2,421,453	135,238,150
5	Lifting and putting down girder	m	55.85	284,854	15,909,096
6	Shifting into its location	m	55.85	337,531	18,851,106
7	Bearing of steel bridge	set	8.00	25,262,571	202,100,568
8	Re-installing rail on bridge	km	0.06	3,500,000,000	196,000,000
9	Construction of superstructure (30% superstructure)				1,590,315,220
II. Substructure					
1	Concrete M300 [#]	m3	9.50	2,152,855	20,452,123
2	Concrete M250 [#]	m3	211.15	920,021	194,262,434
3	Concrete M200 [#]	m3	216.75	745,473	161,581,273
4	Concrete M150 [#]	m3	28.80	620,000	17,856,000
5	Cement mortar M100 [#]	m3	2.00	548,868	1,097,736
6	Typed pipe steel	ton	23.31	10,227,449	238,401,836
7	Rock paving with mortar line M100	m3	105.00	323,585	33,976,425
8	Rock constructed by cement mortar M100 [#]	m3	76.80	551,988	42,392,678
9	Macadam levelling	m3	9.60	183,000	1,756,800
10	Excavated soil	m3	300.00	95,040	28,512,000
11	Filled soil	m3	250.00	137,505	34,376,250
12	Demolition of the existing concrete	m3	390.00	114,048	44,478,720
13	Yellow sand compacted by K95	m3	250.00	205,000	51,250,000
14	Bitumen cover	m2	160.00	66,281	10,604,960
15	Bored pile D = 1m	m	300.00	3,978,241	1,193,472,300
16	Construction of substructure (10% substructure)				207,447,153
III. Railway in two ends of bridge					
1	Re-installing railway in two ends of bridge, prestressed concrete rail P50	km	0.05	4,500,000,000	225,000,000
2	Construction of railway in two ends of bridge (10% railway in two ends of bridge)				22,500,000
IV. Difficult factor (30% of total)					
					2,826,235,393
Total					12,247,020,037

ESTIMATED CONSTRUCTION COST FOR BRIDGE WITH SPAN = 21M AND 2 NEW ABUTMENTS					
No.	Item	Unit	Quantity	Unit Price	Amount
I. Superstructure					
1	Steel girder	tấn	38.52	43,773,668	1,686,030,370
2	Strain girder	m	21.70	2,421,463	52,545,747
3	Transport girder	m	21.70	377,531	8,192,423
4	Lift and lower girder	m	21.70	284,854	6,181,332
5	Steel bearings	cái	4.00	25,262,571	101,050,284
6	Concrete paved with ballast Class M300 [#]	m3	17.50	2,152,855	37,674,963
7	Relay railway on bridge	km	0.025	3,500,000,000	87,500,000
8	Superstructure construction (20% superstructure)				395,835,024
II. Substructure					
1	Concrete Class M250 [#]	m3	422.00	920,021	388,248,862
2	Concrete Class M200 [#]	m3	433.50	745,473	323,162,546
3	Concrete Class M150 [#]	m3	57.60	620,000	35,712,000
4	Cement mortar Class M100 [#]	m3	4.00	548,868	2,195,472
5	Steel tube with many classes	tấn	46.00	10,227,449	470,462,654
6	Dry paving stone	m3	210.00	323,585	67,952,850
7	Building stone with mortar Class M100 [#]	m3	150.00	551,988	82,798,200
8	Blinding stone	m3	20.00	183,000	3,660,000
9	Golden sand k95	m3	500.00	205,000	102,500,000
10	Excavated soil	m3	500.00	95,040	47,520,000
11	Embanked soil	m3	550.00	137,505	75,627,750
12	Demolish concrete	m3	780.00	114,048	88,957,440
13	Bored pile	cọc	600.00	3,978,241	2,386,944,600
14	Spread bitumen	m2	320.00	66,281	21,209,920
15	Substructure construction (10% substructure)				409,695,229
III. Approach railway					
1	Relay railway for the 2 approach railway of the bridge	km	0.05	4,500,000,000	225,000,000
2	Approach roads construction (5% Approach railway)				11,250,000
IV. Coefficient difficult work conditions (30% total)					
Total					9,253,279,964

COST OF TYPICAL 17M SPAN BRIDGE CONSTRUCTION AND NEW CONSTRUCTION OF TWO ABUTMENTS					
NO	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT
	I. Superstructure				
1	Steel girder	ton	32.54	43,773,668	1,424,395,157
2	Plugging girder	m	17.60	2,421,453	42,617,573
3	Shifting girder	m	17.60	337,531	5,940,546
4	Lifting and putting down girder	m	17.60	284,854	5,013,430
5	Steel bearing	pc	4.00	25,262,571	101,050,284
6	Ballast concrete M300 [#]	m3	16.49	2,152,855	35,500,579
7	Putting rail on the bridge	km	0.05	3,500,000,000	175,000,000
8	Construction of superstructure (30% superstructure)				536,855,271
	II. Substructure				
1	Concrete M250 [#]	m3	422.00	920,021	388,248,862
2	Concrete M200 [#]	m3	433.50	745,473	323,162,546
3	Concrete M150 [#]	m3	57.60	620,000	35,712,000
4	Cement mortar M100 [#]	m3	4.00	548,868	2,195,472
5	Typed pipe steel	tấn	46.00	10,227,449	470,462,654
6	Rock paving motar line	m3	210.00	323,585	67,952,850
7	Rock constructed by mortar M100 [#]	m3	150.00	551,988	82,798,200
8	Macadam levelling	m3	20.00	183,000	3,660,000
9	Yellow sand, compact k95	m3	500.00	205,000	102,500,000
10	Excavated soil	m3	500.00	95,040	47,520,000
11	Filled soil	m3	550.00	137,505	75,627,750
12	Demolition of the existing concrete	m3	780.00	114,048	88,957,440
13	Bored pile	pile	600.00	3,978,241	2,386,944,600
14	Bitume cover	m2	320.00	66,281	21,209,920
15	Construction of substructure (10% substructure)				409,695,229
	III. Roads in two ends of bridge				
1	Re-installing railway in two ends of bridge, rail P50, prestressed concrete sleeper for each end of bridge	km	0.05	4,500,000,000	225,000,000
2	Construction of approach railway in two ends of bridge (5% approach railway in two ends of bridge)				11,250,000
	IV. Difficult factor (30% of total)				2,120,781,109
	Total				9,190,051,470

ESTIMATED COST OF TYPICAL 13M SPAN BRIDGE CONSTRUCTION AND NEW CONSTRUCTION OF TWO ABUTMENTS					
NO	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT
I. Superstructure					
1	Steel girder	ton	11.425	43,773,668	500,114,157
2	Plugging girder	m	13.28	2,421,463	32,157,029
3	Shifting girder	m	13.28	377,531	5,013,612
4	Lifting and putting down girder	m	13.28	284,854	3,782,861
5	Steel bearing	pc	4.00	25,262,571	101,050,284
6	Ballast concrete M300 [#]	m3	25.00	2,152,855	53,821,375
7	Putting rail on the bridge	km	0.025	3,500,000,000	87,500,000
8	Construction of superstructure (20% superstructure)				156,687,863
II. Substructure					
1	Concrete M250 [#]	m3	422.00	920,021	388,248,862
2	Concrete M200 [#]	m3	433.50	745,473	323,162,546
3	Concrete M150 [#]	m3	57.60	620,000	35,712,000
4	Cement mortar M100 [#]	m3	4.00	548,868	2,195,472
5	Typed pipe steel	ton	46.00	10,227,449	470,462,654
6	Rock paving with mortar line	m3	210.00	323,585	67,952,850
7	Rock constructed by mortar M100 [#]	m3	150.00	551,988	82,798,200
8	Macadam levelling	m3	20.00	183,000	3,660,000
9	Yellow sand, compact k95	m3	500.00	205,000	102,500,000
10	Excavated soil	m3	500.00	95,040	47,520,000
11	Filled soil	m3	550.00	137,505	75,627,750
12	Demolition of the existing concrete	m3	780.00	114,048	88,957,440
13	Bored pile	pile	600.00	3,978,241	2,386,944,600
14	Bitumen cover	m2	320.00	66,281	21,209,920
15	Construction of substructure (10% substructure)				409,695,229
III. Railway in two ends of bridge					
1	Excavating all embankment in two ends of bridge	m3	275.00	95,040	26,136,000
2	Embankment filling	m3	565.00	137,505	77,690,325
3	Subbase	m3	75.00	190,089	14,256,675
4	Re-installing rail in two ends of bridge	km	0.05	4,500,000,000	225,000,000
5	Construction of railway in two ends of bridge (10% railway in two ends of bridge)				34,308,300
IV. Difficult factor (30% of total)					
Total					7,571,415,805

ESTIMATED COST OF BRIDGE CONSTRUCTION - SPAN 7M AND NEW CONSTRUCTION OF TWO ABUTMENTS					
NO	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT
I. Superstructure					
1	Steel girder	ton	9.461	43,773,668	414,142,673
2	Plugging girder	m	7.00	2,421,463	16,950,241
3	Shifting girder	m	7.00	377,531	2,642,717
4	Lifting and putting down girder	m	7.00	284,854	1,993,978
5	Bearing of steel girder	pc	4.00	25,262,571	101,050,284
6	Bare bridge desk	m	7.00	7,915,673	55,409,711
7	Putting rail on the bridge (wooden sleeper)	m	12.50	2,700,000	33,750,000
8	Construction of substructure (20% substructure)				125,187,921
II. Substructure					
1	Concrete M250 [#]	m3	422.00	920,021	388,248,862
2	Concrete M200 [#]	m3	433.50	745,473	323,162,546
3	Concrete M150 [#]	m3	57.60	620,000	35,712,000
4	Cement mortar M100 [#]	m3	4.00	548,868	2,195,472
5	Typed pipe steel	ton	46.00	10,227,449	470,462,654
6	Rock paiving with mortar line	m3	210.00	323,585	67,952,850
7	Rock constructing with mortar M100 [#]	m3	150.00	551,988	82,798,200
8	Macadam	m3	20.00	183,000	3,660,000
9	yellow sand, compact k95	m3	500.00	205,000	102,500,000
10	Excavated soil	m3	500.00	95,040	47,520,000
11	Filled soil	m3	550.00	137,505	75,627,750
12	Demolition of the existing concrete	m3	780.00	114,048	88,957,440
13	Bored pile	pile	600.00	3,978,241	2,386,944,600
14	Bitume cover	m2	320.00	66,281	21,209,920
15	Construction of substructure (10% substructure)				409,695,229
III. Railway in two ends of bridge					
1	Re-installing railway in two ends of bridge	m	25.00	4,500,000	112,500,000
2	Construction of railway in two ends of bridge (5% railway in two ends of bridge)				5,625,000
IV. Difficult factor (30% of total)					
Total					6,988,670,062

ESTIMATED COST OF THEP BRIDGE - SPAN 5M					
NO	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT
	I. Superstructure				
1	Steel girder	ton	6.758	43,773,668	295,816,195
2	Plugging girder	m	5.00	2,421,463	12,107,315
3	Shifting girder	m	5.00	377,531	1,887,655
4	Lifting and putting down girder	m	5.00	284,854	1,424,270
5	Bearing of steel girder	pc	4.00	25,262,571	101,050,284
6	Bare bridge desk	m	5.00	7,915,673	39,578,365
7	Putting rail on the bridge (wooden sleeper)	m	12.50	2,700,000	33,750,000
8	Construction of substructure (20% substructure)				97,122,817
	II. Substructure				
1	Concrete M300 [#]	m3	2.50	2,152,855	5,382,138
2	Concrete M250 [#]	m3	35.00	804,513	28,157,955
3	Concrete M200 [#]	m3	10.00	685,473	6,854,730
4	Cement mortar M100 [#]	m3	1.00	548,868	548,868
5	Rock constructing with mortar M100 [#]	m3	128.00	551,988	70,654,464
6	Rock with mortar line M100 [#]	m3	135.00	323,585	43,683,975
7	Rock gabion	gabion	350.00	275,000	96,250,000
8	Macadam levelling	m3	65.00	183,000	11,895,000
9	Excavated soil	m3	200.00	95,040	19,008,000
10	Filled soil	m3	100.00	137,505	13,750,500
11	Demolition of the existing concrete	m3	10.00	114,048	1,140,480
12	Construction of substructure (10% substructure)				29,732,611
	III. Railway in two ends of bridge				
1	Re-installing railway in two ends of bridge	m	25.00	4,500,000	112,500,000
2	Construction of railway in two ends of bridge (5% railway in two ends of bridge)				5,625,000
	IV. Difficult factor (30% of total)				308,376,186
	Total				1,336,296,808

ESTIMATED COST OF THEP BRIDGE - SPAN 3M					
NO	ITEM	UNT	QUANTITY	UNIT PRICE	AMOUNT
I. Superstructure					
1	Steel girder	ton	5.677	43,773,668	248,485,604
2	Plugging girder	m	3.00	2,421,463	7,264,389
3	Shifting girder	m	3.00	377,531	1,132,593
4	Lifting and putting down girder	m	3.00	284,854	854,562
5	Steel bearing	pc	4.00	25,262,571	101,050,284
6	Bare bridge desk	m	3.00	7,915,673	23,747,019
7	Putting rail on the bridge (wooden sleeper)	m	12.50	2,700,000	33,750,000
8	Construction of substructure (20% substructure)				83,256,890
II. Substructure					
1	Concrete M300 [#]	m3	2.50	2,152,855	5,382,138
2	Concrete M250 [#]	m3	35.00	804,513	28,157,955
3	Concrete M200 [#]	m3	10.00	685,473	6,854,730
4	Cement mortar M100 [#]	m3	1.00	548,868	548,868
5	Rock constructing with mortar M100 [#]	m3	128.00	551,988	70,654,464
6	Rock with mortar line M100 [#]	m3	135.00	323,585	43,683,975
7	Rock gabion	gabion	350.00	275,000	96,250,000
8	Macadam levelling	m3	65.00	183,000	11,895,000
9	Excavated soil	m3	200.00	95,040	19,008,000
10	Filled soil	m3	100.00	137,505	13,750,500
11	Demolition of the existing concrete	m3	10.00	114,048	1,140,480
12	Construction of substructure (10% substructure)				29,732,611
III. Railway in two ends of bridge					
1	Re-installing railway in two ends of bridge	m	25.00	4,500,000	112,500,000
2	Construction of railway in two ends of bridge (5% railway in two ends of bridge)				5,625,000
IV. Difficult factor (30% of total)					
Total					1,228,142,580

Ref.				RPUC	Bridge Name	Km	Length of Bridge	Estimated Cost (VND)		Priority		
								Rehabilitation	Reconstruction	1	2	3
		1	1	HT	Duc Tú	14+850	29.62					3
		2	1	VP	Phĩ Trx	35+140	54.77					3
		3	2	VP	Thỉnh kỹ	42+272	102.83					3
		4	3	VP	H ơng canh	46+290	55.60					3
1		5	4	VP	Đàm Vạc	52+510	30.24	1,772,373,996			2	
		6	5	VP	Đ á Lạn	54+500	30.21					3
		7	6	VP	Lĩ nh	56+210	31.30					3
2		8	7	VP	Ma Giữa	60+152	18.05	1,772,373,996			2	
		9	8	VP	Me	67+200	41.16					3
		10	9	VP	Việt Trì	71+341	372.88					3
		11	10	VP	Thanh Miếu	73+900	17.50					3
3		12	11	VP	Soan Đào	92+390	14.09	1,336,296,000			2	
4		13	12	VP	Văn Thắg	92+990	19.65	1,772,373,996			2	
		14	13	VP	Bê Tông	95+352	5.00					3
5		15	14	VP	Diên Hồng	95+550	13.84	1,336,296,000			2	
		16	15	VP	Phủ Thọ	98+699	29.15					3
6		17	16	VP	Đồng Minh	99+730	19.16	1,336,296,000			2	
7		18	17	VP	Đồng Miếu	100+387	18.18	1,336,296,000			2	
8		19	18	VP	Chùa	108+872	21.70	2,104,378,927			2	
9		20	19	VP	Sầm	110+900	16.25	1,555,204,619			2	
		21	20	VP	Trầm Bồng	112+900	12.60					3
		22	21	VP	Trầm H ơng	113+700	14.16					3
		23	22	VP	Ma Lạn	115+556	30.74					3
10		24	23	VP	Vĩnh Chân	120+130	21.08	2,104,378,927		1		
11		25	24	VP	Mai ô	122+990	22.08	1,555,204,619			2	
		26	25	VP	Mình Hạc	129+075	24.82					3
12		27	26	VP	Ấm Th ơng	130+500	16.77	1,336,296,000			2	
		28	27	VP	Lửa Việt	132+476	28.48					3
13		29	28	VP	Ngôi Lạnh	134+004	19.1	2,104,378,927		1		
14		30	29	VP	Ngôi Hiền	137+785	24.6	3,721,276,539		1		
		31	30	VP	Đầm Hà	141+148	14.00					3
15		32	1	YL	Mấn	145+520	15.40	1,336,296,000		1		
16		33	2	YL	Ngôi Sen	145+950	26.92	3,721,276,539		1		
17		34	3	YL	Văn Phú	148+920	25.9	3,870,494,037		1		
		35	4	YL		151+750	4.64					3
18		36	5	YL	Gia Đa	152+494	21.12	2,104,378,927		1		
19		37	6	YL	Tuần Quán	152+550	32.68	3,870,494,037		1		
20		38	7	YL	Trầm	153+450	17.69	1,772,373,996			2	
		39	8	YL	Lâm Sinh	154+370	11.88					3
21		40	9	YL	Thủy Lợi	157+341	24.96	3,721,276,539			2	
		41	10	YL	Xuân Lan	158+240	14.41					3
		42	11	YL	Nga Quán	162+692	40.7					3
22		43	12	YL	Nghĩa Ph ơng	166+550	27.76	3,721,276,539		1		
		44	13	YL	Từ M ẫu	168+850	28.00					3
1	23	45	14	YL	Đào Thịnh	171+414	22.3		7,571,415,805	1		
2	24	46	15	YL	Thác Thủ	173+380	12.74		6,988,670,062	1		
		47	16	YL	Con Trần	173+960	13.87					3
25		48	17	YL	Móc tôm	174+185	14.17	769,990,787		1		
		49	18	YL	Đầm S ẫu	174+430	11.74					3
		50	19	YL		174+960	4.55					3
		51	20	YL	Ngôi Hóp	176+619	52.40					3
26		52	21	YL	Sung	177+176	29.95	2,104,378,927		1		
27		53	22	YL	Điều	179+304	38.44	3,721,276,539		1		
28		54	23	YL	T ầy	181+190	22.70	2,104,378,927		1		
		55	24	YL		181+473	5.28					3
29		56	25	YL	Khe Đồi	182+520	29	3,721,276,539				3
66*		57	26	YL	Trang	183+150	35.57	3,870,494,037		1		
30		58	27	YL	Máng	183+960	34.02	3,721,276,539		1		
31		59	28	YL	Khe Nhâm	185+265	18.90	1,772,373,996		1		
32		60	29	YL	Mầu A	188+050	32.50	3,870,494,037		1		
		61	30	YL	Khe Hoi	189+264	13.00					3
		62	31	YL		189+660	5.10					3
		63	32	YL	Quach	190+020	26.2					3
		64	33	YL	Vải	192+462	34.35					3
33		65	34	YL	Muông	194+470	17.89	1,555,204,619			2	
34		66	35	YL	Khai	195+394	30	3,870,494,037		1		
35		67	36	YL	M ời	197+850	29.5	3,870,494,037		1		
		68	37	YL	Lâm	201+216	35.5					3
		69	38	YL		201+503	6.74					3
36		70	39	YL	Bơm n ớc	201+635	19.20	1,772,373,996		1		
37		71	40	YL	Trần	203+150	19.63	1,772,373,996		1		
38		72	41	YL	Đen	204+064	20.20	1,772,373,996		1		
39		73	42	YL	Trở	204+815	35.9	3,870,494,037		1		

		74	43	YL		205+813	6.74					3
		75	44	YL		206+044	6.74					3
	40	76	45	YL	Sau	206+243	16.84	1,555,204,619			2	
	41	77	46	YL	N ớc chảy	206+630	9.62	1,555,204,619		1		
	42	78	47	YL	Bảy	206+960	24.80	2,104,378,927			2	
	43	79	48	YL	Trắc	207+572	20.20	1,772,373,996		1		
	44	80	49	YL	Mãng	208+210	32.86	3,870,494,037		1		
		81	50	YL		208+538	6.70					3
	45	82	51	YL	2 M	208+977	10.10	1,228,142,580			2	
	46	83	52	YL	Khe Sẻ	209+705	26.08	3,721,276,539		1		
		84	53	YL		211+522	4.00					3
	47	85	54	YL	Cài	212+540	38.50	3,870,494,037		1		
	48	86	55	YL	Phúc minh	214+742	31	3,721,276,539		1		
		87	56	YL		216+270	6.16					3
	49	88	57	YL	2 M	217+050	7.00	1,336,296,000			2	
		89	58	YL	Truc	217+736	46.10					3
		90	59	YL		217+944	6.02					3
	50	91	60	YL	Khe Bút	218+486	22.00	2,104,378,927		1		
	51	92	61	YL	Làng Khay	220+139	31.5	3,870,494,037		1		
	52	93	62	YL	Bầu	221+953	23.50	2,104,378,927			2	
	53	94	63	YL	Cop Vồ	222+287	27.30	2,104,378,927			2	
	54	95	64	YL	Bo	223+220	34.33	2,104,378,927			2	
		96	65	YL		224+050	11.30					3
	55	97	66	YL	Ly	225+170	33.37	3,721,276,539			2	
	56	98	67	YL	Làng Thấp	228+030	34	3,870,494,037		1		
		99	68	YL		228+560	4.80					3
	57	100	69	YL	Ba m ới	229+980	24.50	1,555,204,619			2	
	58	101	70	YL	Khe Đen	231+530	18.11	1,772,373,996		1		
	59	102	71	YL	Bùn	232+612	55.66	12,247,020,037		1		
		103	72	YL		233+530	12.20					3
		104	73	YL		235+540	6.54					3
		105	74	YL		235+940	8.92					3
	60	106	75	YL	1 M	236+680	4.36	1,228,142,580			2	
	61	107	76	YL	Bảo Hà	237+326	29.5	3,721,276,539		1		
		108	77	YL		238+108	8.72					3
		109	78	YL		239+428	7.4					3
		110	79	YL	Khoai	241+710	32.6					3
		111	80	YL	Kíp	242+735	19.2					3
		112	81	YL		243+203	6.8					3
	67*	113	82	YL	M ẻo	244+965	32	3,721,276,539		1		
	68*	114	83	YL	Vàn	245+735	42	3,870,494,037		1		
	62	115	84	YL	4 M	247+595	10.5	1,336,296,000			2	
	69*	116	85	YL	Gia	249+004	32	3,870,494,037		1		
	63	117	86	YL	Nhai	250+412	47.5	3,870,494,037		1		
	64	118	87	YL	Cháy	252+420	34	3,870,494,037		1		
		119	88	YL		253+500	2.6					3
		120	89	YL	Nhò	253+750	44.5					3
		121	90	YL		257+175	4					3
		122	91	YL		257+410	4					3
	65	123	92	YL	Trì	258+050	26.7	2,104,378,927			2	
		124	93	YL		260+720	10					3
		125	94	YL	Ngòi lu	261+040	40.15					3
		126	95	YL	Mý	265+775	38.3					3
		128	96	YL	Đền	266+007	11.43					3
		127	97	YL		266+537	10.5					3
		129	98	YL	Làng	269+321	36.2					3
		130	99	YL	Cao	271+296	34.92					3
		131	100	YL	Đo	273+448	38.82					3
		132	101	YL	L ợt	274+648	31.4					3
		133	102	YL		275+733	18.24					3
		134	103	YL		276+007	22.31					3
		135	104	YL	Tây	276+265	6.84					3
		136	105	YL	Khe Quan	276+689	20.7					3
		137	106	YL	Khe dừg	279+417	25.7					3
		138	107	YL	Mức	280+742	25.4					3
		139	108	YL	Giàng	282+398	21.35					3
3		140	109	YL	Thất Cổ	284+388	27.1	7,571,415,805		1		
4		141	110	YL	Quỳnh Sum	286+593	34.8	9,253,279,964		1		
		142	111	YL		286+861	20.3					3
5		143	112	YL		288+732	15.8	6,988,670,062		1		
6		144	113	YL		289+953	32.54	6,988,670,062		1		
		145	114	YL	Sơn Mãn	291+167	23.48					3
		146	115	YL	V ườn rau	292+327	18.5					3
		147	116	YL	Chui	295+329	18.3					3
		148	117	YL	Hồ Kiểu	296+050	70.53					3
TOTAL					Cộng :		3,822	181,183,907,805	45,362,121,760	46	26	76

ESTIMATED COST FOR MAI TUNG STATION					
No	Item	Unit	Quantity	Unit Price	Amount
I. Embankment					
1	Excavation	m3	9,200.00	95,040	874,368,000
2	Embankment	m3	4,500.00	137,505	618,772,500
II. Superstructure					
1	Set up station track P43-25m concrete sleeper K3A elastic connection	km	1.25	4,857,762,886	6,072,203,607
2	Set up rail switch 1/10 P43-24.414m	set	4.00	265,566,600	1,062,266,400
III. Station					
1	Station containing 50 passengers	m2	350.00	3,000,000	1,050,000,000
2	Basic station platform	m2	1,000.00	200,000	200,000,000
IV. Equipment					
1	Trainmaster	system	1.00	4,500,000,000	4,500,000,000
V. Supporting facilities					
1	Temporary calculation (fence, roads for vehicles to the station, electricity, ditches,...)				2,000,000,000
Total					16,377,610,507

QUANTITY AND COST FOR STATIONS WITH EXTENDED TRACK (LOOPS)

TT	Items	Station	Unit	Viet Tri	Phu Duc	Co Phuc	Mau A	Lam Giang	Thai Van	Thai Nien	Xuan Giao		Sum	Unit Price	Amount (VND)
1	Lay new rail P43, concrete sleeper K3A		m	664.00	241.00	150.00	190.00	133.00	170.00	166.00	860.00		2,574.00	4,857,763	12,503,881,668
2	Lay rail switch P43 - 24.414m (China)		set	5.00	2.00	1.00	1.00	1.00	1.00	1.00	3.00		15.00	265,566,000	3,983,490,000
3	Embanked soil		m3	6,427.00	1,518.50	881.71	354.70	987.72	43.98	585.50	1,753.27		12,552.38	137,505	1,726,015,012
4	Excavated soil		m3	52.81	0.91	8.85	40.66	81.94	634.13	6.00	601.40		1,426.70	95,040	135,593,568
5	Remove signal & information system		nos	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		8.00	185,715,000	1,485,720,000
6	Intermediate station platform		m2	455.00									455.00	200,000	91,000,000
7	Others (30%)														5,977,710,074
	Amount			7,434,522,230	2,725,392,390	1,692,633,892	1,854,961,288	1,613,257,724	1,746,440,638	1,740,373,774	7,095,828,388				25,903,410,323

QUANTITY AND COST FOR STATIONS WITH NEW TRACK (LOOPS)

TT	Items	Station	Unit	Thach Loi	Huong Canh	Tien Kien	Chi Chu	Vu En	Mau Dong	Lang Thip	Lao Cai	Van Phu	Sum	Unit Price	Amount (VND)
1	Lay new rail P43, concrete sleeper K3A		m	556.00	671.00	474.00	679.00	637.00	525.00	501.00	5,410.00	1,650.00	11,103.00	4,857,763	53,935,741,322
2	Lay rail switch 1/10 P43 - 24.414m fabricated plate (China)		set	2.00	3.00	1.00		2.00	1.00	2.00	19.00	6.00	36.00	265,566,000	9,560,376,000
3	Embanked soil		m3	4,900.00	6,619.00	45.00	5,844.00	10,150.40	501.20	581.43	5,500.00	3,500.00	37,641.03	137,505	5,175,829,830
4	Excavated soil		m3	18.00	250.00	804.00	110.00	115.60	1,296.60	3,238.00	4,500.00	2,845.00	13,177.20	95,040	1,252,361,088
5	New construction of basic station platform		m2						1,000.00		2,700.00	1,500.00	5,200.00	200,000	1,040,000,000
6	Remove (new set up) signal & information system		nos	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	11.00	1,100,000,000	12,100,000,000
7	Station		m2						500.00			500.00	1,000.00	3,000,000	3,000,000,000
8	Sub-constructions (ditches, fences, rail-to-station, electricity, water,...)			30%	30%	30%	30%	30%	40%	30%	40%	40%			31,361,153,238
	Amount			6,509,793,400	7,917,211,239	4,875,969,141	6,776,191,005	7,971,917,635	8,131,253,039	5,788,328,335	49,350,292,198	20,104,505,486			117,425,461,478

ESTIMATED OF FLY-OVER CONSTRUCTION KM 21+800					
NO	ITEM	UNIT	QUANTITY	UNIT PRICE	AMOUNT
I. Superstructure					
1	Major girder concrete M400 [#]	m3	1,015.21	2,674,000	2,714,671,540
2	Girder concrete M300 [#] , girder crossing bridge desk and joint	m3	800.78	2,152,855	1,723,963,227
3	Normal typed reinforce	ton	256.23	10,227,449	2,620,579,257
4	Pre-stressed steel	ton	194.12	25,804,075	5,009,087,039
5	Typed steel	ton	9.78	13,101,523	128,132,895
6	Installing ducts for prestressed cable	m	14,168.00	50,477	715,158,136
7	Pumping cement mortar into ducts 2.6m3/girder x 45 girder	m3	82.00	7,139,629	585,449,578
8	Shifting girder into its location	m	1,320.00	429,135	566,458,200
9	Asphalt bridge desk	m2	2,550.00	120,284	306,724,200
10	Bearing (rubber)	set	84.00	1,341,300	112,669,200
11	Lighting (provisionally)	pile	42.00	18,000,000	756,000,000
12	Construction of superstructure (30% superstructure provisionally)				4,571,667,982
13	Other provisional quantities (10% superstructure)				1,523,889,327
II. Substructure					
1	Concrete M400 [#]	m3	38.71	2,674,000	103,510,540
2	Concrete M300 [#]	m3	2,104.25	2,152,855	4,530,145,134
3	Bored piles D = 1m	m	1,440.00	3,978,241	5,728,667,040
4	Typed steel	ton	107.15	10,227,449	1,095,871,160
5	Excavation of foundation	m3	2,557.51	69,995	179,012,912
6	Macadam levelling	m3	19.59	172,280	3,374,965
7	Rock paving without mortar	m3	47.12	244,783	11,534,175
8	Filling soil	m3	1,996.47	143,231	285,956,395
9	Construction of substructure (provisionally 30% substructure)				3,581,421,696
10	Other quantities (10% substructure)				1,193,807,232
III. Railway in two ends of bridge					
1	Retaining wall concrete M300 [#]	m3	297.42	2,152,855	640,302,134
2	Typed reinforce	ton	35.60	10,227,449	364,097,184
3	Filling railway in two ends of bridge	m3	2,193.00	143,231	314,105,583
4	Construction of railway in two ends of bridge (10% railway in two ends of bridge)				131,850,490
5	Other quantities (10% railway in two ends of bridge)				131,850,490
Total					39,629,957,713

Cost Estimate for Works Identified as Priority 2

No	Item	Unit	Quantity	Unit Price	Amount (VND)	Amount (USD)
I	Track works					
1	Rail-main line	km	38.219	6,275,260,129.00	239,834,166,870	15,083,910
2	Passing loops	km	45.241	4,857,762,885.00	219,770,050,680	13,822,016
3	Switches	pc	32.000	265,566,600.00	8,498,131,200	534,474
II	Embankment Protection					
1	Solution DR01	m	2,420	883,401.20	2,137,830,904	134,455
2	Solution DR02	m	4,550	2,374,608.70	10,804,469,585	579,526
1	Solution SH01	m	1,200	1,603,528.10	1,924,233,720	121,021
2	Solution SH02	m	150	11,763,830.30	1,764,574,545	110,980
2	Solution PF01	m	2,400	18,152,446.00	43,565,870,400	2,739,992
3	Solution SL01	m	3,920	19,430,094.60	76,165,970,832	4,790,313
III	Bridges	pc	28		54,187,255,957	3,408,004
Total					658,652,554,694	41,424,689

ANNEX H

Digital Maps Of The Hanoi-Lao Cai Rail Route

TA No. 4050-VIE

**KUNMING – HAIPHONG TRANSPORT CORRIDOR PROJECT
UPGRADING HANOI – LAO CAI RAILWAY**

Feasibility Study and Preliminary Design

DRAFT FINAL REPORT

Technical Appendix A.3

ROLLING STOCK

July 2006

CURRENCY EQUIVALENTS
(05 MAY 2006)

Currency Unit	–	Vietnamese Dong (VND)
VND 1.00	=	\$ 0.00006272
\$1.00	=	VND 15,950

ABBREVIATIONS

ADB	-	Asian Development Bank
AFD	-	Agence Française de Développement
AP	-	Affected People
BCR	-	Benefit cost ratio
CAD	-	Computed Aided Design
CARB	-	Compensation and Resettlement Board
CPC	-	Commune People's Committee
CPI	-	Consumer Price Index
DFR	-	Draft Final Report
DGTPE	-	Direction Générale du Trésor et de la Politique Economique
DMC	-	Developing Country Member (of ADB)
DPC	-	District People's Committee
EA	-	Executing Agency
EIRR	-	Economic internal rate of return
EMSA	-	Ethnic Minority Special Actions
EPMD	-	Environmental Protection and Management Division
GDP	-	Gross Domestic Product
GOV	-	Government of Vietnam
GSO	-	General Statistical Office
GTZ	-	Gesellschaft für Technische Zusammenarbeit
IBRD	-	International Bank for Reconstruction and Development (World Bank)
ICB	-	International competitive bidding
IEE	-	Initial Environmental Examination
IoL	-	Inventory of Loss
IP	-	Indigenous People
IPDP	-	Indigenous Peoples' Development Plan
IMO	-	Independent Monitoring Organization
IPSA	-	Initial Poverty and Social Analysis
IRR	-	Internal rate of return
ISA	-	Initial Social Assessment
LURC	-	Land Use Rights Certificate
MOF	-	Ministry of Finance
MONRE	-	Ministry of Natural Resources and Environment
MOT	-	Ministry of Transport
MPI	-	Ministry of Planning and Investment
NGO	-	Non Government Organization
NPV	-	Net present value
OCR	-	Ordinary Capital Resources (of ADB)
O-D	-	Origin Destination
ODA	-	Official Development Assistance
OSPF	-	Office of the Special Project Facilitator
PIB	-	Project Information Booklet
PPTA	-	Project Preparatory Technical Assistance
PRC	-	People's Republic of China
PSA	-	Participatory Social Appraisal

ABBREVIATIONS

RALC	-	(Department of) Resettlement and Land Clearance
RoW	-	Right of way
RP	-	Resettlement Plan
RPI	-	Retail Price Index
RPUC	-	Railway Public Utility Company
RPMU	-	Railway Projects Management Unit
RRP	-	Report and Recommendation of the President (to ADB Board of Directors)
RRP	-	Report and Recommendation of the President (to ADB Board of Directors)
SAP	-	Severely Affected People
SES	-	Socio-Economic Survey
SIEE	-	Summary Initial Environmental Examination
TA	-	Technical Assistance
VOC	-	Vehicle operating costs
vpd	-	Vehicles per day
VRA	-	Vietnam Roads Authority

WEIGHTS AND MEASURES

Metric system

NOTES

1. In this report, "\$" refers to US dollars.

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1 INTRODUCTION

This section shall be read in close connection with the corresponding section concerning Railway Operations on the Railway Line along the Red River Valley. It gives the necessary background and explanations concerning the process of data collection, evaluation and the modelling of the physical characteristics of the trains operating on the Yen Vien – Lao Cai railway line. This was a key prerequisite for performing realistic simulations to be used as a basis for the assessment of the operational characteristics of actual and potential services on the on the Yen Vien – Lao Cai railway corridor.

One of the obvious elements of a short and medium term concept for a considerable increase of the capacity of the line will be to enable hauling of significantly higher train loads, ideally up to 1,200, maybe even 1600 tons and train lengths of up to 400 metres as a first step.

Given all the necessary infrastructure prerequisites and characteristics, train models have been configured that would provide the necessary capacities in combination with the operation scenarios identified by the simulation exercise.

These train models have been based on specific types and categories of rolling stock, be it drawn from the stock of VNR's existing fleet of rail vehicles or especially in the case of locomotives - also using envisaged future additions to VNR's fleet.

2 OBJECTIVES OF THE ANALYSIS OF PRESENT AND FUTURE RAILWAY OPERATIONS

An analysis of the technical characteristics of the rolling stock available in VNR's present fleet and the consequential characteristics of VNR's existing operations on the Yen Vien – Lao Cai segment based on this has been performed in accordance with the modified study work programme. It is the final objective of this section to assess the adequacy of the rolling stock presently assigned to the line in relation to the current and forecast traffic demand as the key criterion.

Apart from the direct performance characteristics from the rolling stock side additional influence factors needed to be registered for analysis of their actual influence on operations procedures and performance data, such as any kind of identified operational constraints arising from, e.g.:

- Track geometry limitations, e.g. radii, if relevant for 6-axle locomotives
- Available track lengths in stations, limiting the train length
- Quality and stability of the track superstructure; especially regarding the effects of horizontal forces exerted by heavy 6-axle locomotives
- Quality and stability of sub-ballast and embankment, i.e. susceptibility for irregular settlement or slides
- Reliability and state-of-repair condition of the available rolling stock
- Maintainability of the rolling stock involved; location and capacities of existing maintenance infrastructure; with respect to its effect on overall availability of the rolling stock fleet All this may result in additional requirements or recommendations for accompanying measures to support the investment-borne key interventions described elsewhere in this report.

Constraints of railway operations caused by inadequate assignment of main line and shunting locomotives have not been reported and could not be recognised during the site visits in February 2006.

However, some powerful locomotives with higher tractive effort, usually 6-axle types, presently are not allowed to work the section Yen Bai – Lao Cai due to infrastructure deficiencies (radii, missing transition curves / cant, condition of bridges, partially still suffering from damages sustained during the American War and subsequent insufficient repair, function of drainage system, ground stability problems, large scale construction work in progress on securing structures, especially along the banks of the River Hong, as well as general permanent way condition, etc.).

3 METHODOLOGY

The large number of trains operated on the Line requires an approach facilitating the data handling and making the results more transparent for evaluation. The 37 scheduled trains in the status-quo scenario have therefore been grouped into two categories, P1 and P2 for passenger trains and six categories, F1 to F6 for freight trains, with the latter being sub-divided where load conditions for operation in the two directions were found to be significantly unsymmetrical. In this case an "L"-suffix (for "loaded") and an "E"-suffix (for "empty") have been added to the individual sub-categories.

For the passenger trains the precise information concerning the composition of the trains and the types of the individual coaches is available from a VNR Directive (No.1735/CTKHNTNV). For the freight trains the usual assignment of locomotives from VNR Directives has been assumed and the order of magnitude of the train size in terms of mass and length could be derived from this.

As the starting point for the iterative simulation procedure, the Base Case (2020) had to be defined. This was done on the basis of the present type of operation and upgraded aiming at target capacity figures corresponding to the increase in traffic demand forecast referred to in the Operations Report (Chapters 7.2 and 7.3). Given the present fleet size and composition of types correspondingly the required numbers and types of rolling stock have been assumed as being available in sufficient numbers.

The initial simulation run very clearly shows that the anticipated traffic density on the line far exceeds the present capacity of the line.

Additional line capacity can be attained if the trains are extended. The options are:

1. Utilise existing medium-powered locomotives in double traction arrangements
2. Utilise higher-powered locomotives after track conditions have been sufficiently improved for them to run safely without restrictions along the whole length of the line and without creating excessive track maintenance work.
3. Introduce new locomotives, suitably powered, equipped for multiple traction and with 'track friendly' running gear exerting low lateral forces on the rails

While Option 1. has been used to some extent on the basis of available types, Options 2 and 3 will be elements of the recommended intervention programme.

4 CURRENT TRAIN OPERATIONS

4.1 ROLLING STOCK

As mentioned before, composition of trains and assignment of locomotives to specific trains presently follow the directives issued by VNR's management in connection with Operation Diagrams. Daily adjustments are made by Operations Control Officers.

4.1.1 Locomotives

VNR in their fleet of diesel locomotives presently operates a large number of vehicles of roughly 15 different meter gauge types, different traction systems, purchased from an equally large number of suppliers in a similarly number of countries.

The traction systems utilised are both Diesel-Hydraulic and Diesel-Electric, whereas the latter are of the DC type with a state-of-the-art AC model on order.

Collection of relevant data for further detailed investigations on locomotives was supported in a very cooperative way by VNR's Railway Project Management Unit (RPMU) and various data from different sources were received for a preliminary compilation. A preliminary tabular representation of the data related to the relevant types of locomotives in service with VNR and assigned to operations on the Hanoi – Lao Cai Line at one time or another can be found in Annex 1.

Of these locomotive types the following assignments have been used for working the (Yen Vien - Lao Cai line) Table 4.1.

Table 4.1 Locomotive Assignment to the Line Sections

Loco Type	Axle Arrangement	Hanoi- Lao Cai	Hanoi – Yen Bai	Yen Bai – Lao Cai
D4	B' – B'	P, F	P, F	P, F
D5	B' – B'	P, F	P, F	P, F
D8	Bo' – Bo'	P, F	P, F	P, F
D9	Bo' – Bo'	P, F	P, F	P, F
D10	B' – B'	P, F	P, F	P, F
D11	B' – B'	P, F	P, F	P, F
D12	Bo' – Bo'	P, F	P, F	P, F
D13	Co' – Co'		P, F	Presently not permitted
D18	Co' – Co'		P, F	Presently not permitted

P Passenger Trains F Freight Trains

Since all locomotive types in the VNR fleet in terms of axle load and compatibility with curve radii are compliant with the actual conditions on the Yen Vien – Lao Cai line segment, the limiting factor for assignment of the existing 6-axle locomotives can be seen in the high overall operating weight in the range of 70 to 80 tons and the inherently higher stress on the track caused by heavier and longer three-axle bogies.

4.1.2 Trains

Another factor determining the utilisation of individual locomotive types is the level of traction effort they can provide for hauling trains on the individual sections of the Yen Vien – Lao Cai line. In the first place it is the grades and the length of the incline sections that will determine the length and the maximum payload capacity of trains hauled by these locomotives.

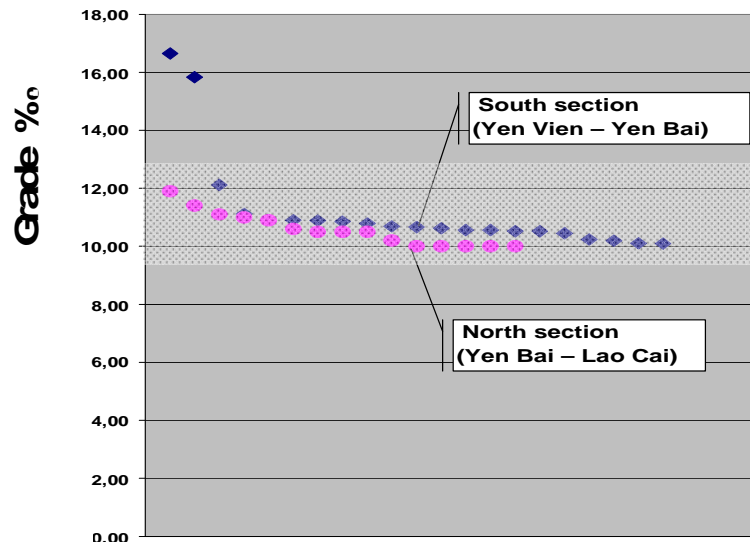
Table 4.2 shows a compilation of all line sections with grades of more than 10 ‰, also indicating their location and length, separated according to their location in the South section (Yen Vien – Yen Bai), marked in the Table as "S" or in the North section (Yen Bai – Lao Cai) indicated as "N".

Figure 4.1 very clearly demonstrates, that the grade values to be taken into consideration mainly are situated in the 10 to 12 ‰ range with maximum values between 16 and 17 ‰ in two locations on the South section.

Table 4.2 List of Gradients Greater than 1% on Lao Cai - Yen Vien Railway

From (km)	To (km)	Gradient (‰)	Length (m)
South Section: Yen Vien to Yen Bai			
84.500	84.700	16,65	200
122.250	122.370	-15,83	120
137.120	137.450	-12,12	330
104.550	104.836	11,12	286
122.750	122.970	-10,91	220
120.000	120.100	10,90	100
73.590	73.770	-10,89	180
120.883	121 .083	10,85	200
100.415	100.770	10,79	355
105.100	105.260	10,69	160
116.445	116.750	10,66	305
123.070	123.200	-10,62	130
76.150	76.275	10,56	125
82.900	83.080	10,56	180
83.715	84.020	-10,52	305
120.200	120.450	10,52	250
136.450	136.895	10,45	445
102.200	102.365	10,24	165
116.030	116.345	10,19	315
74.050	74.240	10,11	190
104.986	105.100	10,09	114
North Section: Yen Bai to Lao Cai			
295.344	295.544	-11,90	200
239.325	239.465	11,40	140
223.210	223.600	11,10	390
212.815	213.240	11,00	425
239.075	239.325	10,90	250
295.054	295.344	-10,60	290
179.500	179.620	10,50	120
232.802	233.150	10,50	348
287.960	288.110	10,50	150
174.800	174.900	10,20	100
177.250	177.400	10,00	150
215.750	215.900	10,00	150
228.450	228.600	10,00	150
252.590	252.845	10,00	255
294.254	294.541	10,00	287

Figure 4.1 Distribution of Grade Values on the North and South sections of the (HaNoi) Yen Vien - Lao Cai Railway Line



Based on these values and the calculation procedure published by VNR (dated 24 May 1985) for relevant locomotives the maximum masses for trains to be hauled have been calculated. This was intended to provide a framework for suggestions for increasing train length and trainload capacity figures in order to make best use of extended passing loops and the limited capacity of single-track line. As the basis for the train length calculation a specific mass of 4.2 t / m was used.

The following Figures 4.2, 4.3 and 4.4 demonstrate the train weight that can be safely hauled by individual types of locomotives at speeds of 20 km/h, 30 km/h and 45 km/h.

Figure 4.2: Calculated Train Weights & Train Length for v=20 km/h

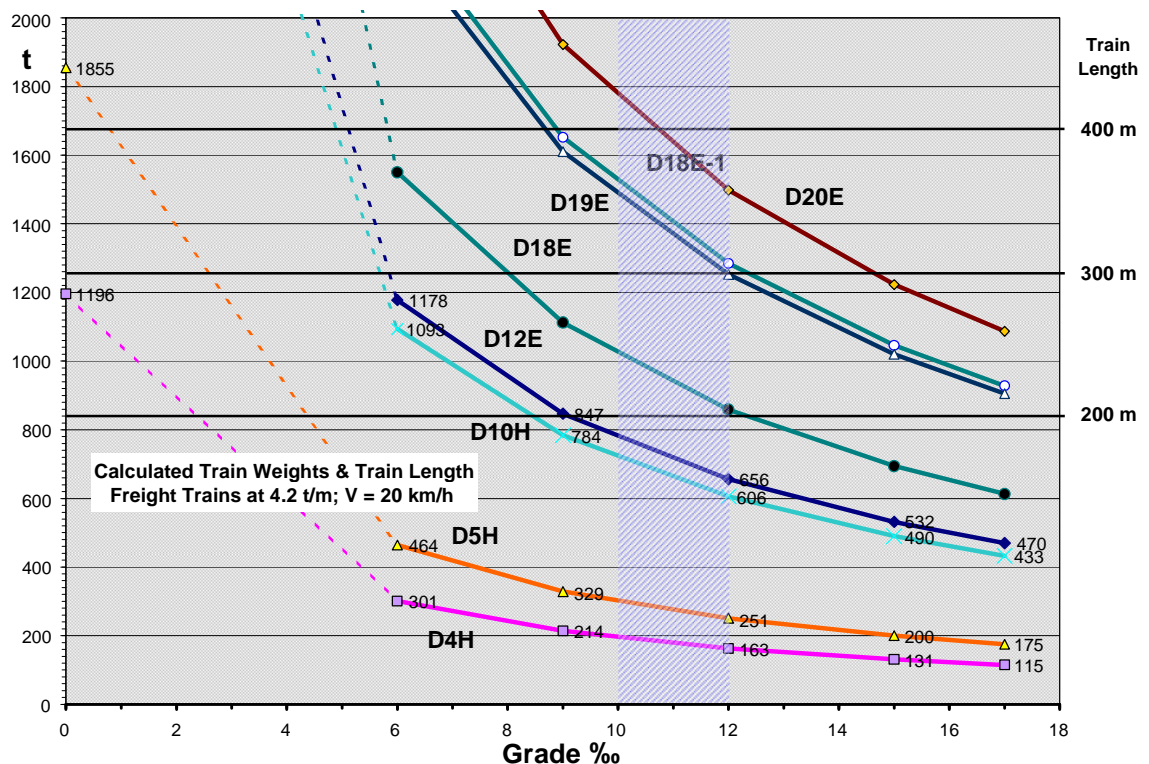
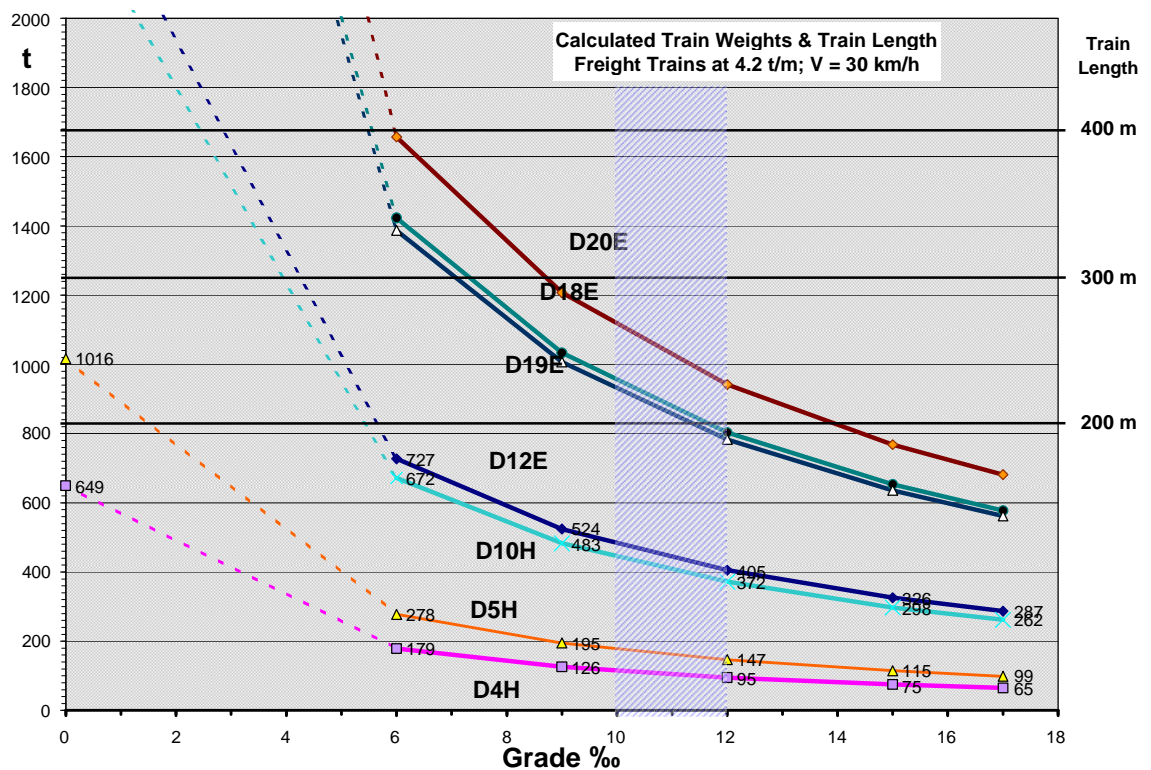
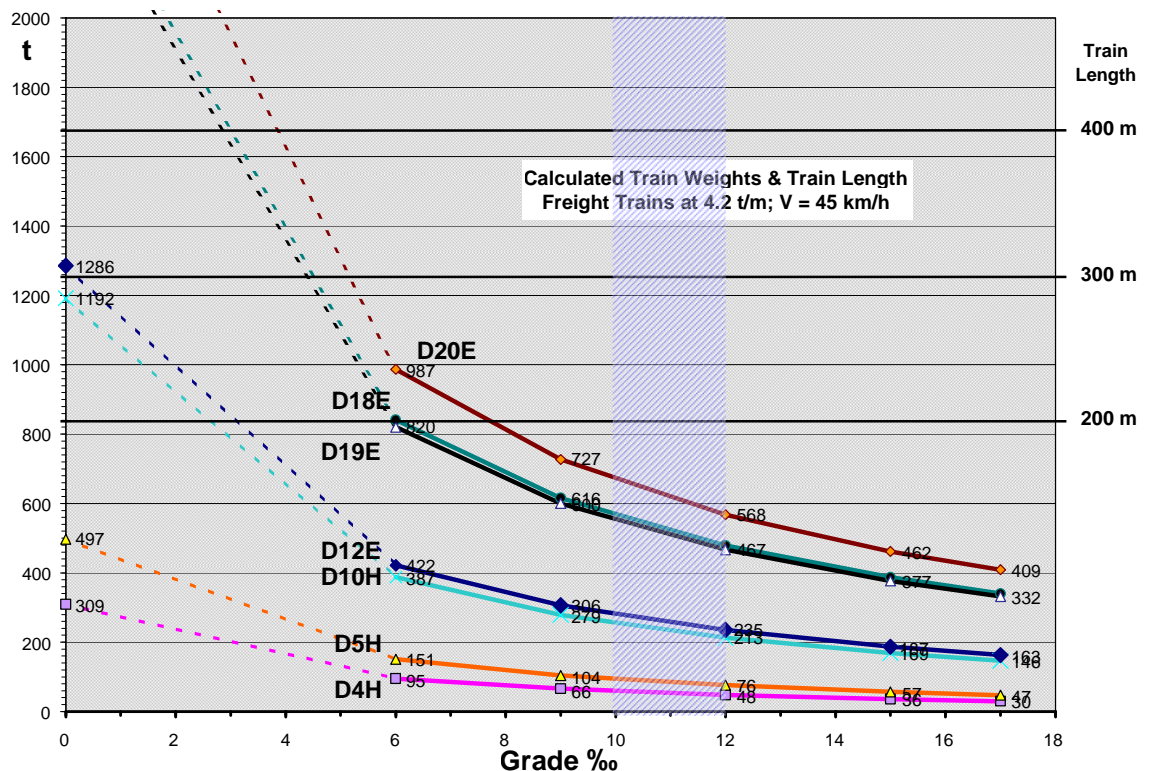


Figure 4.3: Calculated Train Weights & Train Length for v=30 km/h**Figure 4.4: Calculated Train Weights & Train Length for v=45 km/h**

Using these results, an average of 20 freight trains operated today have been classified into 6 categories. For practical reasons these could be further reduced to 5 basic categories. Three of these categories have significantly unsymmetrical loading conditions for the two directions, so they had to be split in “L” (loaded) and “E” (empty)

subcategories. The resulting set of input data for the operations simulation is shown in Annex 3.1 for the Freight Trains. Basis for the estimation of the train data within the framework of the traction power provided by the selected locomotives is Annex 4 (Freight Wagons).

In the case of passenger trains for several units a detailed catalogue for the composition could be made available by VNR. Based on the known coach types (ref. Annex 5) an average of 20 daily trains could be reduced into 8 basic configurations of train consists. For the purpose of operational simulations these in turn can be generalised and be represented by two major categories in the simulation model.

4.2 INPUTS TO OPERATIONAL MODEL

4.2.1 Base Case

Concerning rolling stock this is a true status-quo-simulation, i.e. all rail transport operations will be performed using the existing fleets of locomotives, coaches and wagons.

4.2.2 Options 1 and 2

No change in relation to the utilization of rolling stock as compared with the Base Case.

4.2.3 Option 3

To allow for a reduction in the number of trains concurrently with the increase of train capacity and train masses Option 3 contains, beside the infrastructure improvements heavier and longer trains as far as possible. However, the maximum length remains still 400 m and the maximal gross hauled tonnage / train around 1,200 tons (with minor exceptions).

For the calculation of (heavier and longer) trains further operational improvements (better utilisation of rolling stock and the reduction of the percentage of empty wagons to be hauled) are implicitly considered.

It is assumed that the track condition all along the line from this stage onwards allows utilisation of heavier Co'-Co' locomotives. Specifically the assumption is made, that all trains from now on can be hauled by the new D20E locomotive (SIEMENS AsiaRunner AR15 VR). Technical data ref. Annex 2.

4.2.4 Option 4

In addition to option 3, simulations have been carried out assuming double traction for the train categories F1, F1*, F2L, F3L, F4L* and F5L*. The corresponding characteristics for the D20E can be seen from Annex 7.

However, the results of the simulations do not justify this additional effort. There is no significant increase in the line capacity and the reduction of running time between stations is very small.

In case the D20E locomotive is not (yet) available in sufficient numbers and cannot be assigned to these heavy trains, double traction by other, less powerful locomotives, can be an option.

Annex 1

Technical Specifications of VNR Locomotives

Table A.1.1: Locomotives

Type Designation	[Dimension]	D4H	D4H	D5H	D8E	D9E	D10H	D10H
Name	Assumptions <i>in Italics</i>	TY5	TY7	UC		GE	DFH21	DFH21
Origin		USSR	USSR	Australia	Australia	USA	China	China
Year of Procurement		1981/88	1981/88	1966/70		1963/65		
Code		H2-11						Improved
Remarks, Ops assignment *... Order on Trainload 01-TTCD-2005, 2.c. (limits on bridges YB-PL)		P: HAN-LC F: YV-DA F: DA-YB F: YB-PL F: PL-LC>	P: HAN-LC F: YV-DA F: DA-YB F: YB-PL F: PL-LC>	F: YV-DA F: HAN-LC	P: HAN-LC F: YV-DA F: DA-YB F: YB-PL F: PL-LC>	P: HAN-LC F: YV-DA F: DA-YB F: YB-PL F: PL-LC>	P: HAN-LC F: YV-DA F: DA-YB F: YB-PL* F: PL-LC>	P: HAN-LC F: YV-DA F: DA-YB F: YB-PL* F: PL-LC>
Train Load: No. of wagons	[-]	15 PL-XG: 15 PL-XG/DT:		20 PL-XG: 15 PL-XG/DT:	14	25 PL-XG: 20	25 PL-XG: 25	25 PL-XG: 25
(acc. to OCC Signboard)	[Key Code]	20 B'-B'	B'-B'	20 B'-B'	Bo'-Bo'	Bo'-Bo'	B'-B'	B'-B'
Axle Arrangement								
No. of axles	[-]	4	4	4	4	4	4	4
No. of powered axles	[-]	4	4	4	4	4	4	4
LoC	[mm]	9590	9590	11100	17020	11600	12676	12676
Body Length	[mm]							
Width	[mm]				2860		3046	3046
Height ToR	[mm]				3910		3793	3793
Crosss-Section Area	[m ²]				11,2		11,6	11,6
Bogie Centres	[mm]				9500		6000	6000
Bogie Wheelbase	[mm]				2400		2200	2200
Wheel Diameter	[mm]				1000		915	915
Engine Supplier	[Text]							
Engine Type Designation	[Code]							
Rating Definition	[Text]							
Engine Rating	[kW]	298	336	410	649	671	932	932
	[HP]	400	450	550	870	900	1250	1250
Power on wheel rim / eff. Output	[kW]	147		225,6	225,6	225,6	512,7	512,7
Mech. Efficiency	%	49,3	0,0	55,0	0,0	71,8	55,0	55,0
Traction Effort starting point	[kN]	47,8	69,0	99,6		134,1 / 148	162,0	198,0
Traction Effort max. continuous	[kN]						110,0	140,0
Traction Effort break point - F	[kN]	38		70		112	110,0	140,0
Traction Effort break point - V	[km/h]	13,60				15,30	16,2	12,0
Traction Effort Diagramme	[link]	•				•	•	•
Power Transmission	[Text]				TDD		TDTL	TDTL
Max.design speed – solo	[km/h]	50	50	65	120	80	52	70

Type Designation	[Dimension]	D4H	D4H	D5H	D8E	D9E	D10H	D10H
Name		TY5	TY7	UC		GE	DFH21	DFH21
Origin		USSR	USSR	Australia	Australia	USA	China	China
Year of Procurement		1981/88	1981/88	1966/70		1963/65		
Code		H2-11						Improved
Operating Weight	[t]	24	24	40,6	56	49,6	58	58
	[kN]	235,4	235,4	398,3	549,4	486,6	569,0	569,0
Traction Weight	[t]							
	[kN]	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Axle Load	[kN]	58,9	58,9	99,6	137,3	121,6	142,2	142,2
	[t]	6,0	6,0	10,2	14,0	12,4	14,5	14,5
	[t]	6,3						
Brake System – dynamic	[Text]							
Brake System – mechanic	[Text]							
Dynamic Mass Factor	[-]							
Min. Curve Radius	[m]				75			70
No. Produced / purchased	(GP)	199		13		32		
In VNR operation 1999	(GP)	183		13		32		
Awaiting disposal 2003	(GP)	18						
Awaiting major repair 03/2003	(GP)	16						
Total No. In VNR 2003	(GP)	192		13		33		
In VNR operation 03/2003	(GP)	158		13		33		
Based in Yen Bai	(GP)	78		13				
Based in Ha Noi	(GP)	55						

Type Designation	[Dimension]	D11H	D11H	D12E	D13E	D18E	D18E	D19E	D20E
Name	<i>Assumptions in Italics</i>							Doi Moi	AR 15 VR
Origin		Romania	Romania	Czech	India	Belgium	Belgium	China	Germany
Year of Procurement		1978		1986/90	1984/85;2003	1983		2001;2002	2007
Code			Improved		96	H2-13	modified		
Remarks, Ops assignment *... Order on Trainload 01-TTCD-2005, 2.c. (limits on bridges YB-PL)		P: HAN-LC F: YV-DA F: DA-YB F: YB-PL F: PL-LC>	P: HAN-LC F: YV-DA F: DA-YB F: YB-PL F: PL-LC>	P: HAN-LC F: YV-DA F: DA-YB F: YB-PL F: PL-LC>	P: HAN-YB F: YV-DA F: DA-YB	P: HAN-YB F: YV-DA F: DA-YB X: YB-LC	P: HAN-YB F: YV-DA F: DA-YB X: YB-LC		
Train Load: No. of wagons	[-]	25 PL-XG: 20	25 PL-XG: 20	25 PL-XG: 20	30	35	35	35	
(acc. to OCC Signboard)									
Axle Arrangement	[Key Code]	B'-B'	B'-B'	Bo'-Bo'	Co'-Co'	Co'-Co'	Co'-Co'	Co'-Co'	Co'-Co'
No. of axles	[-]	4	4	4	6	6	6	6	6
No. of powered axles	[-]	4	4	4	6	6	6	6	6
LoC	[mm]	14006	14006	13306	15500 ?	15500	15500	16895	19180
Body Length	[mm]				14326 ?				
Width	[mm]			2754	2730			2900	2688
Height ToR	[mm]			3854	3635			3920	3945
Crosss-Section Area	[m ²]			10,6	9,9			11,4	10,6
Bogie Centres	[mm]			6700	9550			8100	10300
Bogie Wheelbase	[mm]			2400	1767/1829			1650	1650
Wheel Diameter	[mm]			1000	965			1000	1016/956
Engine Supplier	[Text]	?	MTU						MTU
Engine Type Designation	[Code]								12V4000R41
Rating Definition	[Text]								UIC
Engine Rating	[kW]	895	895	895	1007	1342	1491	1474	1500
	[HP]	1200	1200	1200	1350	1800	2000	1976	
Power on wheel rim / eff. Output	[kW]	606	606	550		1057	1057	1031,5	1220
Mech. Efficiency	%	67,7	67,7	61,5	0,0	78,7	70,9	70,0	81,3
Traction Effort starting point	[kN]	139,7 / 156	185,0	109,5	109,54 / 165	189,0	248,0	355,2	260,0
Traction Effort max. continuous	[kN]						195,8	250	234
Traction Effort break point - F	[kN]	110	179	73	73	131			250
Traction Effort break point - V	[km/h]	19,50	5,00	26,30		28,10	16,80		18,80
Traction Effort Diagramme	[link]	•	•	•		•	•		•
Power Transmission	[Text]			TDD	TDD			TDD	AC-AC
Max.design speed - solo	[km/h]	100	100	80	96	100	100	120	135
Operating Weight	[t]	56	56	56	72	84	84	81,6	81

Type Designation	[Dimension]	D11H	D11H	D12E	D13E	D18E	D18E	D19E	D20E
Name								Doi Moi	AR 15 VR
Origin		Romania	Romania	Czech	India	Belgium	Belgium	China	Germany
Year of Procurement		1978		1986/90	1984/85;2003	1983		2001;2002	2007
Code			Improved		96	H2-13	modified		
Traction Weight	[kN]	549,4	549,4	549,4	706,3	824,0	824,0	800,5	794,6
	[t]								81
Axle Load	[kN]	0,0	0,0	0,0	0,0	0,0	0,0	0,0	794,6
	[kN]	137,3	137,3	137,3	117,7	137,3	137,3	133,4	132,4
	[t]	14,0	14,0	14,0	12,0	14,0	14,0	13,6	13,5
	[t]								
Brake System - dynamic	[Text]								
Brake System - mechanic	[Text]								
Dynamic Mass Factor	[-]								
Min. Curve Radius	[m]			75	75			70	97 / 70
No. Produced / purchased	(GP)		18	40	14	16		20	
In VNR operation 1999	(GP)		18	40	14	16			
Awaiting disposal 2003	(GP)								
Awaiting major repair 03/2003	(GP)		3						
Total No. In VNR 2003	(GP)		23	40	24	16		20	
In VNR operation 03/2003	(GP)			40	24	16		20	
Based in Yen Bai	(GP)			5					
Based in Ha Noi	(GP)			22				10	

Annex 2

Passenger Trains Categories & Data

Table A.2.1: Passenger Train Composition

Designation / Train No.	Units	SP ½ LC 1 - 9 LC 2 – 10				YB 1/2 YB 3/4 YL 1/2			71/72
Type of Train		Pass				Pass			Pass
Categories		P1				P2			P2
Loco 1 Type for Category		D12E	D12E	D12E	D12E	D10H	D10H	TY	D5H
Loco 2 Type for Category		or D8E							
Loco 3 Type for Category									
Loco 4 Type for Category									
Specific Train Designation (acc. to No.1735/CTKHN-KTNV)		SP 1/2	LC 1/2	LC 3/4	LC5/6	YB 1/2	YB 3/4	YL 1/2	71/72
Loco 1 for specific Train		D12E	D12E	D12E	D12E	D10H	D10H	TY	D5H
Loco 2 for specific Train									D5H
Type of Coaches / Wagons		Dining Generator 1	Operation Generator 1	Operation Generator 1	Luggage Generator 1	Generator 1	Luggage 1	Ch1 1	
No. of Coaches / Wagons of above type									
Type of Coaches / Wagons (temp.comp. in italics)		a/c	Luggage	Luggage	B80	Luggage	B64	B64	
No. of Coaches / Wagons of above type		3	1	1	1	1	5	3	
Type of Coaches / Wagons		a/c sleeping	B80	B80	A64	B80	Ck	Ck	
No. of Coaches / Wagons of above type		1	5	5	1	10	3	4	
Type of Coaches / Wagons		a/c sleeping	HC Dining	HC Dining	Dining	Ck			
No. of Coaches / Wagons of above type		2	1	1	1	1			
Type of Coaches / Wagons		a/c sleeping	B80	B80	An28 DHTH2 2 nd gen. a/c				
No. of Coaches / Wagons of above type		1	3	5	1				
Type of Coaches / Wagons		a/c sleeping	Bn42	Ckh	An28 a/c				
No. of Coaches / Wagons of above type		2	3	1	1				
Type of Coaches / Wagons		a/c sleeping	B80	B64	An28 DHTH2 2 nd gen. a/c				
No. of Coaches / Wagons of above type		1	2	3	1				
Type of Coaches / Wagons					An24 2 nd gen. a/c				
No. of Coaches / Wagons of above type					1				
Type of Coaches / Wagons					An 20 a/c				
No. of Coaches / Wagons of above type					1				

Designation / Train No.	Units	SP ½ LC 1 - 9 LC 2 – 10				YB 1/2 YB 3/4 YL 1/2 71/72			
Type of Train		Pass				Pass		Pass	
Categories		P1				P2		P2	
Loco 1 Type for Category		D12E	D12E	D12E	D12E	D10H	D10H	TY	D5H
Loco 2 Type for Category		or D8E							
Loco 3 Type for Category									
Loco 4 Type for Category									
Specific Train Designation (acc. to No.1735/CTKHN-KTNV)		SP 1/2	LC 1/2	LC 3/4	LC5/6	YB 1/2	YB 3/4	YL 1/2	71/72
Type of Coaches / Wagons		An28DH a/c JV 2							
No. of Coaches / Wagons of above type									
Type of Coaches / Wagons		An28DH a/c VH 1							
No. of Coaches / Wagons of above type									
Type of Coaches / Wagons		An28DH a/c TSC 2							
No. of Coaches / Wagons of above type									
Type of Coaches / Wagons		Victoria An sleeper 2		Victoria An sleeper 2					
No. of Coaches / Wagons of above type									
Type of Coaches / Wagons		Victoria Dining 1		Victoria Dining 1					
No. of Coaches / Wagons of above type									
Type of Coaches / Wagons		Victoria Generator 1		Victoria Generator 1					
No. of Coaches / Wagons of above type									
Total No. of Coaches / Wagons		11,0	16,0	21,0	18	13	9	8	10,0
Total Length of Train – LoC	[m]	231,0	336,0	441,0	378,0	273,0	189,0	168,0	210,0
Max Gross Weight / Train	[t]	475,6	684,6	892,2	735,0	571,8	395,9	362,1	432,4
Loco limit/segm. (Target: 1200 t @ T14 & 4.2 t/m)	[kN]	4.665,6	6.715,7	8.752,5	7.210,8	5.609,5	3.883,5	3.552,1	4.241,5

Table A.2.2: Freight Train Composition

Designation / Train No.	units	223/224 225/226	227 229	228 220	271, 273 371, 373	272, 274 372, 374	321, 323 421, 423 427 425, 429	322, 324 422, 424 428 426, 420	522 523	521 524	1321/1322 1323/1324
Type of Train		Freight	Freight	Freight	Freight	Freight	Freight	Freight	Freight	Freight	Freight
Categories		F1	F2E	F2L	F3E	F3L	F4E	F4L	F5E	F5L	F6
Loco 1 Type for Category		D10H	D10H	D10H	D10H	D10H	D12E	D12E	TY	TY	TY
Loco 2 Type for Category			D5H / TY	D5H / TY	D5H / TY	D5H / TY					
Loco 3 Type for Category			TY	TY	TY	TY	or D19E	or D19E			
Loco 4 Type for Category											
Specific Train Designation (acc. to No.1735/CTKHN-KTNV)		as above	as above	as above	as above	as above	as above	as above	as above	as above	as above
Loco 1 for specific Train		D10H	D10H	D10H	D10H	D10H	D12E	D12E	TY TY	TY TY	TY
Loco 2 for specific Train		D10H	D5H	D5H	D5H	D5H			TY	TY	
Total No. of Coaches / Wagons		20	21	21	21	21	10	10	12	12	6
Total Length of Train - LoC (Check for $L_{Ni,max}$ / Target: 400 m)	[m]	310,0	325,5	325,5	325,5	325,5	155,0	155,0	186,0	186,0	93,0
Max Gross Weight / Train - Loco limit/segm. (Target: 1200 t @ T14 & 4.2 t/m)	[t] [kN]	1100 10.791,0	378 3.708,2	1140 11.183,4	378 3.708,2	1140 11.183,4	180 1.765,8	550 5.395,5	216 2.119,0	680 6.670,8	340 3.335,4

Annex 3

Wagon Specifications

Table A.3.1: General Freight Wagons (Covered & Open)

Type Designation	(Unit)	G	G	G	GG	H	H	HH
Type]	Covered	Covered	Covered	Covered	Open	Open	Open
Origin								
Remarks, Ops assignment		<i>Assumptions in Italics</i>						
Axles	[-]				4			4
LoC	[mm]	12900	13900	14900	15906	13000	15000	14906
Body Length	[mm]	12000	13000	14000	15000	12000	14000	14000
Width	[mm]				2800			1540/2740
Height ToR	[mm]				3537			
Bogie Centres	[mm]				10700			10000
Axle Distance	[mm]				1600			1650
Tare Weight	[t]	15.7	19.8	19.8	18	15	17	18
	[kN]	154.0			176.6	147.2		176.6
Containers	[-]							
	Type							
	[t]							
	[kN]	0.0			0.0	0.0		0.0
Payload	[t]	30	35	35	35	30	40	35
	[kN]	294.3			343.4	294.3		343.4
Max Gross Weight / Wagon	[t]	45.7			53.0	45.0		53.0
	[kN]	448.3			519.9	441.5		519.9
Axle Load	[kN]	0.0			130.0	0.0		130.0
	[t]	0.0			13.3	0.0		13.3
Design Speed	[km/h]	80	80	80	80	80	80	80
Min. Curve Radius - Main Line	[m]				80			75
Min. Curve Radius - Access tracks	[m]							
Total No. in VNR Service	[-]	1566				1672		

Table A.3.2: Specialized Wagons

Type Designation	Unit	N	N	MC	MM	MM	MM	P	P
Type		Flat	Flat	Container	Container	Container	Container	Tank	Tank
Origin									
Remarks, Ops assignment				Speed Regulations 762/DS- CSHT (02.06.2004)					
Axles	[-]			6	4	4	4		
LoC	[mm]	12300	13600		14906	14906	14906	10800	12300
Body Length	[mm]	11500	12800		14000	14000	14000	10000	11500
Width	[mm]				2440	2440	2440		
Height ToR	[mm]								
Bogie Centres	[mm]				10000	10000	10000		
Axle Distance	[mm]				1600	1600	1600		
Tare Weight	[t]	15	17		18	18	18	15	18
	[kN]	147.2		0.0	176.6	176.6	176.6	147.2	176.6
Containers	[-]				2	1	1		
	Type				CTN 20'	CTN 20'	CTN 40'		
	[t]				19.8	30.5	30.5		
	[kN]	0.0		0.0	388.5	299.0	299.0	0.0	0.0
Payload	[t]	25	35					25	30
	[kN]	245.3		0.0	0.0	0.0	0.0	245.3	294.3
Max Gross Weight / Wagon	[t]	40.0		0.0	18.0	18.0	18.0	40.0	48.0
	[kN]	392.4		0.0	176.6	176.6	176.6	392.4	470.9
Axle Load	[kN]	0.0		0.0	141.3	118.9	118.9	0.0	0.0
	[t]	0.0		0.0	14.4	12.1	12.1	0.0	0.0
Design Speed	[km/h]	80	80	80	80	80	80	80	80
Min. Curve Radius - Main Line	[m]				80	80	80		
Min. Curve Radius - Access tracks	[m]								
Total No. in VNR Service	[-]	404						189	189

Annex 4

Coach Specifications

Table A.4.1: Coach Specifications

Type Designation	(units)	A 64	An28	An28	An24	An20	An	B	B	B80	B64
Type	[Text]	a/c 1st Class	a/c 1st Class Sleeping	DH2H2 2 nd gen.a/c	DH2H2 2 nd gen.a/c	a/c	"Victoria" Sleeper	a/c 2 nd Class	a/c 2 nd Class	2 nd Class	
Origin			JV / VH /TSC								
Remarks, Ops assignment	<i>Assumptions in Italics</i>										
Axles	[-]										
LoC	[mm]	19671	19671					19671	20671		
Body Length	[mm]	19000	19000					19000	20000		
Width	[mm]										
Height ToR	[mm]										
Bogie Centres	[mm]										
Axle Distance	[mm]										
Tare Weight	[t]	34	34					32	32		
	[kN]	333.5	333.5	0.0	0.0	0.0	0.0	313.9	313.9	0.0	0.0
Pax Capacity Seated	[-]										
Pax Capacity max.	75 kg/P	64	28	28	24	20		80	80	80	64
Payload	[t]	10	10					10	10		
	[kN]	98.1	98.1	0.0	0.0	0.0	0.0	98.1	98.1	0.0	0.0
Max Gross Weight / Coach	[t]	44.0	44.0	0.0	0.0	0.0	0.0	42.0	42.0	0.0	0.0
	[kN]	431.6	431.6	0.0	0.0	0.0	0.0	412.0	412.0	0.0	0.0
Axle Load	[kN]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	[t]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Design Speed	[km/h]	100	100					80	80 / 100		
Min. Curve Radius - Main Line	[m]										
Min. Curve Radius - Access tracks	[m]										
Total No. in VNR Service	[-]	105	71					243	243		

Table A.4.1: Coach Specifications (continued)

Type Designation		Bn42	Bn42	C	C	Ch1	Ck	Ckh	HC		
Type	[Text]	a/c 2nd Class Sleeping	a/c 2nd Class Sleeping	3 rd class	3 rd Class				Dining	"Victoria" Dining	"Victoria" Generator
Origin											
Remarks, Ops assignment	<i>Assumptions in Italics</i>										
Axles	[-]										
LoC	[mm]	19671	20671	17000	19671				19671		
Body Length	[mm]	19000	20000	16000	19000				19000		
Width	[mm]										
Height ToR	[mm]										
Bogie Centres	[mm]										
Axle Distance	[mm]										
Tare Weight	[t]	32	32	30	30				34		
	[kN]	313.9	313.9	294.3	294.3	0.0	0.0	0.0	333.5	0.0	0.0
Pax Capacity Seated	[-]										
Pax Capacity max.	75 kg/P	42	42	64	64						
Payload	[t]	10	10	10	10				10		
	[kN]	98.1	98.1	98.1	98.1	0.0	0.0	0.0	98.1	0.0	0.0
Max Gross Weight / Coach	[t]	42.0	42.0	40.0	40.0	0.0	0.0	0.0	44.0	0.0	0.0
	[kN]	412.0	412.0	392.4	392.4	0.0	0.0	0.0	431.6	0.0	0.0
Axle Load	[kN]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	[t]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Design Speed	[km/h]	100	100	80	80				100		
Min. Curve Radius - Main Line	[m]										
Min. Curve Radius - Access tracks	[m]										
Total No. in VNR Service	[-]	116	116	164	164				42		

Table A.4.1: Coach Specifications (continued)

Type Designation						HL	BV	TH2	
Type	[Text]	Dining Generator	Operation Generator	Luggage Generator	Generator	Luggage	Mail		Double-Deck
Origin									
Remarks, Ops assignment	<i>Assumptions in Italics</i>								
Axles	[-]							4	4
LoC	[mm]					19671	19671	20676	21676
Body Length	[mm]					19000	19000	20005	21005
Width	[mm]							2900	2900
Height ToR	[mm]							3900	4100
Bogie Centres	[mm]							14000	15000
Axle Distance	[mm]							2200/2600	2200
Tare Weight	[t]					30	32	38	40
	[kN]	0.0	0.0	0.0	0.0	294.3	313.9	372.8	392.4
Pax Capacity Seated	[-]								
Pax Capacity max.	75 kg/P							107	133
Payload	[t]					15	10	8	10
	[kN]	0.0	0.0	0.0	0.0	147.2	98.1	78.5	98.1
Max Gross Weight / Coach	[t]	0.0	0.0	0.0	0.0	45.0	42.0	46.0	50.0
	[kN]	0.0	0.0	0.0	0.0	441.5	412.0	451.3	490.5
Axle Load	[kN]	0.0	0.0	0.0	0.0	0.0	0.0	112.8	122.6
	[t]	0.0	0.0	0.0	0.0	0.0	0.0	11.5	12.5
Design Speed	[km/h]					100	100	100	100
Min. Curve Radius - Main Line	[m]							97	97
Min. Curve Radius - Access tracks	[m]							75	75
Total No. in VNR Service	[-]					14	30		

Annex 5:

D20E Locomotive Performance Characteristics

General

Subject

The locomotive AR15 is a 6-axle, diesel-electric locomotive with Co'Co' axle arrangement. The operating weight of the locomotive when it is carrying normal equipment is 81 metric tons. This is equal to a load of 13,5 metric tons per axle. The design will take into consideration the tropical conditions in Vietnam. More details see chapter 1.5.

The AR15 represents the latest state-of-the-art in three-phase AC/AC traction technology for locomotives of this performance class. This technology has proven its worth over many years in different voltage systems, on different track gauges and under different climatic conditions. This is the best way of ensuring that the market's usual expectations regarding lifetime and reliability are fulfilled.

The AR15 offers modern solutions and technology, which has been tried and tested over time. The modular construction is based on key components and allows adaptations to be made to specific customer wishes. Other aims such as the high reliability and availability of spare parts can be achieved without any loss of flexibility.

In this description, we have included the latest technical developments. We reserve the right to apply any new technical developments, which occur. This will not lead to different technologies installed in one series of these locomotives and to a reduction of the described functionality.

The engineering features, the components, devices and the materials will be designed and selected with a view to ensure a high degree of reliability, good wear and corrosion resistance for the locomotives during their life expectancy of 30 years, with an average yearly kilometric performance of 150,000 kilometers. Their service performance shall be compatible with the scheduling of normal maintenance operations, which specifically shall include:

- Periodic inspections involving operational checks, minor adjustments, re-placement of worn parts, cleaning, lubrication
- Overhauls carried out in specialized workshops after specified mileage

That valid versions of standards specified in this document are those, 14th of December 2004, the date of the contract being effective.

In this description, we present the actual state of construction of the AR15 VR locomotive for reviewing and approval.

Technical data

Power transmission Diesel engine	- diesel-electric; AC-AC
Diesel engine	- MTU 12V4000R41
Speed range	- 600 rpm to 1,800 rpm
Maximum shaft output	- 1500 kW (at UIC conditions)
Maximum wheel output	- 1220 kW (at UIC conditions)
Maximum speed	- 120 km/h
	- 135 km/h (locomotive running alone)
Maximum starting tractive effort	- 260 kN
Max. continuous effort	- 234 kN
Corresponding speed range	- 0,...,18.77 km/h (15 km/h included)

Maximum braking effort	- 150 kN
Multiple traction	- up to three locomotives of same type
Ambient temperature	- + 10°C to + 38°C (full performance)
	- + 5°C to + 55°C (with performance derating)
Axle arrangement	- Co – Co
Track gauge	- 1000 mm
Length over couplers	- 19,180 mm
Max. width carbody	- 2,688 mm
Max. width with mirror and door handles:	- 2820 mm including door handles
	- 2950 mm including mirrors (adjusted adequately)
Max. height	- 3,945 mm at exhaust opening
Distance between bogie centers	- 10,300 mm
Bogie wheelbase	- 1,650 mm
Powered-wheel diameter	- 1016 mm / 956 mm new/worn
Min. ground clearance with worn wheels	- At tank (4000 l): 100 mm
	- At derailment protection bar: 100 mm
	- At traction motor: 100 mm
	- At traction rod: 112 mm
Minimum curve radius	- 97 m on mainline / 70 m ¹ in the workshop area
Loading gauge	- Regulations of Technical Exploitation of the Railway, PHU BAN II, page 225, issue 1999. We assume the gauge as static!
Minimum vertical radius, convex	- ≥ 250 m
Minimum vertical radius, concave	- ≥ 300 m
General layout-drawing	- "Project drawing/General Layout" Asia Runner AR 15, Drawing # 0000094-003
Axle load (2/3 supplies)	- max. 13,5 t
Tolerance for service weight and axle load	- according to IEC 61133

Diagram of Tractive / Braking Effort

The locomotive has a maximum output at the wheel rim of approximately 1,220 kW and can meet the maximum hauling capacity as indicated in the bidding documents under the condition of an corresponding adhesion factor.

As mentioned under 1.2 Technical Data, up to an ambient temperature of 38°C and a height of 500 m above sea level the full performance is maintained as shown in Fig.3 (Diagram of efforts at gradients).

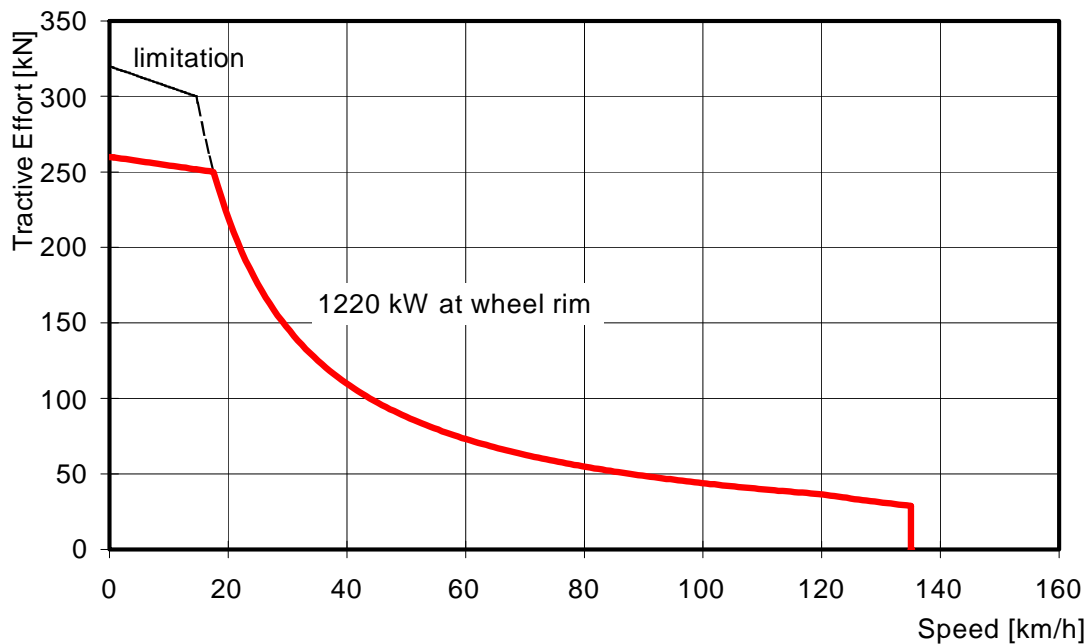
The following two diagrams show the tractive and braking effort available at the wheel rim. How much of this effort can be transferred depends on the track surface conditions.

When the coefficient of friction is 0.33, the starting tractive effort of 260 kN can be reliably transferred to the rails.

Maximum utilization of the available coefficient of friction is ensured by a highly effective electronic friction control system that has proven its worth in many vehicles.

The locomotive could realize a tractive effort of 320 kN for a short time in case of an adhesion coefficient of min. 0,40.

¹ For trouble-free running on a 70 m curve, a gauge widening of 6 mm is required

Figure A5.1: Diagram of Tractive Effort*Diagram of dynamic braking effort (electric brake)*

The maximum electric braking effort of the vehicle is limited due to safety reasons to 150 kN according to a adhesion coefficient of 0,185. The braking power is 1,500 kW at wheel rim.

The theoretical possible braking effort of 320 kN in case of an adhesion coefficient of min. 0,40 is blocked.

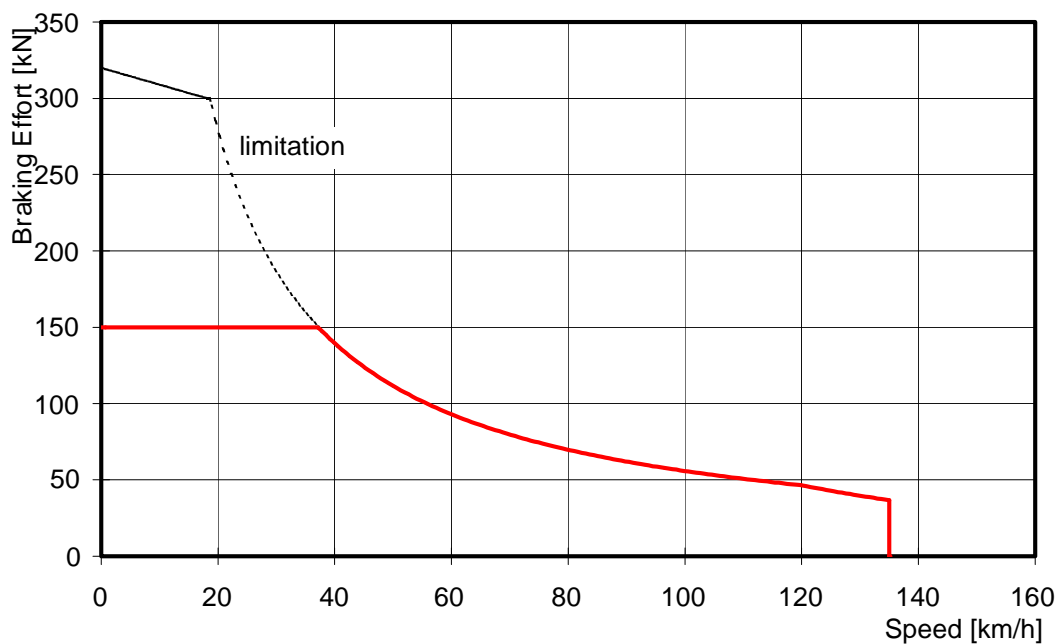
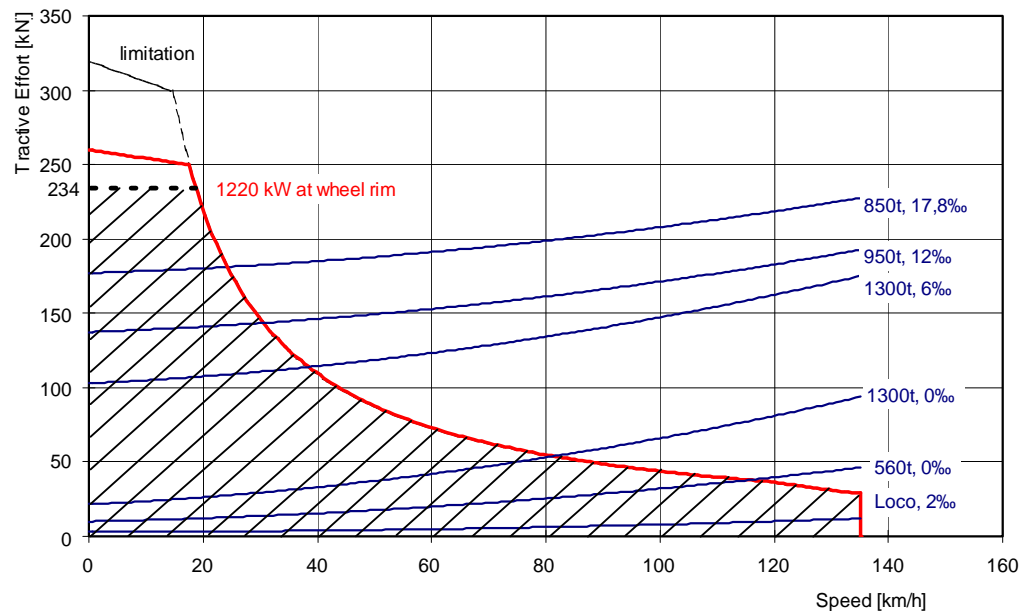
Figure A.5.2: Diagram of Braking Effort

Figure A.5.3: Diagram of Efforts at Gradients

In the hatched area, continuous operation without time limitation is possible.

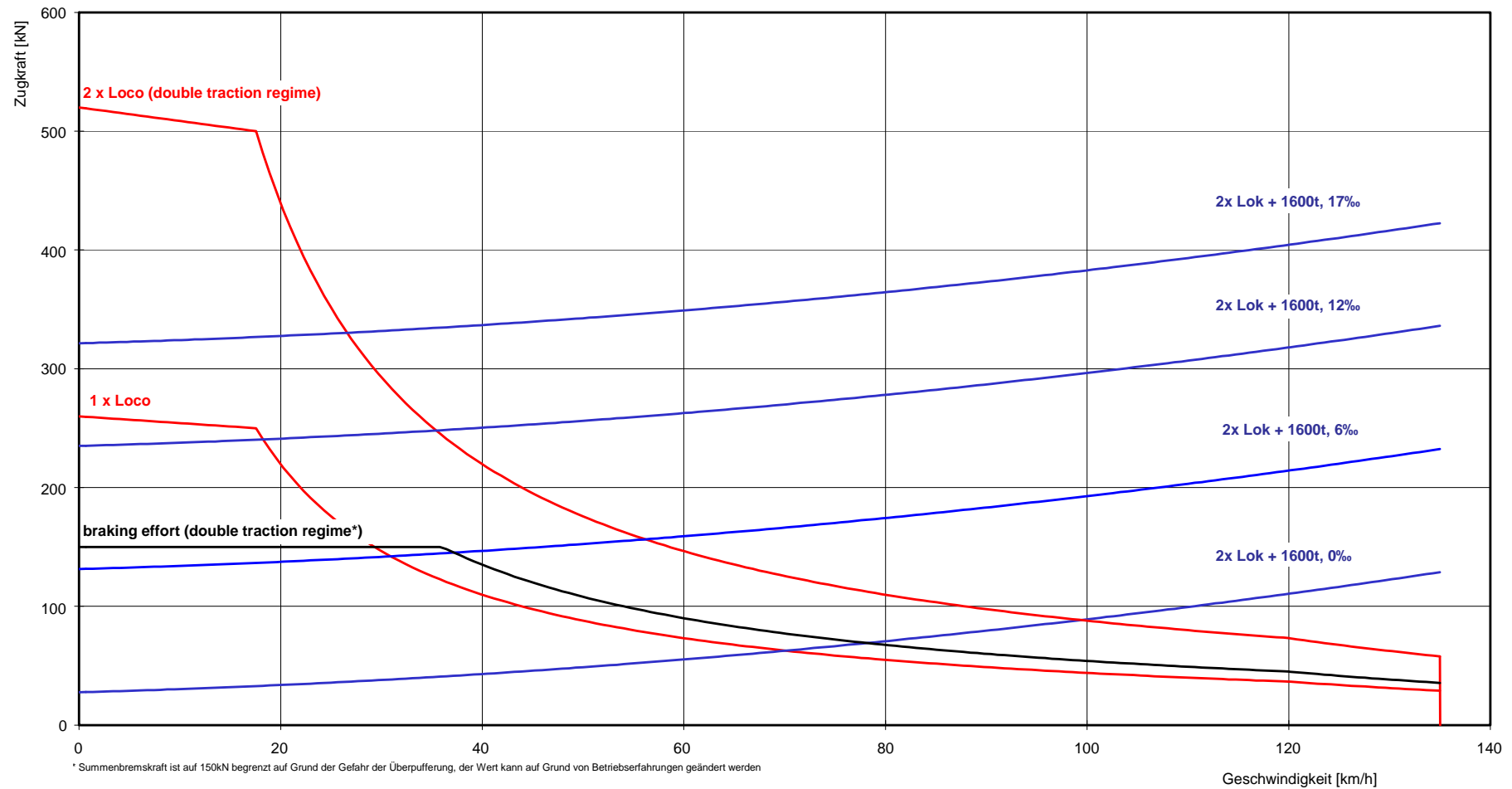
Annex 6

Tractive Effort and Braking Performance of D20E

Figure A.6.1: Tractive and Braking Effort Diagram

SIEMENS

Transportation Systems



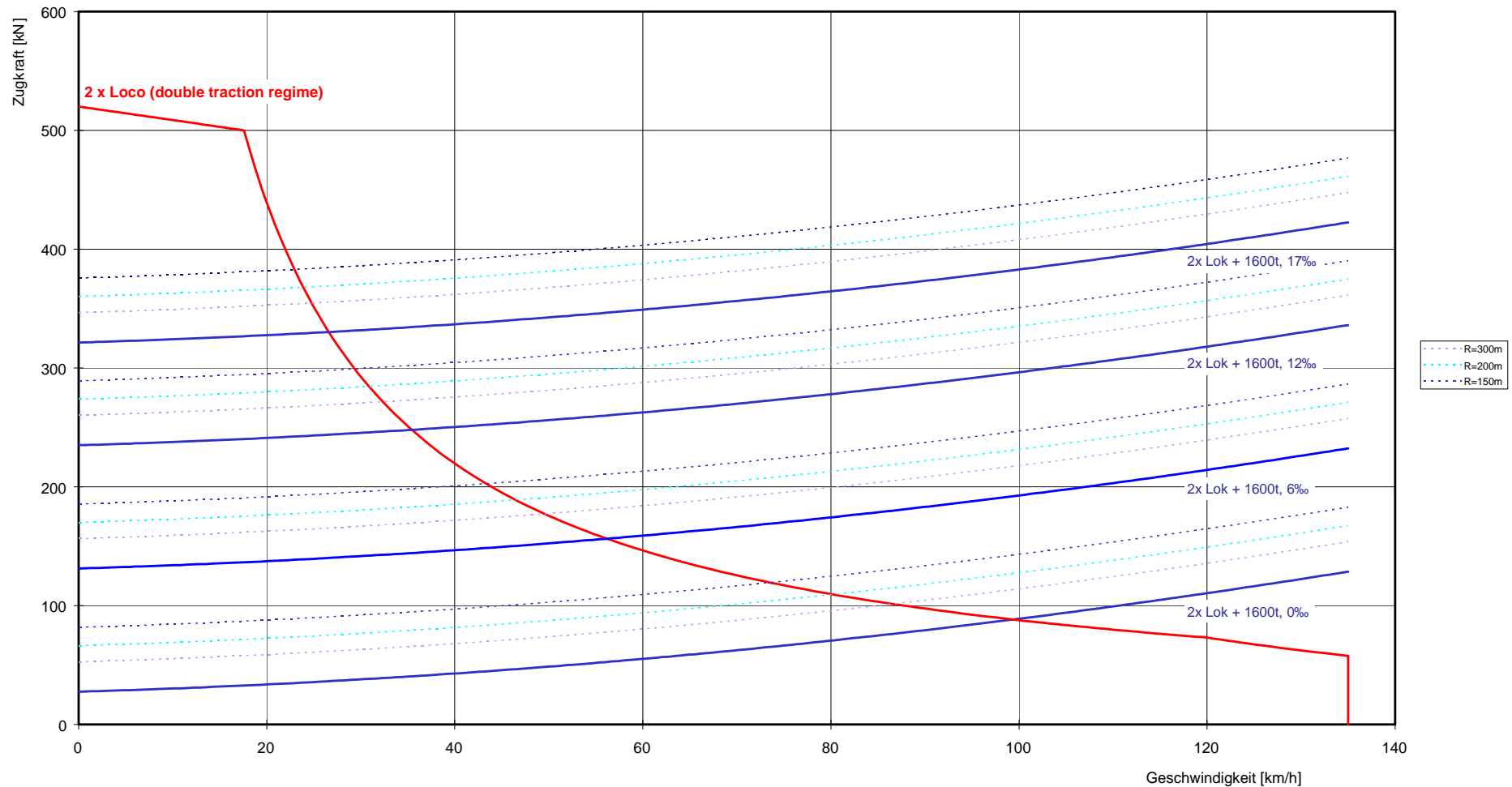
VR Vietnam

Tractive and Braking Effort Diagram

Figure A.6.2: Tractive Effort and Resistance

SIEMENS

Transportation Systems



AR15 VR Vietnam

Tractive Effort Diagram and different Train Resistances

TA No. 4050-VIE

**KUNMING – HAIPHONG TRANSPORT CORRIDOR PROJECT
UPGRADING HANOI – LAO CAI RAILWAY**

Feasibility Study and Preliminary Design

DRAFT FINAL REPORT

Technical Appendix B.1

INITIAL ENVIRONMENTAL EXAMINATION

July 2006

CURRENCY EQUIVALENTS
(05 MAY 2006)

Currency Unit	–	Vietnamese Dong (VND)
VND 1.00	=	\$ 0.00006272
\$1.00	=	VND 15,950

ABBREVIATIONS

ADB	-	Asian Development Bank
AFD	-	Agence Française de Développement
AP	-	Affected People
BCR	-	Benefit cost ratio
CAD	-	Computed Aided Design
CARB	-	Compensation and Resettlement Board
CPC	-	Commune People's Committee
CPI	-	Consumer Price Index
DFR	-	Draft Final Report
DGTPE	-	Direction Générale du Trésor et de la Politique Economique
DMC	-	Developing Country Member (of ADB)
DPC	-	District People's Committee
EA	-	Executing Agency
EIRR	-	Economic internal rate of return
EMSA	-	Ethnic Minority Special Actions
EPMD	-	Environmental Protection and Management Division
GDP	-	Gross Domestic Product
GOV	-	Government of Vietnam
GSO	-	General Statistical Office
GTZ	-	Gesellschaft für Technische Zusammenarbeit
IBRD	-	International Bank for Reconstruction and Development (World Bank)
ICB	-	International competitive bidding
IEE	-	Initial Environmental Examination
IoL	-	Inventory of Loss
IP	-	Indigenous People
IPDP	-	Indigenous Peoples' Development Plan
IMO	-	Independent Monitoring Organization
IPSA	-	Initial Poverty and Social Analysis
IRR	-	Internal rate of return
ISA	-	Initial Social Assessment
LURC	-	Land Use Rights Certificate
MOF	-	Ministry of Finance
MONRE	-	Ministry of Natural Resources and Environment
MOT	-	Ministry of Transport
MPI	-	Ministry of Planning and Investment
NGO	-	Non Government Organization
NPV	-	Net present value
OCR	-	Ordinary Capital Resources (of ADB)
O-D	-	Origin Destination
ODA	-	Official Development Assistance
OSPF	-	Office of the Special Project Facilitator
PIB	-	Project Information Booklet
PPTA	-	Project Preparatory Technical Assistance
PRC	-	People's Republic of China
PSA	-	Participatory Social Appraisal

ABBREVIATIONS

RALC	-	(Department of) Resettlement and Land Clearance
RoW	-	Right of way
RP	-	Resettlement Plan
RPI	-	Retail Price Index
RPUC	-	Railway Public Utility Company
RPMU	-	Railway Projects Management Unit
RRP	-	Report and Recommendation of the President (to ADB Board of Directors)
RRP	-	Report and Recommendation of the President (to ADB Board of Directors)
SAP	-	Severely Affected People
SES	-	Socio-Economic Survey
SIEE	-	Summary Initial Environmental Examination
TA	-	Technical Assistance
VOC	-	Vehicle operating costs
vpd	-	Vehicles per day
VRA	-	Vietnam Roads Authority

WEIGHTS AND MEASURES

Metric system

NOTES

1. In this report, "\$" refers to US dollars.

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A.1	Operations
A.2	Infrastructure
A.3	Rolling Stock
A.5	Topographical Survey
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B	Environment
B.1	Initial Environmental Examination
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C	Resettlement
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E	Preliminary Project Design
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F	Economic and Financial Analysis
F.1	Economics
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1 INTRODUCTION

This is the report of 'Initial Environmental Examination' (IEE) of the 'Kunming-Haiphong Transport Corridor Project (Supplementary GMS Hanoi - Lao Cai Railway Upgrading) proposed by Vietnam Railways (VNR), of Government of Vietnam. It proposes to upgrade a section of the railway line between the port of Haiphong in Vietnam and Kunming in Yunnan province of People's Republic of China. The purpose of the project is to rehabilitate and partially upgrade the existing railway along its present alignment and ensure sufficient capacity to cater to expected increase in traffic up to 2020. The project will benefit by linking the port of Haiphong in Vietnam and Kunming in China for bilateral trade thereby enhancing the socio-economic development of Vietnam.

The works of the proposed project involve local realignments and consequently severance of watersheds, risks of pollution, disturbance to eco-system and so on. These effects and impacts will be examined and their significance assessed with a view to avoidance or mitigation during the proposed Environmental Assessment. Based on the inputs of the earlier Phase I study, ADB has classified the project belonging to Category B, requiring only 'Initial Environmental Examination (IEE)' as part of the feasibility study.

This IEE is based on studies conducted by Wilbur Smith Associates in association with DE-Consult and Vietnam Transport Engineering Consultancy Centre, during the period of February to July 2006. It presents the environmental benefits, adverse effects, and recommended mitigation and monitoring measures related to construction and operation stages of the project following ADB's safeguard policy and guidelines 2003.

The IEE is based on (i) inputs derived from the pre-feasibility study conducted during December 2003, (ii) discussions with railway experts of the project team and Railway Project Management Unit (RPMU) of Vietnam Railways, (iii) primary observations and secondary data on various environmental components collected during the reconnaissance survey of 5 kilometers on either side of the alignment by experts, (iv) review of the environmental regulations of Ministry of Natural Resources and Environment (MoNRE and Ministry of Science Technology and Environment (MoSTE), (v) review of required secondary data procured from concerned departments of Government of Vietnam and (vi) information collected from potentially affected citizens and concerned local officials of the Government and existing railway stations along the alignment.

1.1 GENERAL APPROACH, METHODOLOGY AND SCOPE OF IEE

The approach and the methodology for the IEE study is based on guidelines given by 'Asian Development Bank Guidelines' for IEE and consisted of following tasks.

Task 1: Project Appreciation

Task 2: Preparation of Baseline Environmental Profile

- a. Reconnaissance survey along the alignment (covering area up to 5 km on either side of the track) to understand the features of physical, biological/ ecological and socio economic components of the environment.
- b. Collection of secondary data/information on the above mentioned environmental components through discussion with various concerned local officials/agencies and local people.

Task 3: Identification/screening of the potential environmental impacts and suggesting mitigation measures.

Task 4: Preparation of Environmental Management and Environmental Monitoring Plan.

Task 5: Public Consultation in two stages namely Pre-IEE and Post-IEE consultation meetings and discussion, and

Task 6: Findings, recommendations and conclusions.

1.2 ACTIVITIES

Task 1: Project Appreciation

This was accomplished by desk review of the project documents like, reports of Pre-feasibility studies, documents related to the present study like alignment maps, geomorphology of the project site etc, discussion with the railway experts on the project team and concerned officials of RPMU, regarding nature of improvement and up-gradation works related with the project.

Task 2: Preparation of Baseline Environmental Profile

Reconnaissance survey of the proposed alignment

This was done in two phases. The first phase consisted of a survey of the whole alignment, with experts of the project team and RPMU officials, by rail car, to observe topography and terrain, sites of proposed improvements, vulnerable sites, existing condition of the track, bridges, culverts, railway stations, natural resources like river, forests, vegetation etc. A running video film was also recorded. Some of the distinctive environmental features were noted.

The second phase of the survey was done by road in a car to identify the environmental and socio-economic features covering an approximate area of 5 km on either side of the track. Primary observations of the environmental features were noted. Discussions were held with officials of the railway stations along the alignment to know facts about the environmental issues concerning the railway operations. Important environmental hotspots were noted and filmed.

Collection of secondary data

Available secondary information regarding the environmental baseline along the alignment was collected.

Based on the surveys and the secondary data, an environmental profile of the alignment region was prepared.

Task 3: Forecasting/Screening of the Environmental Impacts and Mitigation Measures

Based on the primary observations, secondary information collected and discussions made, during the surveys along the alignment, the probable impacts likely to arise out of the project activities during, (i) pre construction stage, (ii) construction stage, and (iii) operation stage, were forecasted and the possible mitigation measures suggested.

Task 4: Institutional Requirements for Environmental Management and Environmental Monitoring Plan

In this task, various institutional, organizational and logistic requirements at various levels for managing different environmental issues/activities arising out of railway operating were identified. Also a framework for monitoring various environmental management activities/ issues, their frequency and reporting and approximate cost, during operation phase was formulated.

Task 5: Public Consultation and Information Disclosure

This was done in two stages. (i) During the reconnaissance survey, various informal meetings/discussions were conducted with public, vendors and officials at railway stations along the alignment. During these meetings the proposed project were explained in brief and their comments were sought and noted. (ii) After the completion of IEE activities another pre-arranged, structured and formal Public Consultation Meeting, with relevant officials, community leaders, representatives from women's organizations from different provinces along the alignment, was conducted. During the meeting the IEE findings were presented and their opinion regarding the project was sought and their concerns regarding the project were addressed.

Task 6: Findings, Recommendations and Conclusions

This consisted of compiling all the IEE findings. Recommendations addressing various issues, like any further independent studies required, compliance with the national and local environmental regulations etc. were made Then conclusions, regarding the adequacy or otherwise of the present IEE, were drawn.

The components of the IEE, as per the tasks mentioned above are presented in the succeeding 7 chapters of this report.

2 DESCRIPTION OF THE PROJECT

2.1 INTRODUCTION

2.1.1 Background to the study

With anticipated increases in international trade, and trade between Vietnam and China in particular, certain strategic corridors were identified as providing the best transport corridors for passengers, goods and services. One of these, the Kunming to Haiphong Corridor was, in December 2003, the subject of an earlier ADB Study (TA 4050-VIE Kunming – Haiphong Transport Corridor Project) to determine the best transport mode that would serve both domestic and international demand, as well as providing access to communities residing in some of the poorer mountainous areas of Vietnam.

The railway section to be upgraded traverses about 285 km in a generally northwesterly direction from Yen Vien station near Ha Noi, along the east side of the Red River to Lao Cai on the border with PRC and the branch from Pho Lu to Xuan Giao. The railway line, a single-track meter gauge and not yet electrified, forms an integral part of the Haiphong - Kunming transport corridor and carries substantial traffic composed of transit traffic between Haiphong Port and Yunnan Province, bilateral trade between Vietnam and China, and domestic traffic, especially for the tourism attractions in Sapa. The railway line is owned and operated by Vietnam Railways (VNR). VNR currently operates up to 38 trains per day (19~20 pairs of train per day). The proposed alignment along with major railway stations is shown in Map 2.1.

Transportation Demand Forecast in 2005, 2010 and 2020

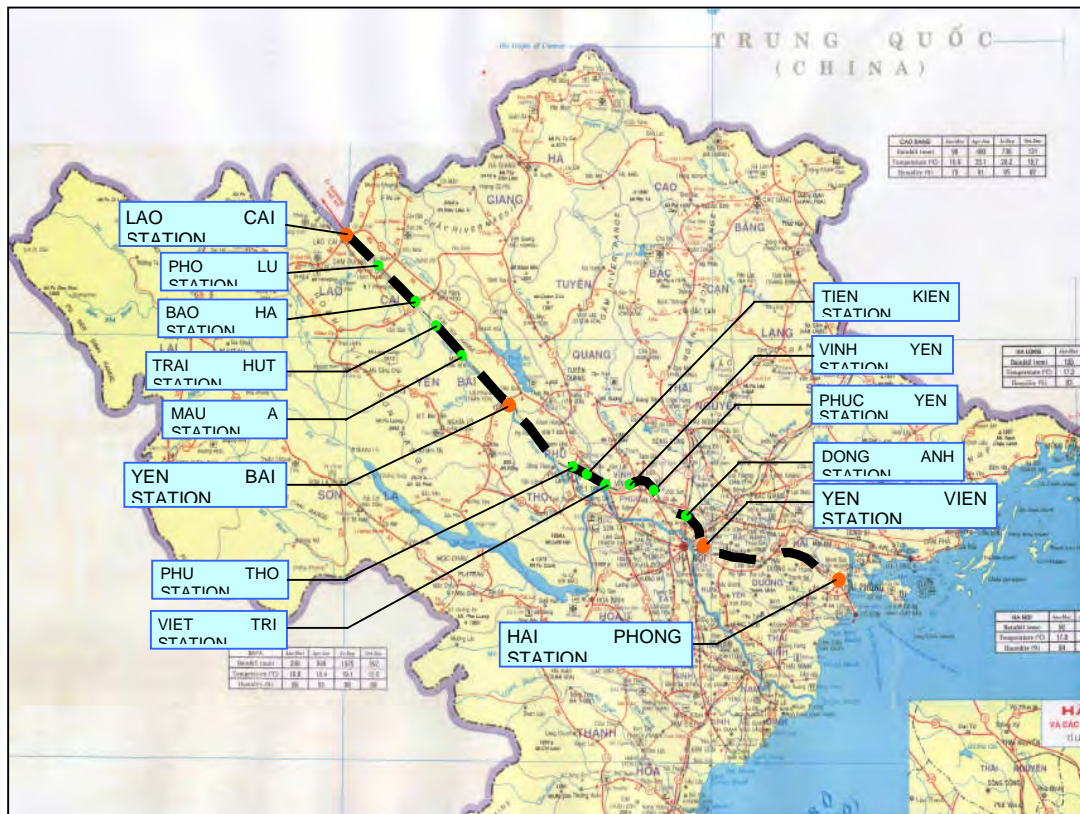
Based on surveys, traffic forecasts for demand along the project alignment are as follows:

- 2005: 2.6 million passengers and 2.5 million tons of goods
- 2010: 3.5 million passengers and 4.7 million tons of goods
- 2020: 5.5 million passengers and 7.3 million tons of goods

The existing condition of infrastructure can not ensure railway safety nor satisfy transport demand in the next few years if timely investments in railway infrastructure and locomotives are not carried out soon.

2.2 STUDY OBJECTIVES

The purpose of the proposed project is to rehabilitate and partially upgrade the railway along its present general alignment to ensure sufficient capacity to cater for foreseeable traffic to 2020; enhance transit traffic between Kunming and Haiphong Port; and improve safety, especially at road crossings.

Map 2.1: Proposed Alignment and Major Railway Stations

The key project components are:

1. Selective improvement of the horizontal and vertical alignment and track layout, (Yen Bai to Lao Cai).
2. Stabilization of embankments and sliding slopes.
3. Upgrading of 40 bridges and constructing new 6 bridges.
4. Improvements of track-work including turnouts (at about 122 locations),
5. Improvements of safety of selected at grade level crossings (2 fly over road bridges located at Dong Anh and Gia Cam).
6. Upgrading of stations (2 new Freight stations at Van Phu and Lao Cai) and.
7. Extension of passing loops for train loads upto 1200 tons and train length of 400 m. (at Viet Tri, Phu Duc, Mau A, Lam Giang, Thai Van and Thai Nien stations).
8. Additional passing loops at 9 atations (at Thach Loi, Huong Canh, Tien Kien, Chi Chu, Vu En, Mai Tung, Van Phu, Mau Dong and Lang Thip stations).

The objectives of the project are to:

- Speed up train operations in order to shorten traveling time resulting in capacity increase to meet the requirements of rising domestic and international transport.
- Enable high power locomotives such as Belgian, Micado and Renovation (made in China) to run on the line to increase the total weight of the freight train.
- Improve safety of train operations and to minimize traffic jams and accidents,
- Reduce traveling and rail traffic cost.
- Ensure economic and social development.

2.3 THE NECESSITY OF THE PROJECT

The project is required to ensure that the railway can carry the traffic forecast for 2020, and to improve the safety of rail operations.

2.4 CIVIL WORKS OF THE PROJECT

The main civil works are:

- Improvement of ballast volume of permanent track as Regulated in Technical Standards.
- Replacement of rail with its weight less than P43 by P50
- Additional loops will be made at several stations.
- One station will be built and several existing stations will be extended so as to increase the traffic capacity of the railway line.
- Rehabilitation of 40 bridge substructures and 6 new bridges.
- Total Investment cost is provisionally estimated as VND 2,364 billion (\$ 148.1 million).

The scope of work is described in Table 2.1 and the estimated cost is described in Table 2.2.

Table 2.1: Scope of Works

Type of Work	Rationale	Location (km)		Volume of Work			
		From	To	Length (km)	Cut (cu.m)	Fill (cu.m)	Land Take (sq m)
Realignment (1)	Avoidance of flooded area	169.9	173.8	3.0	24,981	40,400	43,605
Realignment (2)	Removal of curves of < 150 m radius; moving line away from river	283.6	292.1	6.1	142,253	97,659	41,053
Totals				9.0	167,234	138,059	84,658
Embankments	Protection of track from subsidence; prevention of closures due to soil & rock falls on line	Various		Length (m)			Land Take (sq m)
DR 02 - deep side drainage	Prevention of soil saturation			1,500			
DR 03 - deep side drainage & slope collector drains	Prevention of soil saturation			500			
PF 01 - Piled retaining wall & slope surface protection	Protection against flooding			2,400			
SH 03 - deep piled retaining wall & footing protection	Prevention of embankment slippage			200			
SL 01 - bolting & concrete frame on upper slope	Upper slope protection			600			
Totals				3,700			0
Bridges	Replacement of war damage and weak bridges	various		No	Total Length (m)		
					Bridges	Girders	
Girder replacement & minor work on substructure				40	1137	702	
Replacement bridges				6	145	102	
Totals				46	1282	805	
Stations	Increase in line capacity	km		Loops		Extn	Land Take (sq m)
				No	(m)	(m)	
New station at Mai Tung		124.2		2			29,641

Type of Work	Rationale	Location (km)		Volume of Work			
Additional passing loops at 9 stations		various		20			28,337
Extension of passing loops at 8 stations		various		10		1,196	4,408
Totals					0	1,196	62,385
Safety Measures		km		No	Length (m)		
Overpasses	Reductions in traffic conflict & congestion						
Dong Anh		21.8			307		2,791
Gia Cam		76.5					0
Barriers & gatekeepers	Currently unprotected; high crossing traffic vol			18			0
Fencing & collector crossings					1,150		0
Totals							2,791
Track Renewal		Various		Units	Length (m)	cu m	
New rail (50 kg/m)	Replacement of badly worn rails				415,350		
Ballast	Replacement of crushed ballast				159,510		
Sleepers	Replacement of cracked sleepers; new with new rail			344,202			
Turnouts	Replacement of badly worn turnouts			141			
Totals							0
Total Land Take (sq m)							149,834

Table 2.2: Estimated Cost

Work	Cost	
	VND (mn)	US\$ 000
Total Construction Costs	1,984,458.5	124,808.7
Environmental Protection Measures	29,766.9	1,872.1
Resettlement	82,118.3	5,164.7
Contingency (5%)	99,222.9	6,240.4
Detailed Design & Supervision	158,756.7	9,984.7
Total	2,354,323.3	148,070.6

2.5 MAIN ACTIVITIES OF THE PROJECT

2.5.1 Embankments

- Treat weak embankment, mud raising and water stagnancy. Excavate and replace soil, place geotextile woven fabric, construct underground drainage ditches, top and longitudinal ditches.
- Treat erosion, settlement and slide of slope: construction of retaining wall and reinforcement of slope.
- Improve locally alignment plan at some small-radius curves

2.5.2 Superstructure

- Replace all rails P38 and P43 by rail P50.
- Replace switches (about 122 switches) and sleepers, supplement satisfactory ballast.
- Large-scaled maintain tracks (24 km)

2.5.3 Stations

- Lengthen tracks to ensure usable length $\geq 400\text{m}$ which is suitable with tractive power of large capacity locomotive 1800-1900HP.
- Construct new Mai Tung station including access road.
- Expand Van Phu station, which serves for Van Phu industrial zone.
- Improve and extend Lao Cai freight station.

2.5.4 Bridges

- Replace all Pigeaud girder (11nos) by under-passing open truss and solid girders (in order to keep existing level of girder bottom), repair 2 abutments and approaches. Replace semi-permanent girders (3 girders VN64-71 and 3 girders T66).
- Replace one girder with width of 17.3 – 21.5m (with defects) by solid under-passing girders.
- Replace some bridges with width of between 7m and 13.5m by above-passing solid girders. Replace spans with width of less than 5m by reinforced concrete girders together with abutment reinforcement.
- Reinforce Vom Tu Mau (Km168+850).
- Reinforce Thuy Loi bridge (Km157+341) by rivet instead of coarse bolts.
- Construct 6 new bridges at the realignment locations.

2.5.5 Realignment

- Realignment at 14 locations from km 169+909 to km 292+317 with total length of 9.046 km.

2.5.6 Construction Period

Detailed design will be carried out in early 2007, construction should start in early 2008 and being completed by the end of 2010.

3 DESCRIPTION OF THE ENVIRONMENT

The detail of notable features of different components of the environment like physical, ecological, socio-cultural environment observed during the two reconnaissance surveys are presented in this chapter. For this purpose, the study region was divided into 4 sections namely: (1) From Lao Cai to Bao Ha, (2) From Bao Ha to Yen Bai, (3) From Yen Bai to Viet Tri and (4) From Vinh Yen to Yen Vien stations and are shown in Maps 3.1 to 3.4 respectively. The notable features/hot spots etc. are shown in particular map.

3.1 PHYSICAL ENVIRONMENT

3.1.1 Climate

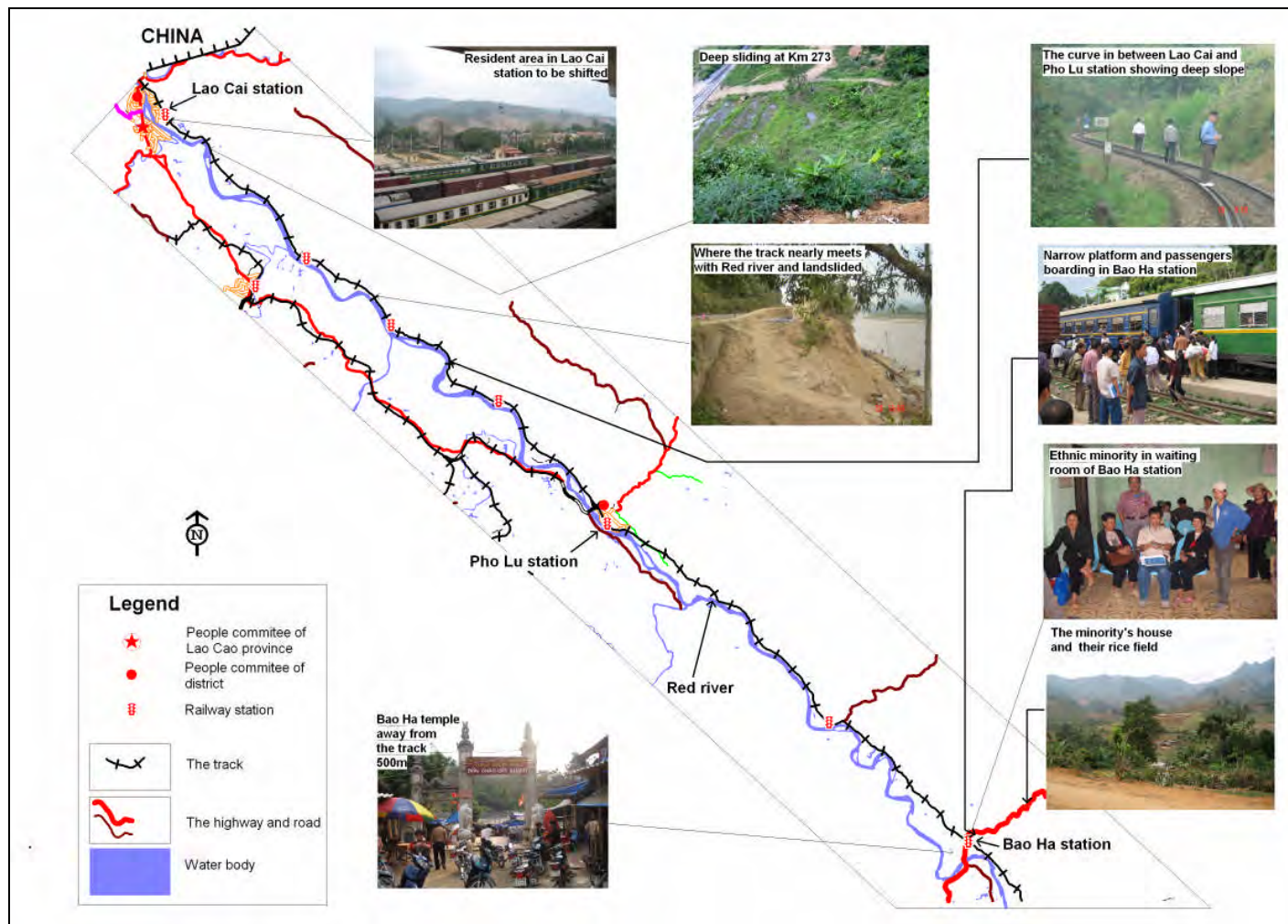
The climate data for 2004-2005, regarding climatic features of the alignment region procured from two of the meteorological stations (Tuyen Quang and Hanoi) closer to the alignment is as indicated below:

Table 3.1: Temperature along the Alignment.

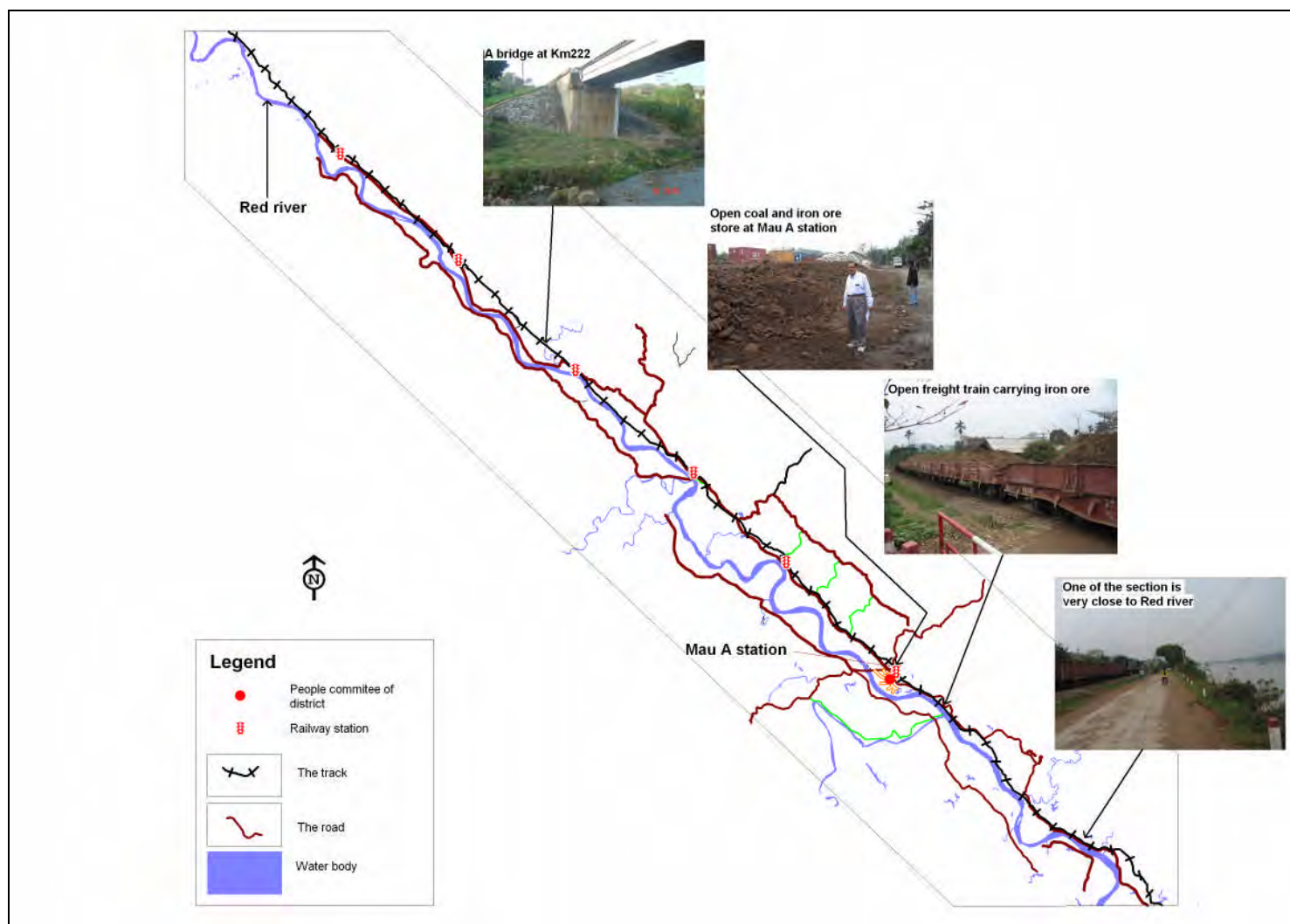
Characteristics	Lao Cai	Luc Yen	Yen Bai
Annual average temperature (°C)	22.8	22.6	22.7
Max. Monthly average temperature (°C)	22.7 (VI)	27.7 (VII)	28 (VII)
Max. Average temperature of the hottest month (°C)	32.7 (VI)	33.1 (VII)	32.5 (VII)
Min. monthly average temperature (°C)	15.8 (I)	15.1 (I)	15.3 (I)
Min. average temperature of the coldest month (°C)	13.2 (I)	12.7 (I)	13.1 (I)
Absolute max. temperature (°C)	41.0	39.9	39.8
Absolute min. temperature (°C)	2.2	2.05	2.0
Daily temperature (°C)	8.1	7	6.9

Table 3.2: Rainfall along the Alignment.

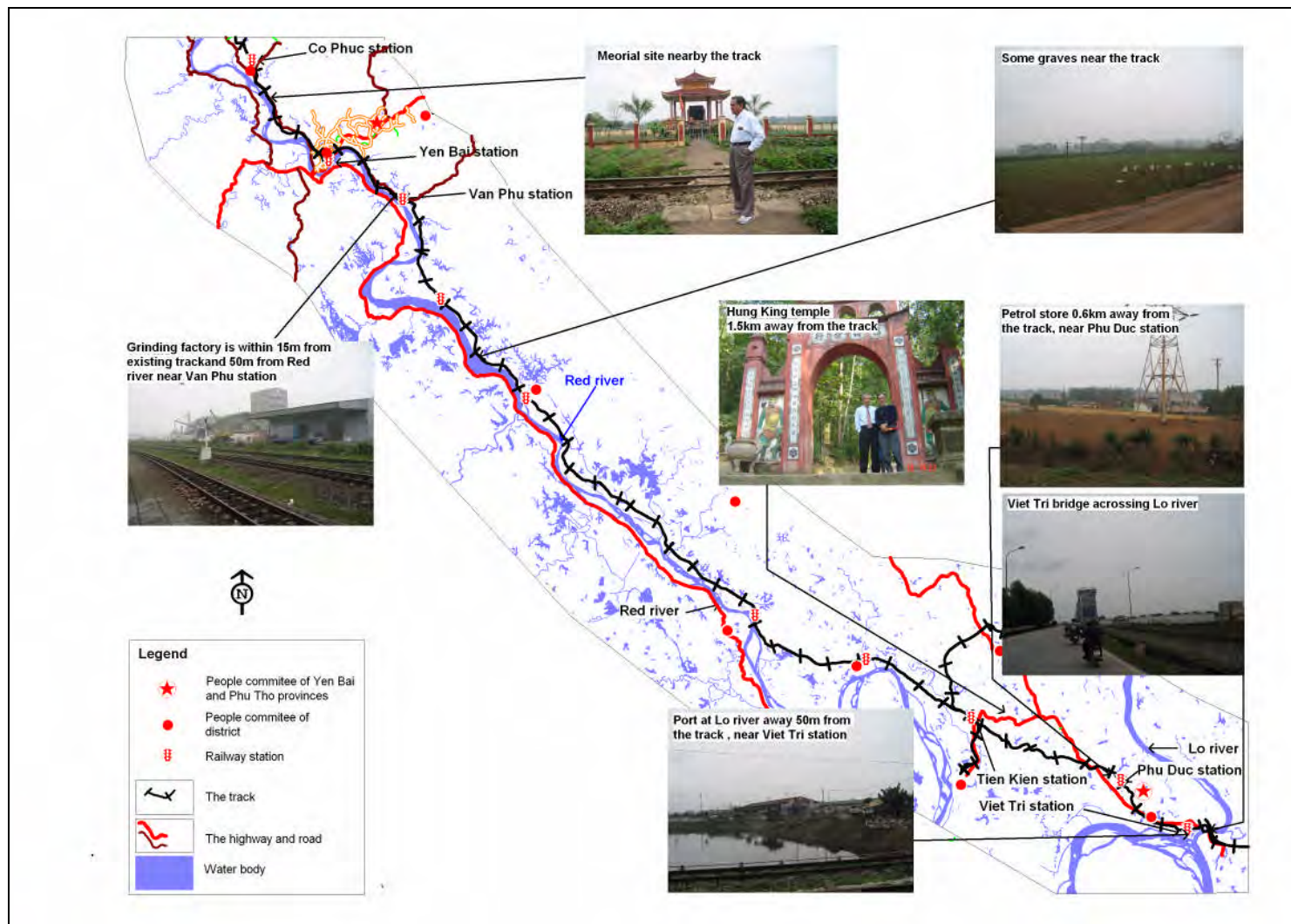
Characteristics	Lao Cai	Luc Yen	Yen Bai
Annual average rainfall (mm)	1764	1226	2107
Average nos. of rainy days per year	153	172	193
Max. monthly average rainfall (mm)	330 (VIII)	420 (VIII)	400 (VIII)
Min. monthly average rainfall (mm)	20.7 (I)	31.2 (I)	32.1 (I)



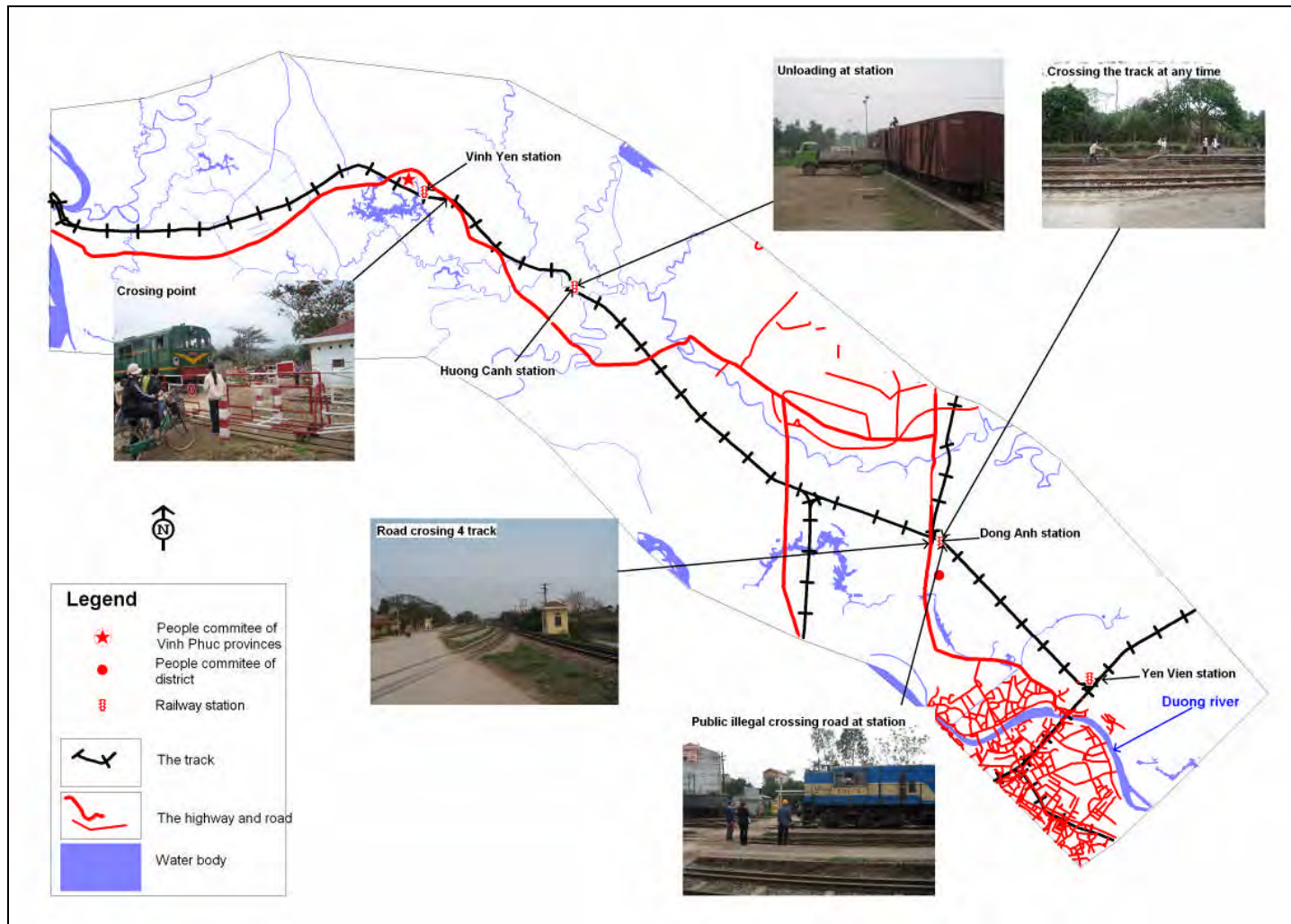
Map 3.1: Section 1, from Lao Cai to Bao Ha Station.



Map 3.2: Section 2, from Bao Ha to Yen Bai station.



Map 3.3: Section 3, from Yen Bai to Viet Tri Station.



Map 3.4: Section 4, from Viet Tri to Yen Vien station

Table 3.3: Relative Humidity along the Alignment.

Characteristics	Lao Cai	Luc Yen	Yen Bai
Annual average absolute moisture (mb)	24.2	24.2	24.7
Annual average relative moisture (%)	86	86	87
Max. monthly average relative moisture (%)	87	87	90
Average min. relative moisture (%)	63	65	67
Absolute min. relative moisture (%)	12	17	20

Source: Hanoi and Tuan Quang Meteorological Stations.

From Viet Tri to Yen Vien, the railway is in midland of Northern plain. Characteristics of this area are as follows:

Temperature

- Annual average temperature 23 – 24°C+ Absolute max. temperature 42.8°C
- Absolute min. temperature 0.40°C

Rain

- Annual average rainfall 1680 mm,
- 142 rainy days per year
- Rain falls from May to October.

3.1.2 Topography

The entire area is part of the Red River watershed, and the River is the main axis of the project corridor. The project area covers 10 provinces and can be divided into 3 zones: (1) the alluvial plain of the Red River (6 provinces); (2) the Midlands (Vinh Phuc & Phu Tho) and (3) the Upland (Yen Bai and Lao Cai).

There is considerable variation along the existing alignment. It varies from broad flat plains from Hanoi to Viet Tri, narrow valleys in the midlands in Vinh Phuc and Phu Tho provinces. There are denuded low mountains and hills near Yen Bai, typical loose masses, deeply incised slopes, eroded gullies and then high mountainous uplands between Yen Bai and Lao Cai. There are land slides/slips and abandoned quarried sites all along mountainous regions.

3.1.3 Geology

It is not of complex nature except for evidence of folding and prominent faulting in the mountainous regions in the Lao Cai province. Thick layers of sediments have accumulated along the Red river delta between Phu Tho and Yen Bai provinces. The mountainous regions between Yen Bai and Lao Cai exhibit underlying materials of limestone and mudstones.

3.1.4 Water Resources

The groundwater resources in the alignment region (North East) are limited and widely scattered. The underground water along the alignment derives mainly from pore water, bedrock crack water, and karst water. The depth to the water table is largely governed by topography. It varies from 1 m (meter) to 10 m in the plains, and flat areas adjacent to the rivers. In the higher altitudes, the depth to the aquifer is normally 40 m to 60 m, and in some sections, more than 80 m. Ground water quality is reported to be good and generally within the National Standards (Standard TCVN 5944). However it is reported

affected in mining areas along the alignment because of the seepage from the open yard ore storage areas especially near Railway Stations of Mau A and Van Phu.

The surface water along the alignment consists mainly of the Red River and its tributaries runs parallel to the alignment and is very close to the tract between Pho Lu and Yen Bai stations (P3.1).

However, the railway never crosses the river all along the alignment. There are various streams, over which the alignment passes without affecting their flow. These streams finally join the Red River.

The main tributaries are, on the right bank, the Da River, which joins the Red River in Viet Tri, and on the east bank, the Chay and Lo rivers which also join the Red river in Viet Tri. In 1972, the Thanh Ba reservoir was built on the Chay River with surface area of 19,000 ha and a length of 90km.



P3.1

On average, the total volume of water carried by the Red River is 1220m³. The largest volume is during the flood season from May to October. Seasonal water level variations are 6 to 7m in the main rivers of the project area. The Red river carries large volumes of alluvial (more than 100 million m³) soil (much more than the Mekong) because of which the river has a very high level of turbidity.

Vietnam has an extensive set of Water Quality Classifications and Standards: Class A is water resource for domestic use (subject to appropriate treatment), Class B – for other users.

The standards prescribed for surface and ground water quality are as shown below:

Table 3.4: Surface Water Quality Standard: STCVN 5942: 1995

Parameter	Unit	Class A	Class B
PH		6-8.5	5.5-9
COD	mg/l	<10	<35
BOD5	mg/l	<4	<25
NO ₃	mg/l	10	15
NH ₄ -N	mg/l	0.05	1.0
Dissolved Oxygen	mg/l	>6	>2
SS	mg/l	20	80
Coliform	MPN/100ml	5000	10,000

Source: Environment Monitor 2002; Vietnam standards TCVN5942- 1995, Surface water quality standards.

A – Surface water used as a source for households water supply

B – Surface water used for other purposes (excluding agricultural and fish rearing purposes, for which there are special regulations).

Table 3.5: Ground Water Quality Standards

Parameter	Unit	Limits
Arsenic	mg/l	0.05
Chloride	mg/l	200-600
Nitrate	mg/l	45
Fe	mg/l	1-5
Coliform	MPN/100 ml	3\

Source: Vietnam standards TCVN5944- 1995, Ground water quality standards.

Upstream reaches of the Red river in the Lao Cai province fulfill Class A water quality criteria which is a water resource for domestic use (subject to appropriate treatment). However, over the years, the Red River has received untreated industrial and municipal wastewaters from adjacent cities. The national Government is now actively trying to reverse this trend by mandating the construction of modern biological (secondary) plants to treat municipal and industrial wastewater. Hot spots include the section of the Red river around Viet Tri town, where COD and BOD exceed National standards (<10 mg/l and <4mg/l respectively). **However no data of the Red river water quality located very close to the track is available. There is a need to monitor these locations to generate base line levels. Also there is no data available regarding the volume of wastewater generated from the railway stations along the alignment. There is need for such a baseline data.**

Table 3.6: Status of Water Quality in Vietnam's rivers

River	Section	Exceeding of Class A Limits
North		
Red River	Lao Cai and Hanoi	1.5-2/NH ₄
	Dien Hong to Viet Tri confluence	3.8/BOD ₅ 2/NH ₄
	Thai Nguyen City	2/NH ₄
	Bac Giang Bridge	2.7/BOD ₅
	Haiphong City	
Central		
Hieu River	Dong Ha (1995)	2-3/BOD ₅ 1.5-1.8/NH ₄
Huong River	Hue City (some locations in dry season)	2.5/BOD ₅
South		
Sai Gon River	Phu Cong Bridge	2-4/BOD ₅
Thi Vai River	Gau Dau	10-15/BOD ₅

Source: Vietnam Environment Monitor 2002

3.1.5 Erosion

Erosion varies widely according to topography. At the southern end of the alignment, in the alluvial plains, which are intensely cultivated, erosion is moderate. This contrasts sharply with the mountainous areas, with its numerous steep slopes, gullies, and minimal vegetative cover, where there is significant erosion. Mountainous areas, in Yen Bai and Lao Cai provinces are characterized by steep slopes, which because of the cutting by railway construction earthworks are already eroded and are causing landslides (P3.2 and P3.3). Another reason for erosion may be deep non – compacted embankment areas such as the one seen at, deep sliding at kms of 279 and 273.



P3.2



P3.3

Improper soil disposal has caused severe sediment impact, particularly at places where the soil is disposed of in steep areas or where the soil is not properly stabilized. Improper disposal of cut soil has affected the adjacent water course of the Red River at km 273.

3.1.6 Seismic Activity

The level of the earthquake activity is divided into 5 zones depending on the Magnitude (M) on the Richter scale (Feeble, M <4,0: low, M 4,0-4,9: Moderate M 5,0-5,9: High M 6,0-6,9 and Large M > 7,0). The alignment between Hanoi to Yen Bai is located in the low seismic zone of 4,0-4,9. (Map 6) Two earthquakes of the intensity of M=5.4 of moderate level, are reported in the Luc Yen region of Yen Bai province during 1954. There is a seismic station located near Sapa recording the seismic activity. However no earthquakes are reported from the vicinity of existing alignment.



Map 3.5: Seismic Zones in Northern Vietnam

Source: Institute of Geophysics, Vietnam

3.1.7 Solid Waste

There are no identified landfill sites along the alignment. Heaps of solid waste deposits are seen in the outskirts smaller towns and villages along the alignment. There is some sorting and recycling systems of municipal solid waste prior to disposal in urban towns like Lao Cai, Yen Bain and Viet Tri. Some solid waste is used for construction fill or disposed of in illegal dumping sites. The discussions with officials of various railway stations along the alignment revealed that no stations along the alignment have proper solid waste disposal systems.

There are open storage yards storing iron ores and tailings, limestone, cement, apatite and Coal near the stations like Mau A, Viet Tri and Van Phu stations, resulting in seepage and affecting the ground water and Red River and Lo river and nearby habitations (P3.4). Within just 50 m from the track about 100 m from Viet Tri station there is a port site with open storage of huge amounts of coal and grinding stone (P3.5). Though the bigger stations like Lao Cai, Yen Bai and Yen Vien have closed storage yards, they are insufficient with the result they are forced to store in open areas without even covering them.



P3.4



P3.5

3.1.8 Hazardous Materials

Apart from the open storage areas of ores, which at times may be hazardous, there is 'Storage Complex of Petromilex' within 500 m of existing track near Phu Duc station (P3.6). The complex stores oil and hazardous petroleum products and functions as a supply point of the products to all the provinces up to Lao Cai.



P3.6

3.1.9 Air Quality

Baseline air quality ranges from poor to moderate in and around stations like Dong Anh, Viet Tri, Mau A, Yen Bai- and Lao Cai. Due to the industries situated close to the track and station areas. It is generally of higher quality in rural areas. However during the survey it was observed that they are open storage yards storing ores of iron, apatite, cement and coal. Finer iron ore particles and dust being blown away by wind,

especially during dry and summer seasons, from these open storages have affected the air quality near stations like Van Phu, Viet Tri, Mau A and Dong Anh stations.

Also the open carriage of such ores and materials without cover in the freight trains are the mobile sources of air pollution (P3.7). As stated above the port site at Viet Tri station is a source of air pollution very close to the track and station. There is a limestone-grinding factory that does not belong to Van Phu station, just adjacent to the track (within 5-10m) at Van Phu station (P3.8) premises causing air pollution of dust and finer particles. It is reported that there are 6 to 7 wells in the vicinity of about 1km radial distance from the station are polluted and have become non functional and there are no polluting source in the vicinity. The local people have repeatedly complained to the officials of the Van Phu Station. The source of the pollutants is the seepage from the storage yard of grinded limestone since no other polluting source is there in the vicinity of the station premises. These issues were discussed with the officials of the Van Phu station. According to them the only permanent solution to the problem is to shift the the factory totally from the existing place to the vicinity of of other industries at about one km distance from the station. No emission data at these locations is available. The local EPB of Yen Bai province carry out air quality monitoring of Yen Bai city at certain locations near station and other places (see Table 3.7).



P3.7



P3.8

Table 3.7: Air Quality in Urban and Industry Areas of Yen Bai City.

N o	Location	2002					2004				
		CO ₂	NO ₂	SO ₂	Pb	Dust	CO ₂	NO ₂	SO ₂	Pb	Dust
1	Yen Bai hospital	2,2	0,05	0,1	-	0,22	1,12	0,07	0,12	Over	0,24
2	Yen Bai square	1,8	0,1	0,12	-	0,22	1,04	0,07	0,1	Over	0,2
3	Yen Bai station	3,6	0,12	0,16	0.0001	0,32	3,42	0,11	0,16	Over	0,34
4	South Yen Bai city	0,47	0,06	0,1	-	0,33	0,52	0,08	0,14	Over	0,36
5	Vietnam standard 5937-1995	40	0,4	0,5	0.005	0,3	40	0,4	0,5	0.005	0,3

Notes (-): non-determined

Source: Annual report of Yen Bai Department of Natural Resources and Environment

The air quality standards are shown below:

Table 3.8: Ambient Air Quality Standards

Pollutant	Averaging time	Standards (mg/m³)
Total Suspended Particulates (TSP)	1-hour avg	0.3
	24-hour avg	0.2
Sulfur dioxide (SO ₂)	1-hour avg	0.5
	24-hour avg	0.3
Nitrogen Dioxide (NO ₂)	1-hour avg	0.4
	24-hour avg	0.1
Ozone (O ₃)	1-hour avg	0.2
	24-hour avg	0.06
Lead (Pb)	24-hour avg	0.005
Carbon-Monoxide (CO)	1-hour avg	40.0
	8-hour avg	10.0
	24-hour avg	5.0

Source: Vietnam Standards TCVN 5937-1995 Ambient Air Quality Standards

3.1.10 Noise and Vibration

There are considerable baseline levels of noise and vibration in the alignment area caused by the movement of freight and passenger train movements, the national highway and other roads, as well as by the range of industrial and commercial areas present near the stations and urban areas along the existing alignment (P3.9 and P3.10). Yen Bai General Hospital is close to the existing track. Local people at almost all the stations along the alignment have much complaint regarding noise levels due to loud honking of trains during their approach to the stations. Even vibration levels at buildings close to the track have higher vibration levels. These noise and vibration levels appear to exceed Noise and Vibration standards, though no current data regarding them is available. The EPB at Yen Bai at times carry out noise monitoring, the data of which is given below.



P3.9



P3.10

Table 3.9: The Fluctuation of Noise in Urban and Industrial Areas of Yen Bai.

No	Location	Parameters	unit	Fluctuation / year			VN standard 5949-1995
				2002	2003	2004	
I	Yen Bai urban area						
1	Crossing at general hospital	- Level of equivalent noise in daylight	dB _A	64,2	64,2	66,5	70
2	Yen Bai square of 19/8	- Level of equivalent noise in daylight	dB _A	64,6	65,2	69,3	70
3	Yen Bai station	- Level of equivalent noise in daylight	dB _A	62,6	71,2	71,9	70
II	Mau A town, Van Yen district						
1	Near police station of Van Yen	- Level of equivalent noise in daylight	dB _A	63,4	64,2	69,1	70
2	Near Van Yen people's commitee	- Level of equivalent noise in daylight	dB _A	59,6	58,5	61,3	70
III	Co Phuc town, Tran Yen district						
1	Paper factory	Level of equivalent noise in daylight	dB _A	60,3	58,7	71,2	75
2	Tran Yen people's committe	Level of equivalent noise in daylight	dB _A	59,7	57,6	62,4	70
IV	South industry area						
1	Near the factory	- Level of equivalent noise in daylight	dB _A	60,5	61,3	65,1	75

Source: Annual report of Yen Bai Department of Natural Resources and Environment

The National Noise and Vibration Standards are given below:

Table 3.10: Noise Standard Level in Different Areas by Time of Day

Areas	6 a.m to 6 p.m	6 a.m to 10 p.m	10 p.m to 6 p.m
Category I	55	50	45
Category II	65	60	50
Category III	70	65	55
Category IV	75	70	60
Category V	80	75	65

Source: MoNRE standards

Notes

1. Category I: Areas that need quietness such as hospitals, kindergartens, schools, libraries, research institutes
2. Category II: Residential areas, surrounding areas 15km from the main traffic roads, markets, station and bus stop.
3. Category IV: Handicraft and light industry manufacturing area
4. Category V: Heavy industry manufacturing area case noise (background noise) in the area when the vehicle does not operate, higher than the standard mentioned in the table above, the vehicle should not make the noise increase more than 5 dBA from the original noise level.

Table 3.11: Permitted Vibration Acceleration

Category	Permitted acceleration (m/s ²)		Permitted line acceleration (m/s ²)
	Vertical vibration	Horizontal vibration	
Category I	0,540	0,380	-
Category II	0,270	0,190	-
Category III	0,081	0,057	0,066
Category IV	0,054	0,038	0,045

Notes:

Category I: Vibration affects driver's seat in vehicles that often operate in bad road for example: lorry, agricultural tractor, construction machine...

Category II: Vibration affects driver's seat differently from Category I.

Category III: Vibration in industrial workshop, in surrounding areas, 15 meters from the main traffic ways.

Category IV: Vibration in areas different from areas in Category III.

Table 3.12: Vibration in each OCTA

Octa (Hz)	Permitted acceleration (m/s ²)		Permitted speed (m/s)	
	Horizontal vibration	Vertical vibration	Vertical vibration	Horizontal vibration
(0,7-1,4)	1,10	0,39	20×10^{-2}	$6,3 \times 10^{-2}$
2 (1,4-2,8)	0,79	0,42	$7,1 \times 10^{-2}$	$3,6 \times 10^{-2}$
4 (2,8-5,6)	0,57	0,80	$2,5 \times 10^{-2}$	$3,2 \times 10^{-2}$
8 (5,6 – 11,2)	0,60	1,62	$1,3 \times 10^{-2}$	$3,2 \times 10^{-2}$
16 (11,2-22,4)	1,14	3,20	$1,1 \times 10^{-2}$	$3,2 \times 10^{-2}$
31,5 (22,4-45)	2,26	6,38	$1,1 \times 10^{-2}$	$3,2 \times 10^{-2}$
63 (45-90)	4,49	12,76	$1,1 \times 10^{-2}$	$3,2 \times 10^{-2}$

Source: MoSTE Guidelines on Setting Up a Report on EIA, 1998.

No primary data regarding the noise and vibration levels emanating from railway stations or areas close to the existing track along the alignment are available. There is the need to monitor these levels.

3.2 ECOLOGICAL ENVIRONMENTAL

3.2.1 Land Use

Examples of land use classifications along the alignment are not much diversified (see Table 3.13 below)

The alluvial plain of the Red River is the most populated area (71% of the project area population). Agriculture is still the main economic activity and is dominated by rice cultivation.

The midlands are formed by the provinces of Vinh Phuc and Phu Tho. It is a transitional zone, both socio-economic and ecological, between the plain and the mountain area. In agriculture, rice cultivation dominates in plain areas. In the hills, crops such as cassava, maize, and soya beans are found on gentle slopes. This area benefits from the proximity of Hanoi and has started its industrialization. The road network is relatively well developed, but old. Viet Tri is the main urban centre with 131,000 inhabitants. The provinces of Yen Bai and Lao Cai form the uplands. It is a mountainous area where

communication is difficult except along the axis of the Red River (roads and railway). It is the least dense area (respectively 76.7 and 101.7 inhabitants per m²). Sapa, in Lao Cai province, is a major tourist destination in Vietnam. Forestry occupies twice the area of agricultural land and many communities rely on forestry production. Agriculture production is low and many slopes are subject to swidden cultivation. The population is characterized by the presence of important ethnic minorities, which account for more than half of the population in Yen Bai province and two thirds in Lao Cai province.

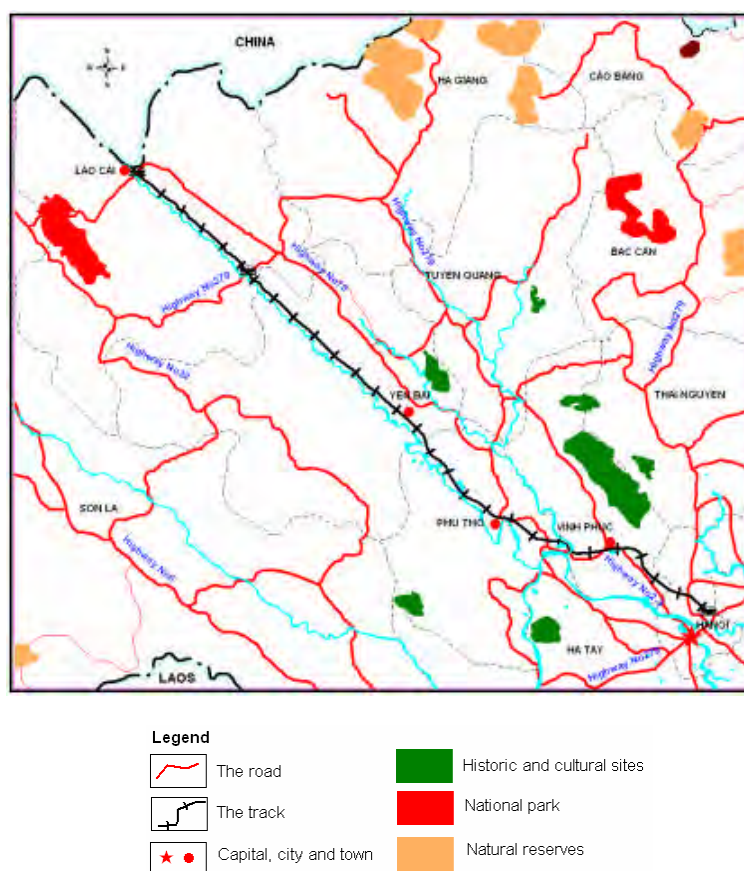
Table 3.13: Land Use along the Alignment

Provinces	In Thousand Hectares except the percent share				
	Total Area	Agricultural Land	Forest Land	Special Use	Home- stead Land
Hanoi	92.1*	42.5	6.6	21.7	11.8
Vinh Phuc	137.2*	66.5	30.3	19.0	5.2
Phu Tho	352.0*	97.2	144.3	21.7	7.7
Yen Bai	688.3*	69.3	282.2	29.2	3.8
Lao Cai	805.7*	92.0	288.7	13.5	3.3
Total	2,075.3	367.5	752.1	105.1	31.8
% to total of two regions	25.9	20.7	25.4	23.1	20.9
% to total of Viet Nam	6.3	4.0	6.2	6.5	7.0

Source: Statistical Year Book, 2002, published by General Statistical Office.

There are 26 protected forest areas in the alignment region. But all of them are more than 5 km away from the existing alignment as seen from the map 7.

Map 3.6: Protection and Preservation Areas



Source: http://www.wing-wbsj.or.jp/~vietnam/source_book/pro_map_fra.htm

3.2.2 Land Acquisition of Project Areas

The main types of land loss as a result of the Project are agricultural land, residential land, garden or pond land, forestland and common lands. By Vietnamese legislation, there is no commercial land. Land used for commercial activities is categorized as residential land, although the compensation price for residential land in commercial areas is usually higher. In the project's Area of Impact, 131 households will lose agricultural land, of which 43 will be marginally affected (<10% loss) and 88 will be severely affected (>10% loss) (Table 17). A total of 227 households will lose residential land, of which 105 will reorganize on their remaining land and 122 will relocate. Of the households required to relocate, 74% are from Lao Cai Rail Station. A total of 88 AP households will lose garden land and 13 households will lose forest land. Two areas in Van Phu will also lose common land, for whom the proprietors are a local school and factory. Only 5 households were renting land and 18 households were identified as illegal land-users.

The Project will use two resettlement sites currently being prepared by the Lao Cai City People's Committee for AP households relocating from Lao Cai Rail Station. The establishment of the resettlement sites will impact on another 180 households, all of whom will relocate (Table 19). All of them will lose residential land and 114 households will also lose garden land. In the project's Area of Impact, the total area of land acquired from AP households will be approximately 155,000 sq.m, consisting of 29,000 sq.m of residential land, 42,000 sq.m of agricultural land, 60,000 sq.m of garden or pond land, 19,000 sq.m of forestland and 5,000 sq.m of common land (Table 16). In the resettlement sites, the total area of acquired land will be approximately 69,000 sq.m, consisting of 16,000 sq.m of residential land and 53,000 sq.m of garden land (Table 18). The project components that will require the most land are the Lao Cai Rail Station (15,000 sq.m), which is entirely residential land mixed with garden and pond land; and the new station at Mai Tung (30,000 sq.m) and realignments sections km 169-171 (46,000 sq.m) and km 283 - 292 (45,000 sq.m), which are mostly agricultural land. Substantial areas of land will also be acquired for the resettlement sites, particularly in Van Hoa (60,000 sq.m).

Mitigation measures: Resettlement impacts were minimized, first, by selecting the engineering designs that affected the least number of persons, while providing the most operational gains in railway line safety and efficiency. For example, track extensions and passing loops could have been added on either side of the Rail Station, but site surveys by project consultants determined which areas impacted the least impacts on persons and communities. In Huong Canh Rail Station, a protective wall was designed to prevent the railway line's embankment from encroaching onto a rural road. Second, the Project will generally apply a policy of attrition for clearing the Construction Corridor (7m from edge of embankment) and Safety Corridor (15m from edge of embankment), unless certain structures or land-uses create special safety risks to line operation. This means that persons and their properties will *not* be evacuated from these corridors for project components. However, persons currently using land in these corridors will retain a future option for compensation and new persons will not be allowed to move into the corridors. This approach was deemed appropriate for the national context, as clearing of the Construction and Safety Corridors is inconsistent along the entirety of the railway line. The main exceptions will be for the sections of realignment, where clearing the Construction Corridor was deemed necessary for the safety of operations.

Table 3.14: Area of Land Acquisition in Area of Impact

Area of Impact	Type of land use for acquisition							Proposed Intervention	TOTAL
	Residen- tial	Agricult- ural	Garden/ Pond	Forest	Common land	Renter	Illegal		
HANOI	2,052	0	1,071	0	0	0	0		3,123
Dong Anh	2,052	0	1,071	0	0	0	0	Fly-over bridge	3,123
VINH PHUC	0	0	0	0	0	0	322		0
Thach Loi	0	0	0	0	0	0	212	New loop	0
Huong Canh	0	0	0	0	0	0	110	New loop	0
PHU THO	1,945	17,628	11,932	0	0	0	879		31,559
Viet Tri	0	8	18	0	0	0	282	Extension of passing loop	26
Phu Duc	0	92	0	0	0	0	0	Extension of passing loop	92
Tien Kien	31	0	108	0	0	0	108	New loop	139
Chi Chu	0	653	105	0	0	0	439	New loop	758
Vu En	0	1,015	0	0	0	0	0	New loop	1,015
Mai Tung	1,914	15,915	11,701	0	0	0	50	New station	29,530
YEN BAI	10,361	14,789	24,827	3,200	4,991	91	0		58,619
Co Phuc	0	849	0	0	0	0	0	Extension of passing loop	849
Mau A	50	759	0	0	0	0	0	Extension of passing loop	809
Mau Dong	76	0	841	0	0	75	0	New loop	917
Lam Giang	0	481	0	0	0	0	0	Extension of passing loop	481
Lang Thip	1,119	0	716	0	0	16	0	New loop	1,915
Van Phu	2,651	0	0	0	4,991	0	0	Extension of passing loop	7,642
Realign. Km169-171	6,385	12,700	23,270	3,200	0	0	0	Realignment	45,555
LAO CAI	14,918	9,916	21,763	15,449	0	0	753		62,046
Thai Van	165	260	350	0	0	0	0	Extension of passing loop	775
Thai Nien	119	238	238	0	0	0	0	Extension of passing loop	357
Xuan Giao	0	0	0	0	0	0	0	Extension of 3 passing loops	906
Lao Cai	10,704	4,554	4,554	0	0	0	753	9 new loops	15,258
Realign. Km283-291	3,930	16,622	16,622	15,449	0	0	0	Realignment	44,751
TOTAL	29,276	42,387	59,593	18,649	4,991	91	1,954		154,896

Table 3.15: Land Loss by Affected Person in Area (No. of AP)

Area of Impact	Agricultural land			Residential land			Garden Pond	Forest	Common land	Renters	Illegal Users
	Marginal	Severe	Total	Re-organize	Relocate	Total					
HANOI	0	0	0	44	3	47	3	0	0	0	0
Dong Anh	0	0	0	44	3	47	3	0	0	0	4
VINH PHUC	0	4	4	0	0	0	0	0	0	0	4
Thach Loi	0	2	2	0	0	0	0	0	0	0	2
Huong Canh	0	2	2	0	0	0	0	0	0	0	2
PHU THO	26	49	75	9	3	12	12	0	0	0	7
Viet Tri	0	3	3	1	0	1	2	0	0	0	2
Phu Duc	1	0	1	0	0	0	0	0	0	0	0
Tien Kien	0	0	0	3	0	3	1	0	0	0	1
Chi Chu	4	5	9	0	0	0	1	0	0	0	3
Vu En	2	4	6	0	0	0	0	0	0	0	0
Mai Tung	19	37	56	5	3	8	8	0	0	0	1
YEN BAI	12	23	35	40	26	66	39	5	2	5	0
Co Phuc	8	0	8	0	0	0	0	0	0	0	0
Mau A	4	4	8	0	1	1	0	0	0	0	0
Mau Dong	0	0	0	2	0	2	5	0	0	2	0
Lam Giang	0	6	6	0	0	0	0	0	0	0	0
Lang Thip	0	0	0	14	2	16	3	0	0	3	0
Van Phu	0	0	0	3	17	20	0	0	2	0	0
Realign. Km169-171	0	13	13	21	6	27	31	5	0	0	0
LAO CAI	5	12	17	12	90	102	34	8	0	0	7
Thai Van	1	1	2	1	0	1	1	0	0	0	0
Thai Nien	0	0	0	2	0	2	1	0	0	0	0
Xuan Giao	4	3	7	1	0	1	0	0	0	0	0
Lao Cai	0	0	0	0	90	90	6	0	0	0	7
Realign. Km283-291	0	8	8	8	0	8	26	8	0	0	0
TOTAL	43	88	131	105	122	227	88	13	2	5	18

Table 3.16: Area of Land Acquisition in Resettlement Sites

Area of impact	Residential	Agricultural	Garden/Pond	Forest	Common land	Renter	Illegal	TOTAL
Pho Moi	4,017	0	4,300	0	0	0	0	8,317
Van Hoa	12,234	0	48,635	0	0	520	0	60,869
TOTAL	16,251	0	52,935	0	0	520	0	69,186

Table 3.17: Land Loss by Affected Person in Resettlement Area

Resettlement sites	Agricultural land			Residential land			Garden Pond	Forest	Common land	Renters	Illegal users
	Marginal	Severe	Total	Reorganize	Relocate	Total					
Pho Moi	0	0	0	0	50	50	7	0	0	0	0
Van Hoa	0	0	0	0	130	130	107	0	0	2	0
TOTAL	0	0	0	0	180	180	114	0	0	2	0

3.2.3 Flora and Fauna

They are of normal type and not much diversified Biodiversity, with no protected or endangered species of flora or fauna reported in the study area. There are recently



P3.11



P3.12

grown plantations of bamboo, litchi, eucalyptus, banana, pear, mango etc. along the slopes of mountains between Yen Bai and Lao Cai regions. But for some trees of medium growth within 10 to 20 m of the existing track and few ancient trees located about 30-50 m away from the track, there are no thick forests near the alignment. Terraced tea gardens and rice fields are located in the steep locations with practices of swidden cultivation (P3.11 and 12). No migrant wild fauna are reported along the study area. There are normal livestock, especially maintained by ethnic minorities, in the mountainous regions. The list of common species of flora and fauna is shown below:

Table 3.18: Forest Plants Reported to be Present in the Project Region

No.	Vietnamese name	Scientific name	Note
1	Cầm lai	<i>Dalbergia oliverrii</i> Gamble	
	Cầm lai Bà Rịa	<i>Dalbergia bariaensis</i>	
	Cầm lai	<i>Dalbergia oliverrii</i> Gamble	
	Cầm lai Đồng Lai	<i>Dalbergia dongnaiensis</i>	
2	Gà te (Gỗ do)	<i>Azeliaxylocarpa</i>	
3	Gụ		
	Gụ mật	<i>Sindora cochinchinensis</i>	Go mat
	Gụ lau	<i>Sindora tonkinensis</i> – A. Chev	Go lau
4	Giáng hương		
	Giáng hương	<i>Pterocarpus pedatus</i> Pierre	
	Giáng hương cambốt	<i>Pterocarpus cambodianus</i>	
	Giáng hương mắt chim	<i>Pterocarpus indicus</i> Wild	
5	Lát:		
	Lát hoa	<i>Chukrasia tabularis</i> A.juss	
	Lát da đồng	<i>Churkrasia</i> sp	
	Lát chun	<i>Churkrasia</i> sp	
6	Trắc:		
	Trắc	<i>Dalbergia cochinchinensis</i> Pierre	
	Trắc dây	<i>Dalbergia annamensis</i>	
	Trắc Cambốt	<i>Dalbergia combodiana</i> Pierre	

No.	Vietnamese name	Scientific name	Note
7	Pơmu	Fokienia hodginsii A. Henry et Thomas	
8	Mun		
	Mun	Diospyros mun H.lec	
	Mun sọc	Dyospyros sp	
9	Đinh	Markhamia pierrei	
10	Sến mặt	Madhuca pasquieri	
11	Nghiến	Durretiodendron hosienmu	
12	Lim xanh	Erythrophloeum fordii	
13	Kim giao	Padocarpus fleuryi	
14	Ba gạc	Rauwolfia verticillata	
15	Ba kích	Morinda officinalis	
16	Bách hợp	Lilium brownii	
17	Sâm ngọc linh	Panax vietnamensis	
18	Sa nhân	Anomum longgiligulare	
19	Thảo quả	Ammomum tsaoko	

Source: Some Primary Observations and Publications of IUCN, 2003, Hanoi office.

Table 3.19: Forest Animals Reported to be Present Project Region.

No.	Vietnamese Name	Scientific name	Note
1	Khỉ:		
	- Khỉ cộc	Macaca arctoides	
	- Khỉ vàng	Macaca mulatta	
	- Khỉ mốc	Macaca assamensis	
	- Khỉ đuôi lợn	Macaca nemestrina	
2	Sơn dương	Capricornis sumatraensis	
3	Mèo rừng	Felis bengalensis	
		Felis marniorata	
		Felis temmiskii	
4	Rái cá	Lutra	
5	Gấu ngựa	Selenartos thibethanus	
6	Sói đỏ	Cuon alpinus	
7	Sóc đen	Ratuta bicolor	
8	Phượng hoàng đất	Buceros bicornis	
9	Rùa núi vàng	Indotestudo elongata	
10	Giải	Pelochelys bubroni	

Source: Some Primary Observations and Publications of IUCN, 2003, Hanoi office.

No endangered species of flora or fauna declared by Government of Vietnam or IUCN are reported from the alignment region. No migratory wild fauna are reported from the alignment region

3.2.4 Impacted vegetation by project

An approximate total area of 45,000 sq.m of annual crops and 8,600 trees will be impacted in the Area of Impact (Table 3.20) and an approximate 6,000 sq.m of annual crops and 2,900 trees in the resettlement sites (Table 3.21). Not surprisingly, the

project components impacts on most crops and trees will be in the rural areas of Mai Tung (16,000 sq.m crops, 579 trees) and the realignment sections km 169-171 (7,800 sq.m crops, 658 trees) and km 283-292 (54,290 sq.m crops, 2,258 trees). The resettlement site in Van Hoa will impact on 6,000 sq.m of crops and 2,534 trees.

Table 3.20: Impacts on Crops and Trees in Area of Impact

Area of Impact	Annual Crops (sq.m)								Trees			
	Rice	Corn	Sugar Cane	Cas-sava	Sweet Potato	Herbs /Leaves	Gourd /Vines	TOTAL	Fruit	Timber/ Bamboo	Shade/ Décor.	TOTAL
HANOI	0	0	0	0	0	0	0	0	39	70	5	114
Dong Anh	0	0	0	0	0	0	0	0	39	70	5	114
VINH PHUC	212	0	0	0	0	50	0	262	4	9	0	13
Thach Loi	212	0	0	0	0	0	0	212	0	0	0	0
Huong Canh	0	0	0	0	0	50	0	50	4	9	0	13
PHU THO	15,570	105	0	35	492	1,785	104	18,091	586	826	291	1,703
Viet Tri	0	0	0	0	217	65	0	282	2	0	0	2
Phu Duc	0	0	0	0	0	0	0	0	0	0	0	0
Tien Kien	0	0	0	0	0	0	0	0	3	2	0	5
Chi Chu	621	0	0	0	193	330	0	1,144	2	22	0	24
Vu En	164	0	0	0	0	268	0	432	0	512	0	512
Mai Tung	14,785	105	0	35	82	1,122	104	16,233	579	290	291	1,160
YEN BAI	4,553	300	300	4,102	70	744	100	10,169	931	2,097	6	3,014
Co Phuc	542	0	0	0	0	0	0	542	0	0	0	0
Mau A	719	0	0	0	0	0	0	719	0	0	0	0
Mau Dong	0	0	0	562	0	0	0	562	22	253	0	275
Lam Giang	332	0	0	0	0	0	0	332	15	0	0	15
Lang Thip	0	0	0	20	0	0	0	20	114	13	6	113
Van Phu	0	0	0	0	0	204	0	204	122	0	0	122
Realignment km169-171	2,960	300	300	3,520	70	540	100	7,790	658	1,831	0	2,489
LAO CAI	9,856	150	2	3,531	0	2,638	154	16,330	2,686	1,154	0	3,780
Thai Van	200	0	0	0	0	5	0	205	10	20	0	30
Thai Nien	0	0	2	325	0	0	0	327	8	2	0	10
Xuan Giao	906	0	0	0	0	0	0	906	0	0	0	0
Lao Cai	0	0	0	56	0	543	4	603	410	30	0	440
Realignment km283-291	8,750	150	0	3,150	0	2,090	150	14,290	2,258	1,102	0	3,300
TOTAL	30,190	555	302	7,668	562	5,216	358	44,851	4,246	4,147	302	8,624

Table 3.21: Impact on Crops and Trees in Resettlement Sites

Resettlement sites	Annual Crops (sq.m)								Trees			
	Rice	Corn	Sugar cane	Casava	Sweet Potato	Herbs/leaves	Gourd/Vines	TOTAL	Fruit	Timber /Bamboo	Shade/Deco	TOTAL
Pho Moi	0	0	0	0	0	1,300	0	1,300	178	2	13	193
Van Hao	0	0	0	0	0	4,697	0	4,697	2,534	219	3	2,758
TOTAL	0	0	0	0	0	5,997	0	5,997	2,712	221	16	2,949

3.2.5 Sensitive and Protected Areas:

There are no sensitive or protected areas within 5 Kms on either side of the proposed alignment (Map 3), except for the protected monuments, Bao Ha temple and King's Hung temple complex, which are within 2 km of the track. It is reported that 1500 to 2000 pilgrims visit the temple every day and most of them travel by train. The King's Hung Temple complex is a National monument surrounded by aesthetic and wild vegetation. Visitors usually take the road route, since Tien Kien station is more than 3 km away by road (P3.13 and P3.14). The proposed rail improvement will not endanger these monuments.



P3.13



P3.14

Table 3.22: Ecological resources in the alignment region

Protected sites east bank	Status and characteristics	Location
Den Hung Temple (300ha)	<ul style="list-style-type: none"> National park Historical/Cultural site Protected forest 	<ul style="list-style-type: none"> Phu Tho province Lam Thao district
Thanh Ba islands (5,000ha)	<ul style="list-style-type: none"> Wildlife reserve 1.300 islands are protected for bird habitat 	<ul style="list-style-type: none"> Yen Bai province (Thac Ba Reservoir)
Tam Dao Mountain (19,00ha)	<ul style="list-style-type: none"> National Park 	<ul style="list-style-type: none"> Vinh Phuc province
Cat Ba Archipelago Park (27,000ha)	<ul style="list-style-type: none"> National Park On-island limestone karst forest; Rich fauna and flora 	<ul style="list-style-type: none"> Haiphong Province

All the ecological sources mentioned above are far away from the project area

3.3 SOCIO ECONOMIC ENVIRONMENT

There are dispersed, isolated and self-contained habitations of Ethnic minorities (reportedly from Laos, Thai etc.) with typical lifestyle and atypical of Vietnamese. They stay up in the mountainous regions in house made of thatched roof (P3.15). Their main occupation is agriculture and practice cultivation of rice and tea. The bamboo, cassava, tea and rice are the economic products contributing to the Gross Domestic Products (GDP) of Vietnam. The basic infrastructure is below normal with poor water and power

supply. The local transportation is basically by bicycles or motorbikes. Schools are in isolated places with the result the children have to cycle more than 4-5 km distance. Most of the provinces especially Yen Bai, Lao Cai, Phu Tho are rich in mineral deposits like iron, limestone, apatite and coal. Most of the natural forests are managed by the local Forest departments. The well-known 'Sapa' tourist location is about 35km by road from Lao Cai station along the alignment. Many foreign tourists visit Sapa because of the scenic nature and cool weather conditions in the region, especially near Lao Cai, few private tourist resorts are under construction. The Chinese border being in the visible distance, across the Red river bridge in Lao Cai city, many of the Chinese goods are traded in Lao Cai city markets (P3.16).



P3.15



P3.16

3.4 ENVIRONMENT OF PROPOSED SITES FOR CONSTRUCTION

3.4.1 Mai Tung Station

Mai Tung is the name of a commune of Ha Hoa district, Phu Tho Province. The new station of Mai Tung is located at Km 124.2 between Vu En and Am Thuong station. There is a small village in the east of the new station with 58 house holds and about 300 people living in. The ethnic group is 100% Kinh. The rice field is in between the track and Red river. The distance between Red river and the tract is about 1km. There is a dike and also is a road for vehicles. The road connecting the existing road and the location of new station should be built. If the new station is constructed there, there will be 90% of affected people who depends on agricultural land for their main source of income. The Village Land Fund is managed by the village administration, which would be willing to use the land fund to provide replacement land for AP households, if they so wish. The Village Administration would sell plots of land to the Project and then use proceeds from the sales to invest in community services and infrastructure. AP households in Mai Tung should also be able to benefit from new economic opportunities created by the building of the new Rail Station. In particular, the RPMU will work with the Vinh Phu RPUC to reserve a portion of the jobs created by the new station for AP, as well as secure potential commercial spaces on the station's grounds for AP households to open up small shops and businesses.

3.4.2 Extension of Stations

There are 17 stations where the loops supposed to be constructed and extended with the details are described in Table 25.

Table 3.23: New Loops and Extension of Passing Loops

Km	Station	Works	Existing Tracks	Addn Loops	Extn length	Land Reqmt
					(m)	(sq m)
33.2	Thach Loi	New loop	3	1		212
47.5	Huong Canh	New loop	3	1		110
72.7	Viet Tri	Extension of passing loop	5		96	308
81.8	Phu Duc	Extension of passing loop	4		98	92
90.7	Tien Kien	New loop	6	1		139
108.2	Chi Chu	New loop	3	1		1,197
118.2	Vu En	New loop	3	1		935
148.4	Van Phu	New loops	4	3		7,042
165.1	Co Phuc	Extension of passing loop	3		56	849
186.3	Mau A	Extension of passing loop	3		110	769
194.8	Mau Dong	New loop	2	1		992
210.0	Lam Giang	Extension of passing loop	3		100	412
227.8	Lang Thip	New loop	2	1		1,957
247.5	Thai Van	Extension of passing loop	3		93	715
272.2	Xuan Giao	Extension of 3 passing loops	4		563	906
277.3	Thai Nien	Extension of passing loop	3		80	357
293.0	Lao Cai	9 new loops		9		15,754
	Totals			19	1,196	32,744

3.4.3 Bridges

Table 3.24: Bridges to be Constructed

No	Name	Location (km)	Length (m)
1	Dao Thinh	171.414	22.3
2	Thac Thu	173.380	12.7
3	That Co	284.388	27.1
4	Quynh Son	286.593	34.8
5	No name	288.732	15.8
6	No name	289.953	32.5

3.4.4 Realignments

Table 3.25: Realignment Locations

STT	Start Point (km)	End Point	Length (m)	Filling Volume (m3)	Excavation Volume (m3)
1	Km169+909	Km171+409	1,500	23,864	10,816
	Km172+336	Km173+809	1,473	16,531	14,165
	Sub Total		2,973	40,394	24,981
2	Km283+550	Km284+078	528	14,289	1,261
3	Km284+183	Km284+856	673	29,082	5,576
4	Km285+200	Km285+478	278	7,205	9,954
5	Km285+519	Km286+761	1,242	11,726	62,110
6	Km286+843	Km287+130	287	487	13,106
7	Km287+511	Km288+031	520	0	16,574
8	Km288+131	Km288+407	276	0	4,053
9	Km288+500	Km288+802	302	0	10,417
10	Km288+973	Km289+527	554	17,637	1,470

STT	Start Point (km)	End Point	Length (m)	Filling Volume (m3)	Excavation Volume (m3)
11	Km289+665	Km290+077	412	4,788	6,761
12	Km290+764	Km291+116	352	4,184	1,767
13	Km291+539	Km291+828	289	4,839	2,739
14	Km291+957	Km292+317	360	3,422	6,467
	Sub Total		6,073	97,659	142,253
	Total		9,046	138,053	167,234

4 FORECASTING ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Based on the primary observations, secondary information collected and discussions held with the officials at the railway stations along the existing alignment, the following impacts are forecasted out of the project activities during the three phases namely, pre-construction phase, construction phase and operation phase.

4.1 PRE - CONSTRUCTION PHASE

There is total absence of environmental baseline data regarding (i) water quality data of the rivers, especially the Red river close to the track at various locations, along the alignment, (ii) wastewater generated at stations and their workshops, (iii) air quality along the alignment in the vicinity of Railway stations and urban areas close to the track, (iv) noise and vibration levels emanating from stations and urban locations very close to the existing track, and (v) solid and hazardous waste generated at the stations and at workshops. Such a baseline data at pre-construction stage, is essential and will be useful in knowing the incremental levels and assessing the degree of impacts arising out of the project activities during the construction and operational phase and there by in identifying the need based mitigatory measures. The RPMU can take up this work with the help of local EPBs The base line to be generated can be along the following lines.

Table 4.1: Plan for Generation of Environmental Baseline Data at Pre Construction Stage

Environmental Component	Parameter to be monitored or analyzed	Locations	Period
Water quality	PH, BOD, COD, DO, SS and Coliforms	Red river near Viet Tri, Mau A, Bao Ha, Dong Anh and ,Vu En stations and locations close to existing track (within 50m)	Once a week for one month
Waste water quality	All parameters stated above plus heavy metals and coliforms	At all major stations and workshop points like Vietri, Yen Bai, Lao Cai, Yen Vien and Vinh Phu and workshop points near these stations	Once a week for a month
Air Quality	Sulphur oxide and Nitrogen Oxide, SPM	At all major stations near loading and unloading places and near Viet Tri, Van Phu and Dong Anh	Twice a week for one month
Noise and vibration levels	Noise levels (dba) and Vibration levels (OCTA)	At all stations during train movements along alignment and locations close to track (within 50 m), hospitals and Schools along the entire alignment	Alternate days in a week for a week

4.2 CONSTRUCTION

The summary of anticipated impacts, their mitigation measures along the degree and duration of impacts during the construction and operation stage are separately enumerated in Tables 4.2 and 4.3

Table 4.2: Construction Phase

Environmental Parameter/Issue	Anticipated Impacts	Mitigation Measures	Degrees of impact
Soil	Disposal of excess earthworks	To use for soil embankments	Significant Negative Impact for short period
	Loss of top soil	Stripping & storing and reuse for rehabilitation works	
	Damage to temporarily acquired land and failure to rehabilitate borrow areas	Appropriate rehabilitation works	
	Soil erosion and situation	Planting of shrubs and grass, Suitable compaction, placement of geosynthetics, construction of berms and dikes	
	Contamination by fuel and lubricants	Oil separators at washing areas and installing secondary containment at fuel storage areas	
	Improper erosion control and disposal run-off entering the Red river.		
Water	Wash water from workshops	Pass through separator prior to discharge	Minor Negative impact
	Sanitary wastewater effluent from work camps	Use of septic tanks and primary treatment before discharge to nearby watercourse No direct discharge of untreated waste water to surface to waterbody like Red River	
Air Quality	Particulate dust from construction vehicles and activities	Covering the stored material with tarpulin sheets or store in the enclosed area to prevent flying due to wind; spraying of the vehicle movement area with water for the settlement of dust.	Minor Negative Impact
Noise and Vibration	Impact of noise on residential areas will be noise from, maintenance workshops, construction vehicles, earthmoving equipment	Within 200 m of the nearest habitation, construction work such as crushing, concrete mixing and batching, mechanical compaction etc. will be stopped between 2200 and 0600 hours	Major Negative Impact for entire construction period
	Impact from vibration to buildings from heavy earthmoving equipment	Pneumatic instalation of equipment wheels to reduce vibration during movement. Proper lubrication of moving arms equipments to reduce wobblings.	
Solid Waste	Domestic and construction waste from work camps	Regular disposal of the waste to the identified disposal sites	Minor Negative Impact. Site specific
		No on-site development of landfills	

Environmental Parameter/Issue	Anticipated Impacts	Mitigation Measures	Degrees of impact
	Hazardous waste from work sites	Collected and stored on-site in approved facilities as per relevant standards. Then remove from site to the site approved by MoNRE officials	Short period
	Spoil and muck from cuts	Used for filling embankments and excess quantity stored with containment walls for future use	Minor Negative Impact, site specific.
Hazardous Materials	Lubricating oil and grease will be used by construction machinery. Accidental spillages affecting soil, groundwater and adjacent water bodies especially in regions very close to Red river.	There will be secured place to store them. After use the spent chemical will be emptied in labelled containers and sold to the identified users or reuse or recycle. Installing appropriate hazardous storage facilities wherever required.	Minor Negative Impact
Soil Erosion	Increase in the levels of erosion, particularly in areas where the soil types and topography are susceptible to erosion	Follow the mitigation measures suggested in the Erosion Prevention Plan (ErPP) prepared for the project as part of Pre Feasibility studies	Major Negative Impact during the entire construction period
Seismic Activity	Liquefaction of soils primarily in the mountainous regions between Yen Bai and Lao Cai and subsequent loss of foundation bearing capacities	Extending slopes, widening sub grade surfaces a adding dual-direction geotechnical gratings in the crushed layer	Minor Negative Impact
Flora and Fauna	Minimal impact in the plains between Yen Vien to Yen Bai. Some loss of revegetated and plantation areas very close to the existing track between kms 277 to 280 towards Lao Cai	Development on non-agricultural land of a 30m green belt on both sides of the proposed rail track. Additional land will be seeded with grass	Minor Negative Impact becoming positive after green belt is developed
	Loss of small number of median sized trees very close to the existing track (within 20m) coming in the way of construction work. No loss of ancient trees since they are about 50-60 m away from the existing track	Prevention of cutting of firewood and poaching by construction staff Loss of trees compensated by planting of similar species in the proposed green belt on either side of the new track	Minor Negative impact for short period
	Impact to aquatic ecology during construction of bridge, as pile driving will increase sedimentation in the waterways below	Engineering design to minimise solid storage discharge to the water column below	Minor Negative Impact, sight specific, short term
Environmentally sensitive areas	No impacts	None	Nil

Environmental Parameter/Issue	Anticipated Impacts	Mitigation Measures	Degrees of impact
Historical, Cultural and Archeological Sites	No impacts	None	
Public Safety and Health	Increased risk of construction workers spreading sexually transmitted diseases and HIV/AIDS	A public Health officer will regularly inspect work camps and disseminate appropriate information	Minor Negative Impact , site specific
	Normal activities of the industries and petrol storage complexes, as seen near Van Phu station, Viet Tri and Phu Duc stations, may hamper during the construction phase of the project	Make them know about the proposed construction activities and their duration	

Table 4.3: Operation Phase

Environmental Parameter/Issue	Anticipated Impacts	Mitigation Measures	Degrees of impact
Degrees of impact	Spillage of hazardous wastes and materials including hydrocarbons	Collection and proper disposal at identified site	Minor Negative
Water	Waste water from shops, maintenance facilities and stations	Establishing waste water treatment at facilities at major stations	Minor Negative, site specific
	Major pollutants will be suspended solids, petroleum, COD and BOD	Treatment will include septic tank, oil separators and electro dialysis for heavy metals	
Air quality	Dust and particulate matter from open and uncovered transportation of ores, coal and grinded limestone	Transportation in closed containers. During open transportation they will be fully covered	Minor Negative , site specific
Noise and Vibration	Noise from train movements, stations and switching yards	Installation of sound barriers or insulating windows at noise generating locations and regular noise monitoring at these locations to check compliance to National standards	Major Negative Impact
	Excess levels of vibration result in damage to buildings very close to the track	Installing low vibration slab tracks and continuous welded rail. Vibration level monitoring for compliance with National standards	
Solid Waste	Domestic and industrial waste from stations and maintenance facilities	Disposal at identified and approved sites. Sludge from treatment facilities recycled as fertilizer	Minor significant impact
Hazardous materials	Accidental spillage during transportation of chemicals and hazardous materials	Trains conveying toxic or hazardous chemicals shall comply with transportation procedures in accordance with National standards	Minor, but significant impact at specific locations
Soil Erosion	No significant erosion is expected out of project activities	Regular supervision of the nearby embankments close to the track	No impact
Seismic Activity	Probable liquefaction of soils	Periodic seismic tests and supervision	Minor Negative
Flora and Fauna	Probable impact on aquatic ecology by discharge of untreated waste water	Proper treatment and disposal of waste water	No impact
Environmentally sensitive areas	No impacts are expected out of project activities	None	No impacts
Historical, Cultural and Archeological sites	None	None	No impacts
Public Safety and Health	Increase in sound and vibration levels affecting people with low hearing levels and staying near close to the track	Complying with noise mitigation measures	Major, irreversible negative impact for long time

Environmental Parameter/Issue	Anticipated Impacts	Mitigation Measures	Degrees of impact
Induced Impacts	Increase in industrial activity leading to increased water and air pollution	Complying with relevant emission and discharge standards	Minor negative impact
	Excessive commercialization affecting natural tourist locations in the mountainous regions	Planned growth and thrust on natural conservation	
	Major positive benefits like significant reduction on the road traffic, reduced transportation cost, growth in tourism potential especially the 'Sapa' region, up-gradation of tourist facilities, enhanced direct and indirect employment opportunities, preservation of aesthetics of the area etc	Proper infrastructure and their maintenance, planned growth, good environmental planning etc	Significant Positive Impact

Table 4.4: Proposed Wastewater Treatment Facilities at Railway Stations

Station	Station Type	Sewage (m3/day)	Sewage Treatment Facilities	Discharge Outlet
Lao Cai (1800 outgoing passengers/day)	Station with existing switching yard and workshop	10 with oil, About 300 domestic	Oil separation pond, septic tank	Existing station drainage system
Mau A (1200 outgoing passengers)	District station	175 domestic	Septic tank,	Red river
Mau A (1200 outgoing passengers)	District station	175 domestic	Septic tank,	Red river
Tien Kien (About 1200 outgoing passengers/day)	Existing district station with workshop-	15 with oil. 160 domestic	Oil separation pond, septic tank,	City sewage system
Viet Tri (About 400 outgoing passengers/day)	District station	About 80 domestic	Septic tank	Municipal drainage system
Huong Canh (40 outgoing passengers/day)	Intermediate station	25 domestic	Septic tank	Municipal pipe system
Yen Bai (About 1400 outgoing passengers/day)	Station with existing switching yard and workshop	10 with oil, About 220-250 domestic	Oil separation pond, septic tank	Existing station drainage system linked to the municipal sewage system
Chi Chu (About 160 outgoing passengers/day)	Existing passenger station	About 50 domestic;	Septic tank,	Red river
Dong Anh (About 180 outgoing passengers/day)	Intermediate station, with Port nearby	About 60 domestic	Septic tank	Red River

Source: Wilbur Smith Associates, 2006

Table 4.5: Proposed Soil Conservation Management Framework

Potential Erosion Problem	Mitigation Measure
Use of spoil/borrow pits	All available spoil will be used for structural fill for access roads, stations, and embankments before borrow pits are excavated.
Locating borrow pits	Borrow pits will be centrally located to serve more than one site.
Location of spoil/borrow pits	Sites for spoil and borrow pits will be a long way from industrial, agricultural, Residential, historic, and ecological sites. Soil and borrow pit sites will be at least 1 km from historic relics.
Topsoil from borrow pits	Topsoil from the borrow pits will be removed and set aside. When the Project is completed, the areas will be regarded, the topsoil replaced, and the area reseeded. Intercepting ditches will be constructed on the high sides of restored pits to prohibit surface scouring by storm runoff.
Spoil disposal	Spoil will be spread on the lowest yield/least productive land available.
Soil disposal	When soil is spread on slopes for permanent disposal, it will be buttressed at the toe by a retaining wall. The surface of the slopes, if necessary, will be stabilized by concreting, rip rapping, or laid rubble prior to seeding.
Steep cuts	All steep cuts will be flattened and benched.
Natural watercourses	Watercourses will not be blocked, and temporary soil and rock stockpiles will be designed so runoff will not induce sedimentation of waterways.

Source: Wilbur Smith Associates 2006

5 INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MONITORING PLAN

5.1 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

Railway Project Management Unit (RPMU) will be the Executing Agency (EA) for the Project, and thus has overall responsibility for ensuring that all environmental standards and procedures are followed. The EA will establish an Environmental Protection and Management Division (EPMD) that will ensure implementation of the environmental management and monitoring plan during the pre-construction, construction and operation phases of the project. A project manager and at least three technical personnel will staff the EPMD. The EA will translate the summary initial environmental examination, into Vietnamese language and provide copies to relevant parties, including local authorities and bidding contractors. RPMU and EPMD will ensure that the impacts and mitigation measures suggested for the construction phase and operation phase are included in all the bidding documents and operating contracts. The EA and EPMD will ensure that the contractors comply with the mitigating measures suggested during the construction and operation phases. The EMPD will be especially responsible to ensure the implementation of mitigation measures during the construction period. The EPMD will also ensure that the 'Environmental Base Line Data' generated as per the guidelines indicated in Table 4.1 is in place for the use by contractor before the construction stage. The summary of environmental management plan (EMP) during construction and operation phase is given in Table 5.1.

5.2 ENVIRONMENTAL MONITORING PLAN

The EMPD will prepare a detailed environmental monitoring plan for the Project prior to commencement of bidding for construction contracts. The environmental monitoring plan will be included in all bidding contractor documents and construction contracts. The EMPD will ensure that the environmental monitoring plan is updated, as required, during project construction and operation. Environmental monitoring will be undertaken by a range of relevant authorities, local environmental protection bureaus (EPBs), the forestry department, the relics bureau's, WRB and others. The EMPD will be responsible for coordinating all environmental monitoring activities, including collation of all monitoring results.

The provincial EPBs are competent enough to take up the environmental monitoring.. They could be hired on deputation basis by EA. A framework of the environmental monitoring plans and approximate cost for the same is suggested in Table 5.2.

Table 5.1: Summary Environmental Management Plan

Environmental Impact/Issue	Mitigation Measures	Location	Time Frame	Responsibility	
				Implementation	Supervision
A. Construction Phase					
1. Soil					
Disposal of excess excavated earthworks	Earthworks cut will be used in embankments where possible. Residual spoil will be placed in storage areas with containment walls. Residual spoil will be disposed of according to the erosion prevention plan (ErPP).	Throughout the Project corridor at all construction sites	During Construction	Contractor	EPMD and Soil Conservation Department (SCD)
Loss of topsoil	The topsoil from all areas to be permanently covered will be stripped and stored in stockpiles. Topsoil will be used for vegetation works. Construction vehicles, machinery, and equipment will move or be stationed in designated areas. Access to adjacent agricultural land will be minimized.	Throughout the project corridor, all borrow and spoil areas	During Construction.	Contractor	EPMD and SCD
Impact to temporarily acquired agricultural land	All temporarily acquired land will be rehabilitated after completion of construction.	Throughout the project corridor	During Construction.	Contractor	EPMD and SCD
Failure to rehabilitate borrow pits	All borrow pits will be rehabilitated after use.	All borrow areas	During Construction.	Contractor	EPMD and SCD
Soil erosion and siltation	On road embankment slopes, slopes of cuts, etc., soil erosion mitigation and siltation prevention measures will include, on a case-by-case basis, planting shrubs and grass, appropriate compaction, placement of geosynthetics, construction of berms, dikes, sediment basins, fiber mats, mulches, grasses, and slope drains.	Within construction corridor and all construction and work sites	During Construction.	Contractor	EPMD and SCD
Contamination by hazardous waste and materials, including hydrocarbons	(i) Oil separators will be installed at wash down and refueling areas. (ii) Fuel storage and hazardous waste and materials storage sites will have adequate secondary containment to contain spills. All spilled materials and contaminated earth will be collected and disposed of according to EPB guidelines.	Throughout project corridor	During Construction and Operation.	Contractor	EPMD with assistance from local EPBs
Seismic activity	Mitigation measures include extending slopes, widening subgrade surfaces, and adding dual-direction geotechnical gratings in the crushed stone layer.		Construction and Operation	Engineering designers and contractors	EPMD and RPMU

2. Water Resources

Siltation into water bodies	Erosion prevention measures will be conducted in accordance with the ErPP including construction settling ponds.	Throughout project corridor	During Construction	Contractor	EPMD and Local WRB
Disposal of septic waste and maintenance workshop wastewater into waterways	(i) Maintenance workshop wastewater will be treated to discharge standards. Where Possible, wastewater will be discharged to municipal treatment systems. (ii) The sewage system for the construction camps will be properly designed, built, and Operated to prevent pollution to ground or adjacent watercourses. (iii) The wastewater from the battery room will undergo electro dialysis.	Maintenance Workshops and Construction Camps	During Construction and Operation	Contractor	EPMD and Local WRB
Contaminated runoff from inappropriately stored hazardous material and solid waste	Solid hazardous and no hazardous waste will be appropriately stored to prevent contaminated runoff to adjacent waterways.	Storage areas for Hazardous Materials and solid Wastes (hazardous and non Hazardous)	During Establishment, Operation and Dismantling Storage	Contractor	EPMD and local EPBs

Environmental Impact/Issue	Mitigation Measures	Location	Time Frame	Responsibility	
				Implementation	Supervision
			Areas		

3. Air Quality

Generation of dust	(i) All earthworks vehicles will be covered to avoid spillage. (ii) Material storage site should be 300 m away from residential areas. (iii) Water will be sprayed on the construction sites and major feeder roads twice daily during dry season. (iv) The concrete batching plants and crushing plants will be sited at least 500 m from the nearest habitation and fitted with dust extraction units in compliance with the PRC and local standards.	Throughout project corridors, all access roads, sites temporarily acquired and all borrow areas	Construction.	Contractor	EPMD and EPBs
Emissions from Construction Vehicles, Equipment, and Machinery	Discharge emission standards. All vehicles, equipment, and machinery used for construction will be regularly maintained and correctly operated (including the use of dust filters or hoods).	Throughout project Corridor	Construction	Contractor	EPMD and EPBs

4. Noises and Vibration

Noise from vehicles, plant and earthmoving equipment	(i) Plant and equipment used in construction will strictly conform to the PRC and local noise standards. (ii) Within 200 m of the nearest habitation, construction work such as crushing, concrete mixing and batching, mechanical compaction, etc. will be stopped between 2200 and 0600 hours.	Throughout project corridor, all access roads, sites temporarily acquired and all Borrow areas	Construction	Contractor	EPMD and EPBs
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5. Solid Waste and Hazardous Materials

Storage and disposal of hazardous and no hazardous waste, and hazardous materials	(i) Disposal of domestic waste (hazardous and no hazardous) and construction waste will occur regularly in approved municipal disposal sites. (ii) There will be no on-site development of landfills. (iii) Hazardous waste and hazardous materials will be stored on-site in approved facilities according to relevant standards, including secondary containment. (iv) Licensed contractors will remove hazardous waste from site to approved hazardous waste disposal facilities.	Construction sites, construction camps, stations and maintenance workshops.	Construction and operation	Contractor (construction period) and EA (operation period)	EPMD and Soil cultivation department
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6. Impact on Flora

Loss of or damage to vegetation	(i) All works will be carried out in a manner such that damage or disruption to vegetation is minimized. (ii) Trees or shrubs will only be felled or removed if they impinge directly on the permanent works or necessary temporary works. (iii) A 30 m greenbelt will be developed on both sides of the railway. (iv)	Entire project site.	Construction.	Contractor	EPMD and Forest Department
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Environmental Impact/Issue	Mitigation Measures	Location	Time Frame	Responsibility	
				Implementation	Supervision
(v) (vi)	Trees will be planted at all station and depot areas, with an average coverage of 70%. The trees to be planted will be selected for adaptability to the local soil and climate. Along the alignment, additional land will be seeded with grass, and intercepting drainage systems will be constructed to prevent rainstorms from excessive erosion in the Grasslands. Environmental training of construction staff will include training on limitations and penalties on cutting of firewood and poaching There will be no ancient trees cut down or impacted by the construction or operation of the railway				

7. Impact on Fauna

Impact to aquatic biology at bridge Construction.	Mitigation measures will include appropriate engineering design to minimize increases in Suspended solids.	Bridge sites	Construction	Contractor	EPMD, Forestry and Agricultural Departments
Loss of habitat	Minimize habitat clearance during construction operations. Rehabilitation of temporarily occupied sites.	Throughout the corridor, in particular the mountainous areas.	Construction	Contractor	EPMD, Forestry and Agricultural Departments

8. Historical, Cultural, and Archaeological

Encounter sites during construction	Should a historical, cultural, or archaeological site be encountered during construction, all activities will halt and an established action plan will be enacted.	Throughout project corridor	Construction	Contractor	EPMD and Conservation Department
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9. Social Impact

Accidents due to unfamiliarity with railways	Along the majority of the alignment and the public is unfamiliar with safety issues associated with railway crossings. A public education campaign will be undertaken to minimize accidents at grade crossings and other locations. Furthermore, all road crossings will be grade-separated to increase public safety.	Throughout project corridor	Construction	Contractor	EPMD and RPMU
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B. Operation Phase

Contamination by hazardous waste and materials, including hydrocarbons	(i) Oil separators will be installed at wash down and refueling areas. (ii) Fuel storage and hazardous waste and materials storage sites will have adequate secondary containment to contain spills. All spilled materials and contaminated earth will be collected and disposed off according to guidelines.	Throughout project corridor	Construction and Operation periods	Contractor and EA	EPMD with Assistance from Local EPBs.
Wastewater disposal from maintenance facilities and stations	(i) Wastewater will be treated to appropriate discharge standards. (ii) All wastewater will be directed to municipal treatment where possible. (iii) The wastewater from the battery room will undergo electro dialysis.	Maintenance workshops and stations	Operation	EA	EPMD & EPBs
Air emissions from boilers at stations and	(i) All boilers will conform to GB 13271-2001. Boilers with capacities equal to or greater than 1 ton/hour will be equipped with multipurpose dust traps. Boilers of 1.4 megawatts	Maintenance Workshops and stations	Operation	IA	EPMD & EPBs

Environmental Impact/Issue	Mitigation Measures	Location	Time Frame	Responsibility	
				Implementation	Supervision
maintenance workshops	or greater will be equipped with wet desulfurization dust traps. (ii) Boilers will be regularly inspected to ensure that they are operating efficiently and emission standards are met.				
Noise from maintenance workshops	(iii) Noise from maintenance workshops will strictly conform to the local noise standards.	Maintenance Workshops	Operation	IA	EPMD & EPBs
Noise from operation of the railway	(i) Noise control measures will be installed for noise-sensitive points within 60 m on either side of the tracks. (ii) Sound barriers, 3 m in height with high absorbing capacity, will be installed in noise-sensitive communities with over 50 households. (iii) Sound-insulating windows will be installed in noise-sensitive communities with less than 50 households. (iv) Monitoring will be conducted during the operational phase to confirm modeling results.	Along entire Alignment	Operation	IA	EPMD & EPBs

Table 5.2: Environmental Monitoring Framework

Area to Be Monitored	Competent Authority	Parameters to be monitored	Location	Approximate costing
1)Air Quality	EPMD and Local EPB	Sulphur oxides and Nitrogen Oxides, Suspended Particulate Matter (SPM). Once a Week through construction period	At all locations of construction	Sampling and Laboratory test costs: US \$ 25 per sample
2)Air emissions from boilers	EPMD and Local EPB	Sulphur and Nitrogen Oxides and Ammonia once a month during operation period	Near workshops and switch yards	Sampling & Laboratory test costs: US \$ 25/sample
Water quality	EPMD and Local EPB	COD, BOD, SS and Coliform and Heavy metals once a month through construction period	Red river situated very close to existing track and water streams over which bridges are to be built/ repaired	Sampling & Laboratory costs: US \$ 50 per sample
Noise levels	EPMD and EPB	Noise levels with Sonometers, twice a week through construction period and once a week during operation especially during train movements	Regions very close to residential areas at all construction locations and station areas during operation	US \$ 10 per sample
Vibration levels	EPMD and Local EPB	Horizontal and Vertical vibrations twice a week through construction period and once a week during operation phase	Regions very close to residential areas at all construction locations and station areas during operation	US \$ 10 per measurement
Aquatic ecology	EPMD and EPB	SS and Coil forms Once month through construction period	Water streams below the bridges to be newly built/ repaired	Sampling and Laboratory tests US \$50/ sample
Forest, plantation areas and agricultural fields	EPMD and Forestry and Agricultural Departments (provincial and local)	Status of proposed green belt development, ancient and firewood trees. Illegal felling or poaching by construction workers Once in two months during construction period and Semi annual during operation	Regions very close to the alignment and construction camp areas	Agreed per diem and transport costs
Disposal Muck and Spoil	EPMD and local Water Resources Bureau	Loss of arable land, impairment of visual quality. Semi annual	Regions very close to the alignment and construction camp areas	Agreed per diem costs and transportation costs
Erosion	EPMD and local Water / Soil Resources Bureau	Loss of land, Land slides/slips, embankment etc. Once in two months and semi annual during operation	Regions very close to the alignment and construction camp areas	Agreed per diem and transportation costs

Note: EPB- Environmental Protection Bureaus, WRB –Water Resource Bureau.

5.3 ENVIRONMENTAL PROTECTION BUREAUS (EPBs)

The EPBs will be responsible for monitoring a range of parameters along the alignment as stated above.. There are EPBs located in all the provincial head quarters along the alignment. There are adequately qualified personnel in the EPBs. However it was reported that all the EPBs have financial constraints due to which, there is insufficient equipment for carrying out the monitoring work on regular basis. Hence they do monitoring work only at few places surrounding the towns of EPB locations. Even the data is not properly recorded. Some EPBs at bigger towns like Yen Bai, Lao Cai and Viet Tri conduct monitoring work and publish the annual Environmental reports concerning their region. There is urgent need for environmental capacity building of all the EPBs in general and those along the alignment in particular.

The training needs are (1) Field monitoring techniques for estimating the quality of various components like air, surface and ground water, noise and soil, (2) sampling and analysis methodology, (3) techniques for environmental survey, (4) waste water treatment techniques, (5) noise monitoring techniques, (6) soil sampling and analysis and (7) conducting initial and detailed EIA studies etc. The interested officials of the EPBs can be deputed for Training Courses/ Workshops frequently conducted by Local Universities/Research Institutions. RPMU in association with MoNRE and MoSTE can arrange for such training for selected EPBs at least six months before the actual commencement of construction before the commencement. RPMU has to work out an arrangement with them for monitoring work by meeting their requirements to certain extent by providing funds out of project cost.

6 PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

The basic purpose of conducting the stakeholder consultation was to involve the local people into the process of project implementation and to incorporate the appropriate Environmental concerns into the process. Moreover the Asian Development Bank Guidelines specify that the Public Consultation process shall be integral part of the Environmental Assessment. This section presents the essence of the stakeholder consultation process.

6.1 PRE - MEETINGS

These Consultation meetings were conducted during the survey from 7th to 10th March, 2006 and 13th to 14th March, 2006, following the reconnaissance survey during 22nd 23rd February, 2006. Individual and group discussions were conducted in the rural areas, especially with ethnic minority individuals, vendors at railway stations and at urban sites along the proposed rail alignment. Also discussions were conducted with officials of the various Railway Stations and project management officials, regarding the proposed project and their views were elicited. The objective of the consultation was to disseminate the project information in order to ascertain probable Environmental and Social impacts that may arise due to implementation of the proposed project. The consultants apprised the stakeholders of the salient features of the project. The following were discussed during Consultation.

- Overall need of the project
- Project location
- Environmental concerns; and
- Social concern.

At the meetings, the project was described in sufficient detail so that people became aware of the rail improvement locations and expected impacts on their respective areas. Then questionnaires (translated into Vietnamese language) were distributed to about 120 individuals, collected and analyzed. A breakdown of the respondents is presented in Table 6.1. A good cross section was achieved, with representations from various age groups, different educational levels and three occupational classifications: farmer, worker and career/ professionals. The responses are summarized in Table 6.2.

6.1.1 Outcome

As there are no major environmental issues, no specific issues were brought out during this group discussion. However various stakeholders made the following comments and suggestion. These were mainly derived from the consultation conducted with people residing closed to the rail alignment along the project and other officials of the railway.

- Most of the Stakeholders were of the opinion that since the project is envisaged to improve the connectivity, there would be rather a lot of positive impact and were also aware of the increased economic benefits due to the proposed upgrading / improvement of the rail corridor
- Some concern were raised in terms of additional rail tracks since some of the proposed structures will be close to the existing roads, residential areas, commercial establishments and rice fields. Also concerns were raised regarding the safety of the level crossings due to the proposed increase in the speed of new trains and also an increase in the frequency of traffic.
- The stakeholders also anticipated an impact on air and noise during the construction activities and increase in noise and vibration levels during the operational stages

- They also insisted for timely completion of project.

The stakeholder consultation reveals that the implementation of the present project i.e. upgrading of the Hanoi- Lao-Cai railway may not have any significant or adverse impact either on the natural environmental or socio-economic environment of the project area. However, the concern of the stakeholders, about (a) proximity of the new alignment and the laying of the new proposed railway track close to the residential areas, commercial establishments, existing parallel roads and rice fields, and (b) increase in noise and air pollution levels during the construction stage and increase in noise and vibration levels during operation stages needs to be taken into consideration by adopting the mitigation measures addressed in the environmental management plan.

Table 6.1: Characteristics of Participants at Public Consultation Meetings.

(Total No. of Participants 120)

Age	18-30	31~40	41~50	>50
Subtotal	18/120	60 /120	30/120	12/120
Educational Background	Primary School	Junior Middle School	Senior Middle School	College and above
Occupation	Farmer	Worker	Professional/Technical	Other
Questionnaires Distributed	45/120	25/120	22/120	28/120
	20/120	35/120	45/120	20/120
	Rural Areas		Town Areas	
	55/120		65/120	

Source: Wilbur Smith Associates Draft--- Initial Environmental Examination 2006

Table 6.2: Responses to Questionnaire

(Total Number of Respondents 120)

No	Issues	Response (individual)				
1	Are you aware of the project?	Yes	Understand through the media		Do not know	
		55	45		20	
2	Are you satisfied with the current transportation?	Satisfied	Not very		Not satisfied	
		40	55		25	
3	What is the effect of the Project on local transportation?	Good	Bad		Do not know	
		65	4		51	
4	How are the environmental conditions where you live?	Good	Average		Bad	
		35	65		20	
5	What environmental problems will be generated by the Project?	Water pollution	Air pollution	Noise and vibration	Ecological damage	Other
		10	25	65	12	8
6	What is the degree of impact of the Project on local environment?	Major		Minor		Do not know
		15		55		50
7	What are the methods you prefer to alleviate railway noise?	Vegetation	Sound barrier	Sound window	Village away from railway	Removal
		15	45	-	9	51
8	What are the ways you prefer to prevent water and soil loss, and protect ecological condition?	Proper alignment	Check dam	Vegetation	Windbreak and sand fixation	Enhance management
		35	15	10	-	60

No	Issues	Response (individual)		
		Vegetation and protection	Control during construction	Others
9	What is the best way to protect Nature Reserve as the railway will pass through it?			
		55	45	20
10	With this new alignment, the numbers of crossing roads are going to reduce. How do you think about it's effect?	Good	Don't mind	Not good
		35	40	45
11	With this new alignment, the number trees closed to the track will be cut.. Do you agree with that?	Agree	Don't mind	Disagree
		25	35	60
12	During the construction, there is going to be a lot of noise. Do you agree if the construction is done during day and night?	Agree	Only during day	Disagree
		15	75	30
13	Do you support the setting of construction worker's camp near your area?	Yes	Don't mind	No
		15	25	80
14	Are you satisfied with local economic development?	Satisfied	Not very	Not satisfied
		20	40	60
15	How is the waste water disposal and solid waste disposal system at Railway station	Satisfactory	Very bad	Not satisfactory
		15	85	20
16	If removal is required, what is your view on resettlement?	Money compensation	Land recovery in other place	Job opportunity
		55	25	40
17	What is the effect of the new railway on your life?	Good	Bad	Do not know
		65	15	40
18	What is your general view on the Project?	Support	Against	Do not know
		75	15	30

Source: Wilbur Smith Associates: Draft: Initial Environmental Examination 2006

During the consultations with the stationmasters, their opinions regarding the following were sought:

- Information regarding the volume of the outgoing and incoming traffic,
- Number of trains plying per day,
- Type, quantity and places of loading and unloading operations,
- Storage yards and workshops,
- Waste water generated and their treatment and discharge,
- Solid waste management,
- Accidents at illegal crossings.

6.2 POST IEE – PUBLIC CONSULTATIONS

In conformity with ADB Guidelines, an environmentally focused Public Consultation meeting was conducted on 4th April 2006 at Yen Bai, the mid point of the proposed alignment. The meeting was organized, in coordination with RPMU. About 35 people,

specifically invited to the meeting were officials from Environmental Protection Bureau, Forestry, Health, Construction Management Units of VNR and Women's organizations from the provinces of Lao Cai, Yen Bai and Phu Tho. The senior officials of RPMU explained brief details of the project. A power point presentation of the IEE studies and their findings, was made and the opinion of the participants were elicited. The participants expressed concerns about:

- Likely increase in the levels of noise and vibrations during the movement of trains at increased speed and their impacts on nearby schools, clinics and hospitals and houses close to the track.
- Impact of increase in noise levels during construction especially during night hours.
- Safety at level crossings especially near the unmanned crossings.
- Absence of solid waste management and disposal systems at all the railway stations, especially at bigger stations and their premises.
- Leaking and discharge of waste water from the stations on to the land and nearby river and water streams.
- Seriousness of compliance of the suggested mitigation measures by the contractors at construction stage and by VNR during operation phase.
- Non de-mobilisation of construction camps after completion of the work and continue to stay on permanently there after.
- Lack of institutional co-ordination between different departments like, EPBs, urban planning, local public institutions and VNR resulting in environmental degradation.

Also some good suggestions made by the participants were:

- Development of an 'Environmental Baseline Data' regarding quality of water, especially Red River, air, noise and vibration levels along the alignment before construction phase.
- Totally banning the illegal crossings.
- Declaring the 200 m. distance on either side of the new track as 'no development zone' henceforth.
- Erecting signs, indicating the presence of hospitals and schools, along the alignment and ban the practice of honking of trains near the these places,
- Integration of railway development/ improvement plan with development plan of cities along the proposed alignment,
- Encouragement/ mandate hiring local people, especially those from the ethnic minorities, during the construction work in the mountainous regions near Lao Cai.

The concerns expressed and suggestions made were well addressed and noted by the consultants and RPMU. The consultants explained in detail the methods of mitigation and their serious monitoring during construction. The RPMU told that there is strong political will at the top of the Government of Vietnam and VNR, to implement the transportation projects as per the best practices which would percolate down the line while implementing the project. All the participants were supportive of the proposed project and wanted its early implementation which would bring the required socio economic development of the region.

The list of participants who attended the meeting is given in the Annex 2.

The questionnaire translated in Vietnamese language and given to participants is given in Annex 3.

7 FINDINGS AND RECOMMENDATIONS

The proposed project mainly is aimed at rail improvement and up-gradation of the track, stations and other associated facilities required for the rail traffic expected till 2020. All the proposed improvements and up-gradation are along the existing alignment. The trains are in operation with maximum capacity. It is not totally a green field project with severe impacts. All the ecological, environmental and historical areas along the proposed alignment are far away from the impact area of the project with no major or critical threat to natural resources or ecosystems of the region.

However the IEE studies showed there are few environmental issues out of the proposed project, which need to be mitigated on priority basis before the construction phase. They are (a) Soil erosion and disposal, (b) water quality of Red River and (c) noise and vibration levels (d) waste water treatment and solid waste management. For this it is suggested that the following studies, using site specific information/data be done.

Soil Erosion and Disposal

Nearly half of the land area in the project is mountainous. The Con Voi mountain systems exist between Red river and Chay river. With elevations of 400 to 1400 m in the mountainous areas, in Yen Bai and Lao Cai are characterised by steep slopes, which cut by railway construction earthworks are easily eroded, have become unstable causing land slides/ landslips. Improper soil disposal could also cause severe sediment impacts, particularly where the soil is disposed of in steep areas, or where the soil is not properly stabilized. Careless disposal of cut soil could also result in the negative impacts on the adjacent water courses like Red river which runs close to the track (within 10 m) at certain locations. Hence a proper '**Soil Erosion Prevention and Control**' study especially for the region between Yen Bai and Lao Cai, addressing issues like, (i) topography of the region, (ii) methodology for construction earthworks, (iii) soil removal, selection of sites for disposal to control sediment impacts and (iv) standards for slope stabilisation etc. is recommended.

Water Quality of Red River

The entire project area is a part of the Red river watershed. The improper erosion control and disposal run-off and already eroded embankments run the risk of affecting water quality of the river in the sections of the alignment close to track. Added to this is the discharge of untreated wastewater from stations along the alignment. So there is a need for 'Red River Water Quality Management Plan' covering areas along the alignment and address issues like, (i) current water quality, (ii) siltation and sedimentation of the watercourse near the places of erosion and their control, (iii) estimation of waste water being discharged from the existing stations and workshops, (iv) impact of sudden floods in the Red river on the track at places close to it. Though some studies on the general water quality of the river exist, no current site-specific data on the issues mentioned above is available.

Noise and Vibration

The alignment at various locations runs very close to the residential areas, Hospitals and Schools. No data on the noise levels exists regarding them. There is a need for database of their levels along the entire length of alignment. This data would help in formulating a precise mitigation measure to be adopted especially at urban locations during the operation phase of the trains.

Waste Water treatment and Solid Waste Management at Railway Stations

This situation is very poor at all the railway stations and workshops along the alignment and could become worse with the increase in frequency and traffic volume. It needs a study based on the of existing and future scenario, covering aspects like, (a) estimation of waste water generation for the present and in future (water balance), (b) type of treatment facility required and their discharge points, (c) estimation of current and expected increase in solid waste, (d) their existing and future handling, collection and disposal methods.

But for the above-mentioned issues, there are no major long-term significant impacts out of the proposed project. The IEE study, at this juncture of feasibility study is sufficient, without the requirement of detailed study or EIA. **The above-mentioned studies could be taken as projects, independent of this study, by the project proponents (VNR), before implementing the project.** In view of the financial constraints, the RPMU and VNR could explore the possibility of getting funds for such Environmental infrastructure related projects. There are 'Environment Technology' focused mini scale funding agencies like 'United States Asia Environmental Programme' (USAEP) which fund such projects. USAEP has presence in Hanoi.

However, there is a need to comply with the requirements of MoNRE and MoSTE. As per the list of projects requiring EIA studies stipulated by MoSTE and subsequently followed by MoNRE, all the Railway Projects of more than 50 km in length, do require an investment license by them based on the EIA studies and report. The present IEE studies, which forms a chapter of the Feasibility study (preliminary design stage), are sufficient for making an application for Investment License, which is called **Stage I**. After getting permission to apply for investment license, while submitting detailed design (**Stage II**), for obtaining Investment License, a detailed EIA (as per the guidelines and format stipulated by MoSTE for Transport Related Projects) is required. The extract of the MoSTE explaining above-mentioned regulation is given in Annex 3. A copy of the extract of the circular of MoSTE dated 29th April 1998 "Providing Guidelines for setting up and appraisal of an EIA report for investment projects", indicating general principles, compliance stages etc are given in appendix. The Guidelines and format for preparing such an EIA studies for Transportation projects, like road and railway projects, stipulated by MoSTE is appended with this report (see Annex 4).

8 CONCLUSION

The proposed Kunming - Haiphong Transport Corridor Project (supplementary GMS Hanoi- Lao Cai Railway upgrading) is a link between the Western mountainous provinces, the midland and delta provinces at the north band of the Red river, reaching Hanoi. The proposed project will (i) improve transport infrastructure in an area rich in natural resources, (ii) augment a vital corridor for the national movement of passengers and freight, (iii) improve the link between the port of Haiphong in Vietnam and Kunming in Yunnan province of the People Republic of China (PRC) for bilateral trade and (iv) enhance social and economic development and raise the living standard of the local inhabitants

Potential environmental impacts from the proposed project arise from (i) earthwork disposal, (ii) soil erosion, (iii) sight specific degradation of surface water quality, (iv) noise pollution and vibration. No sensitive environmental sites were identified in the impact corridor of 5km on either side of the alignment. Appropriate mitigation measures have been developed to minimize the degree of impacts.

The environmental benefits directly associated with the project include improvements in air pollution and improved energy efficiency. Transporting passengers and freight by trains generate significantly less total air pollution than does road transport.. Rail transport is considerably more energy efficient than equivalent truck transport, particularly for freight transport.

Based on the results of the present IEE, the adverse environmental impacts out of the project can be mitigated or minimized with suggested Institutional requirements and Environmental Monitoring Plan resulting in completion of EIA.

ANNEX 1 SUMMARY OF RESETTLEMENT PLAN

Scope of Land Acquisition and Minimization of Resettlement

The Resettlement Plan for the Kunming-Haiphong Transport Corridor Project TA 4050-VIE (hereafter referred to as the “Project”) covers all project components permanently impacting on land used by Affected Persons¹. Resettlement impacts were minimized by selecting engineering options that affected the least number of persons, while providing the most operational gains in safety and efficiency for the railway line. This included the general application of a policy of attrition for clearing the Construction Corridor (7m from edge of embankment) and Safety Corridor (15m from edge of embankment). Persons and their properties will *not* be evacuated from the corridors by the Project, but persons will not be allowed to move into the corridor in the future.

Affected Persons (AP) are persons who will lose land, fixed assets or income as a result of land acquisition by the Project. The land area acquired by project components is referred to here as the project’s **Area of Impact**. The Resettlement Plan also covers land acquired for the establishment of resettlement sites for AP relocating from Lao Cai Rail Station. The total number of AP covered in the Resettlement Plan is 2,378 in 591 households.

Severely Affected Persons (SAP) are persons that will lose more than 10% of their productive assets or they are required to relocate their residence². A total of 207 SAP households were identified in the project’s Area of Impact, of which 93 households will lose more than 10% of their productive assets and 122 households will be required to relocate; while all 180 households in the resettlement sites were identified as SAP.

Vulnerable Groups are persons from a particular social or economic group who face elevated risks of impoverishment as a result of resettlement. The vulnerable groups identified in the project’s Area of Impact and resettlement sites were 33 ethnic minority households, 84 single female-headed households with dependents, 25 poor households, eight (8) households whose primary income earner is elderly or physically disabled, and twelve (12) households who are landless or whose current land tenure is unstable.

The main types of land loss as a result of the Project will be agricultural land, residential land, garden or pond land, forest land and common lands. In the project’s Area of Impact, 131 AP households will lose agricultural land, of which 43 will be marginally affected (<10% loss) and 88 will be severely affected (>10% loss). A total of 282 AP households will lose residential land, of which 118 will reorganize on their remaining land and 122 will relocate.

Of the households required to relocate, 74% are from Lao Cai Rail Station and for whom two resettlement sites in Lao Cai City have been planned. A total of 88 AP households will lose garden land and 8 households will lose forest land. Only 5 households were renting land and 18 households were identified as illegal land-users. In the resettlement sites, a total of 180 households will lose residential land, all of whom will relocate³. Among them, 114 households will also lose garden land.

¹ Temporary impacts will be covered in the civil works contracts of contractor companies after the detailed designs for the Project are prepared.

² The two categories of SAP are non-exclusive, as one household can belong to both categories. Hence, the total SAP is less than the sum of the two categories.

³ AP currently located in the area designated for the resettlement sites will be given first priority for acquiring residential plots in the resettlement areas. However, they are still defined as relocating AP, as the resettlement will require the complete reorganization of current land use in the resettlement area.

The total area of land acquired from AP households in the project's Area of Impact will be approximately 155,000 sq.m, consisting of 29,000 sq.m of residential land, 42,000 sq.m of agricultural land, 60,000 sq.m of garden or pond land, 19,000 sq.m of forestland and 5,000 sq.m of common land. In the resettlement sites, the total area of acquired land will be approximately 69,000 sq.m, consisting of 16,000 sq.m of residential land and 53,000 sq.m of garden land⁴. A total of 177 houses will be impacted in the Area of Impact, of which 57 houses will be partially affected and 120 houses will be left structurally unsound and, hence, entirely affected. Another 163 houses will be impacted in the resettlement sites, all of which will be entirely affected. A total of 554 structures will be impacted in the Area of Impact and 379 structures in the resettlement sites. An approximate total area of 45,000 sq.m of annual crops and 8,600 trees will be impacted in the Area of Impact and an approximate 6,000 sq.m of annual crops and 2,900 trees in the resettlement sites. In the Area of Impact, 46 businesses will be affected, of which 41 will be able to re-build on the AP's remaining land and 5 would be required to relocate. The employment of 40 persons will also be affected as a result of the Project, of which 18 are employees of affected businesses and 22 are sharecroppers. In the resettlement sites, ten (10) businesses would be required to relocate and two (2) employees in these businesses will be affected. In the Area of Impact, 268 AP households will be entitled to income rehabilitation assistance, 207 of these households will also be entitled to the subsistence allowance and 119 of these households will further be entitled to the transport allowance, while all 180 households in the resettlement sites will be entitled to all three allowances.

Impacts on Trees and Crops

An approximate total area of 45,000 sq.m of annual crops and 8,600 trees will be impacted in the Area of Impact (Table 1.10) and an approximate 6,000 sq.m of annual crops and 2,900 trees in the resettlement sites (Table 1.15). Not surprisingly, the project components impacts on most crops and trees will be in the rural areas of Mai Tung (16,000 sq.m crops, 579 trees) and the realignment sections km 169-171 (7,800 sq.m crops, 658 trees) and km 283-292 (54,290 sq.m crops, 2,258 trees). The resettlement site in Van Hoa will impact on 6,000 sq.m of crops and 2,534 trees.

Socio-Economic Information

Basic socio-economic information on AP was gathered through an Inventory of Losses (IOL) administered on 100% of AP households (n=591) and a Socio-Economic Survey (SES) administered on 20% of Affected Households (n=118) (Tables 2.1 and 2.2). At least one AP household was sampled for the SES, even for project components that impacted less than five AP households. The main purpose of collecting socio-economic information was to establish baseline data for monitoring project impacts on the living standards and productive capacity of AP, as well as address particular social and economic issues related to gender and ethnic minorities. Both surveys were administered by the Survey Teams from the Railway Public Utilities Company (RPUC) Vinh Phu and Yen Lao from March to June 2006.

Legal and Policy Framework

The legal and policy framework relevant to resettlement for this Project are based on the relevant laws of the Government of Viet Nam (GoV) and ADB policies. The main national laws relevant to resettlement are Decree 17/2006/ND-CP, Decree 197/2004/ND-CP, Circular 116/2004/TT-BTC and the 2003 Land Law. The main ADB policies relevant to resettlement are the Policy on Involuntary Resettlement (1995),

⁴ Agricultural land in residential areas is classified as garden land under Vietnamese legislation, usually with higher compensation prices than the highest category of agricultural land.

Policy on Indigenous Peoples (1998), Policy on Gender and Development (1998), Policy on Public Communications (2005) and the ADB Accountability Mechanism (2003).

Project Principles and Policies

To ensure the achievement of national laws and ADB policies, the Project has adopted specific principles and policies for resettlement. The Project's main principles are that resettlement will be avoided or minimized by exploring all viable options; all AP are entitled to compensation and other benefits to assist them to maintain or improve their pre-project living standards and production levels; lack of legal rights will not bar an AP from project entitlements; compensation shall be paid at least at replacement cost in current markets; efforts will be made to preserve existing social and cultural ties in the case of population relocation; planning and implementation of the Resettlement Plan will be carried out with the participation and consultation of AP; compensation will be paid out directly to AP prior to awarding civil contracts; and compensation and rehabilitation assistance will be carried out with respect for the needs of ethnic minorities, women and other vulnerable groups.

Eligibility and Entitlements

The eligibility cut-off date for the Project will be the date of the Detailed Measurement Survey. Project entitlements for all types of AP and all types of losses are defined in the Entitlement Matrix.

Public Consultation and Disclosure of the Resettlement Plan

Because the project's Area of Impact has many project sites with generally few AP households in each site, the first **Orientation Meeting** was carried out simultaneously with the IOL and SES and facilitated with 100% of AP households. The primary purpose of the first Orientation Meeting was to familiarize AP with basic information on the Project, policies and principles for resettlement, and the process for developing the Resettlement Plan. After the draft Resettlement Plan is complete, the Project will convene a second **Orientation Workshop**. One workshop will be held in Lao Cai Rail Station covering all project components within the Yen-Lao RPUC; and another workshop will be held at the Vinh Phu RPUC for all project components within its jurisdiction, as well as the fly-over bridge in Dong Anh under the Ha Thai RPUC. The primary purpose of the Orientation Workshop will be to disclose the Resettlement Plan and gain feedback from local authorities, AP representatives and other relevant stakeholders. The **Project Information Booklet** and the ADB's **Information Guide** on public consultation and the ADB accountability mechanism will also be circulated at the Orientation Workshop, as well as copies delivered to each of the project sites for circulation to all AP.

Comments and concerns raised at the Orientation Workshops will be incorporated into the final Resettlement Plan. Once the Resettlement Plan is approved, copies will be distributed to each RPUC and Provincial, District and Commune People's Committees with project components. The Resettlement Plan will be made available for public consultation by AP, in coordination with the RPUC or the relevant People's Committee. A copy of the final Resettlement Plan will also be posted on the ADB's website.

Grievance and Complaints

AP may address their grievances and complaints through the national system and/or the ADB's Accountability Mechanism. In the national system, the AP should begin by filing their complaint with the Commune People's Committee. If still unsatisfied with the resolution, then the AP may pursue their complaint through the District People's Committee, the provincial People's Committee and, finally, the national court system. All legal and administration fees for filing complaints will be waived for AP, except for cases

filed in the national court system. The AP may also file their complaints directly with the ADB by writing a letter to the Office of the Special Project Facilitator (OSPF). Under the **ADB's Accountability Mechanism**, the OSPF has a responsibility to respond to the complaint, investigate it and pursue its resolution until all of the concerned parties are agreed on its termination.

Resettlement and Rehabilitation Strategy

The primary strategy for ensuring that AP are able to maintain or improve pre-project living standards and production levels is **replacement value compensation** in cash or in kind (e.g., replacement land) for all losses in land, fixed assets and income. In addition, **special assistance allowances** will be awarded to Severely Affected Persons (SAP) and vulnerable groups (as defined above) to support them in re-establishing their income sources and production bases. The specific application of funds designated for **income rehabilitation assistance** will be decided together with the relevant People's Committee and the eligible AP households, depending on the income opportunities available in the locality and the specific needs and interests of the AP. Examples of uses for these funds are training, micro-credit funds and start-up materials and equipment for new businesses. Because nearly all project sites counted less than five SAP, the specific strategy for their rehabilitation will be determined on a case-by-case basis together with local authorities during implementation of the Resettlement Plan.

However, a more elaborate rehabilitation strategy has been developed for project components at the new Rail Station at Mai Tung and Lao Cai Rail Station, as well as at both resettlement sites. Based on consultations with local authorities, RPMU and RPUC, the rehabilitation strategies in Mai Tung and Lao Cai qill emphasize replacement land where available, notably at Mai Tung; finding new employment, such as by assisting AP to secure jobs at the new Rail Station in Mai Tung or Industrial Zones currently being developed in Lao Cai; developing non-land based businesses, such as by reserving land spaces at the Rail Station for AP to build small service sector businesses; and integrating rehabilitation efforts with the social and economic development programs and policies of local government and NGOs present in the area, such as the Vocational Training and Support Centres in Lao Cai City.

The Lao Cai City People's Committee has also planned Resettlement Sites to accommodate the 90 AP households who will relocate from Lao Cai Rail Station. The People's Committee is currently preparing several different resettlement sites in and around Lao Cai City to accommodate displaced persons from various economic development projects, such as the upgrading of the Lao Cai Rail Station. The particular resettlement sites that will be used by the Project are located in Pho Moi Ward and Van Hoa Commune in Lao Cai City. The resettlement site in Pho Moi Ward will comprise an area of approximately 47,000 sq.m and it will be able to accommodate 110 households. The resettlement site in Van Hao Commune will comprise an area of approximately 61,000 sq.m and accommodate 220 households. The resettlement sites will provide each incoming household with a residential land plot of 80-100 sq.m, as well as make investments in road access, residential electricity, residential water supply and drainage. AP will be required to purchase the residential plots with their compensation money, if they so wish. The Lao Cai City People's Committee will engage in amortization schemes with households who may not have sufficient money to purchase a plot in the resettlement sites, whereby the AP would pay-off the purchase price over a period of time determined together with the People's Committee.

Gender and Ethnic Minority Issues

In accordance with ADB policy, special provisions have been made to help prevent discrimination against women and ethnic minorities in the implementation of the

Resettlement Plan. Ethnic minorities were under-represented in the AP population, comprising only 5% (32 households) of AP households compared to the 14% that ethnic minorities comprise in the national population. Furthermore, no large groups of even more than 10 (ten) ethnic minority AP households were found living together as a single community in the project's Area of Impact or the resettlement sites. Socio-economic data indicated that ethnic minority AP earned less annual income than the general AP population, but showed better educational achievement and security over land use than their Kinh counterparts. Women and girls comprised exactly 50% (1,179 AP) of the AP population, while single female-headed households comprised 14% (81 households) of AP households. Socio-economic data showed that female-headed households tended to earn less annual income and were less likely to have their lands registered under their names when compared with the general AP population. To address the special risks and needs facing ethnic minorities and women as a result of resettlement, **gender and ethnic minority specific actions** have been outlined in the Resettlement Plan.

Monitoring and Evaluation

Monitoring for the Resettlement Plan will be both internal and external. The RPMU will be responsible for **Internal Monitoring** together with the Provincial People's Committees through regular supervision of the Compensation and Resettlement Boards. The RPMU will also prepare quarterly and bi-annual Progress Report for submission to Vietnam Railways and the Ministry of Transport. Internal monitoring will be ongoing throughout the period of project implementation.

External Monitoring and Evaluation will be carried out by an Independent Monitoring Organization (IMO) contracted to the RPMU. An IMO can be a university, research institution, non-governmental organization (NGO) or other organization that is legally and administratively independent from government. The IMO will be primarily responsible for assessing whether AP have been able to maintain their pre-project living standards and productive levels, as well as whether resettlement activities have been implemented in quality, quantity and timeliness according to the Resettlement Plan. The IMO will report directly to the Ministry of Transport and the ADB. External monitoring will be carried out every six (6) months during the first two years of implementation of the Resettlement Plan and then every year until all AP have been relocated. The IMO will conduct further evaluations at the first, second and fifth years after land acquisition and relocation of AP. The IMO should also organization evaluation missions to coincide with the finalization of the updated Resettlement Plan, the period between payment of compensation and evacuation, and within three months of the AP's relocation to the resettlement sites.

Institutional Organization and Implementation Schedule

The main institution responsible for executing the Resettlement Plan will be the RPMU, under the supervision of Vietnam Railways and the Ministry of Transport and in close coordination with the relevant Provincial People's Committees. The Provincial People's Committees will establish the Compensation and Resettlement Boards at the provincial and district levels for updating and implementation of the Resettlement Plan. The Project will also hire one international and one national Resettlement Specialist with expertise in ethnic minority issues, as well as one international Gender and Social Development specialist.

Implementation Schedule and Budget

The envisioned timeframe for implementing the Resettlement Plan is 10 months. All costs for resettlement will be financed by the Government of Vietnam. The total cost for implementing the Resettlement Plan is estimated at 82.6 billion VND (approx. 5.1 million

USD), of which 37.2 billion VND (approx. 2.3 million USD) is for compensation costs in the project's Area of Impact and 9.4 billion VND (approx. 0.6 million USD) for compensation costs in the resettlement sites.

ANNEX 2 PUBLIC MEETING AND DISCLOSURE

Dự án Hành lang giao thông Côn Minh - Hải Phòng
Lập Nghiên cứu khả thi và Thiết kế sơ bộ
Nâng cấp tuyến đường sắt Yên Viên – Lào Cai

Yen Bai, 4th April 2006

LIST OF PARTICIPANTS

No	Name	Organization	Signature
1	LUU VAN LUYEN	Department of Health, Yen Bai	
2	PHAM GIA CAC	Department of Construction, Yen Bai	
3	HOANG THI LANG	Women Union, Yen Bai	
4	HA MANH CUONG	Dept of Natural Resources and Environment, Yen Bai	
5	TRAN HUY HUNG	People's Committee of Yen Bai city	
6	DAM HONG TOAN	Hoa Binh Co. LTd, Yen Bai	
7	NGUYEN NGOC BACH	Hong Ha ward People's Committee	
8	CAO TIEN TRONG	People's Committee of Nga Quan commune, Yen Bai	
9	DANG DINH VUONG	Dept of Natural Resources and Environment, Phu Tho	
10	TRAN THANH TAM	Vinh Phu RPUC, Phu Tho	
11	DUONG VAN THUY	Ethnic Minority Department, Yen Bai	
12	NGUYEN TINH BANG	Commercial & Tourism Dept., Yen Bai	
13	NGUYEN VAN SON	People's Committee of Tuy Loc commune, Yen Bai	
14	LE QUANG VINH	Yen Lao RPUC, Lao Cai	
15	DANG XUAN HOAN	Transport Department of Lao Cai	
16	THIEU VAN LAC	Yen Bai Station	
17	LU THI TIU	Environmental Resource Dept of Lao Cai city	
18	TRAN TUYET MINH	Environmental Resource Dept of Lao Cai city	
19	PHAM THI THANH BINH	Women Union of Yen Bai	
20	HA MINH PHUONG	Women Union of Yen Bai	
21	NGUYEN THI THU HANG	Women Union of Yen Bai	
22	TRAN MAI KHANH	Women Union of Yen Bai	
23	TRAN VAN TUY	RPMU	
24	LE THANH PHUONG	RPMU	
25	BUI NHAT LE	RPMU	

ANNEX 3 PHIẾU ĐIỀU TRA CÁ NHÂN

Họ tên:

Tuổi:

Trình độ học vấn:

Nghề nghiệp:

Nơi ở:

Stt	Các câu hỏi	Trả lời				
		Hiểu rõ	Biết	Không biết		
1	Bạn có biết gì về dự án này không?					
2	Bạn đã hài lòng với tình trạng giao thông ở địa phương bạn hiện nay chưa?	Thỏa mãn	Không vừa lòng lắm	Không vừa lòng		
3	Dự án có ảnh hưởng gì đến vấn đề giao thông ở địa phương bạn không?	Tốt	Sấu	Không biết		
4	Điều kiện môi trường nơi bạn đang sinh sống thế nào?	Tốt	Bình thường	Kém		
5	Bạn có biết dự án sẽ gây nên những vấn đề môi trường gì ở địa phương bạn không?	Nhiễm bẩn nước	Ô nhiễm không khí	Tiếng ồn và các dung động	Đe dọa hệ sinh thái	Những vấn đề khác
6	Theo bạn, tác động đến môi trường ở địa phương của dự án là ở mức nào?	Nặng	Nhẹ	Không biết		
7	Bạn muốn sử dụng phương pháp nào để loại bỏ tiếng ồn?	Trồng cây	Dùng tường ngăn âm thanh	Dùng cửa sổ cách âm	Làm đường sắt	Di chuyển
8	Biện pháp nào bạn muốn sử dụng để ngăn ngừa sự mất nước và đất, và bảo vệ môi trường sinh thái?	Sắp xếp hợp lý	Đê con trạch	Trồng cây	Đa cổ hàng đào chống gió và cát	Tăng cường sự quản lý
9	Phương pháp nào là tốt nhất để bảo vệ Tài nguyên thiên nhiên nếu có tuyến đường sắt chạy qua đó?	Trồng cây và bảo vệ	Điều khiển trong quá trình xây dựng	Các phương pháp khác		
10	Với tuyến đường sắt mới, nhiều đường cắt ngang đường sắt sẽ bị ngăn lại. Bạn nghĩ thế nào về hệ quả của việc này?	Tốt	Không quan tâm	Không tốt		
11	Với tuyến đường sắt mới, nhiều cây cối ven đường quá gần đường sắt sẽ bị chặt bỏ. Bạn có suy nghĩ gì về việc này?	Đồng ý	Không quan tâm	Không đồng ý		
12	Trong quá trình xây dựng, sẽ có nhiều tiếng ồn, bạn có	Đồng ý	Chỉ xây dựng vào ban ngày	Không đồng ý		

Stt	Các câu hỏi	Trả lời		
	đồng ý với việc xây dựng được tiến hành vào ban đêm không?			
13	Bạn có ủng hộ cho việc dựng lán trại để cho những người làm đường ở gần khu vực sinh sống của bạn không?	Ủng hộ	Không quan tâm	Không ủng hộ
14	Bạn đã hài lòng với sự phát triển kinh tế của địa phương bạn chưa?	Hài lòng	Không hài lòng lắm	Không hài lòng
15	Quan điểm của bạn về vấn đề thu hồi đất đai phục vụ cho công việc làm đường thế nào?	Tuân theo sự sắp xếp	Yêu cầu đền bù	Không đồng ý
16	Nếu bị chuyển đi, bạn muốn tái định cư như thế nào?	Đền bù bằng tiền	Đền bù bằng đất ở nơi khác	Mang đến cơ hội nghề nghiệp
17	Ảnh hưởng của đường sắt đến cuộc sống của bạn như thế?	Tốt	Không tốt	Không biết
18	Quan điểm chung của bạn về dự án?	Ủng hộ	Phản đối	Không biết

Ngày điều tra:

Người điều tra:

ANNEX 4 MOSTE GUIDELINES FOR EIA: GENERAL**CIRCULAR***No. 490/1998/TT-BKHCNMT**Hanoi, 29th April 1998***PROVIDING GUIDELINES FOR SETTING UP AND APPRAISAL OF AN
ENVIRONMENT IMPACT ASSESSMENT REPORT FOR INVESTMENT PROJECT**

The Ministry of Science, Technology and Environment (“MoSTE”) provides guide lines for setting up and appraisal of an environment impact assessment report (“EIA Report”) for domestic investment, joint venture and foreign direct investment projects as follows:

I. GENERAL PRINCIPLES:

I.1 Domestic investment project, joint venture projects, business co-operation with foreign parties. 100% foreign-owned investment projects and other forms of investment (collectively, “investment project”) to be implemented in the territory of Vietnam shall all comply with provisions of the Circular with respect to environment protection.

I.2 It is MoSTE’s stipulation that investment projects be divided into two types:

1. Project in respect of which an EIA Report is required to be set up and appraised shall be referred to in this Circular as projects of **Type I**. They are those, which have a potential for causing or are likely to cause environment pollution on a large area where it is difficult to control the situation and to determine environmental standards. The list of those projects are provided in Appendix I.
2. All projects other than those defined above shall be of Type II and they shall be registered as meeting the environmental standards on the basis of an EIA Report to be set up and analyzed by the project investors themselves.

II. COMPLIANCE STAGES**II.1 The stage of application for an Investment License****1. Projects of Type I**

In the documentation of any project of this Type there shall be part or chapter giving brief description of the project’s potential impact on the environment (see Appendix II). The State authorities in charge of environment protection shall base themselves on this when evaluating the project documentation.

II.2 The stage of design and construction

1. After an Investment License is issued and a project site is identified for a project of Type I, an EIA Report must be set up for the project and be submitted to the State authorities in charge of environment protection for appraisal.

Extracts of the List of Projects as mentioned in Appendix I of the Circular

LIST OF PROJECTS IN RESPECT OF WHICH AN ENVIRONMENTAL IMPACT ASSESSMENT REPORT IS REQUIRED TO BE SUBMITTED FOR APPROVAL.

No. 17. Railways, motorways, and roads for vehicles (of Clauses I to III under the Vietnamese Standards 4054-85) of more than 50 km in length;

JUSTIFICATIONS FOR FACTORS HAVING AN ENVIRONMENTAL IMPACT

*(as part of the feasibility study or econo-technical justifications
to be submitted in application for an Investment License)*

Brief description of the main factors, which have an environmental impact

Data on the current situation of the environment in the place where the project is to be implemented (covering quality of surface and underground waters, the air and bio-ecological system), and general remark as to the pollution level at the project site;

Description of the production technology process/flow charts, and list of materials, fuel and chemicals to be used (in case the same is not provided in detail in the econo-technical justifications);

Main factors having an environmental impact as a result of the project's operation at the implementation stage (with estimates for discharged smoke and gas, solid waste, noise etc.), and assumption of the level of impact to be caused on the environment.

(Brief) proposals for mitigating the negative affect caused by the project on the environment.

ANNEX 5 MOSTE GUIDELINES FOR EIA: TRANSPORT PROJECTS

GUIDELINES FOR SETTING UP OF ENVIRONMENTAL IMPACT ASSESSMENT
REPORT OF TRANSPORT PROJECTS (ROADS, RAILWAYS AND BRIDGES)
MINISTRY OF SCIENCE, TECHNOLOGY AND ENVIRONMENT (MOSTE) NATIONAL
ENVIRONMENT AGENCY, HANOI 1999

Chapter 7STRUCTURE OF THE EIA REPORT**I. INTRODUCTION**

In this section of “Introduction” main contents must be included as follows:

1. Purposes of the EIA report setting up.
2. List of Legal documents, technical data and references for reporting:
 - Legal documents include:
 - + The LEP adopted by the National Assembly of the S.R. Vietnam on 27th Dec. 1993;
 - The Government Decree 175/CP of 18 Oct. 1994 on the guidance for implementing LEP.
 - + Relevant legal instruments relating to EIA requirement issued by MOSTE;
 - + TCVNs issued by the State of Vietnam, for instance TCVN-1995.
 - Technical data and references for EIA report setting up:
 - + Publications;
 - + Survey and inventory documents;
 - + Other references;
3. EIA Methods:

In this section, relevant EIA methods will be listed.
4. EIA organization and schedule
 - List of EIA investigation partners including institutions and individual practitioners;
 - EIA activity schedule.

II. PRELIMINARY DESCRIPTION OF THE PROJECT

1. Description of the project:

- Project title:
 - Proponent: name of employer(s) or agencies(s) who have developed economic-technical feasibility studies or other equivalent project documents.
 - Proposed project site(s);
 - Socio-economic goals/ objectives and political significance of the project;
 - Basic activities and specific sector of the project;
 - Socio-economic benefits are expected from the project;
 - Forms of capital investment by the project;
 - Estimated activity schedule of the project;
 - Estimated budgets and financial costs for the project
2. Preliminary description of the project technology(s) and equipment
- Technologies and equipment for exploitation;
 - Technologies and equipment for processing.
3. Preliminary description of environmental technologies and equipment intended to be applied.

III. CURRENT STATE OF THE ENVIRONMENT AT THE PROPOSED PROJECT AREA

General description of natural geographic, socio-economic conditions at the proposed project sites.

Prediction of changes in conditions without the project.

Table 7.1 Environmental Parameters and Natural Resources need to assessed for the transportation project(s)

No.	Environment and Natural Resources	Parameters	Survey and Monitoring Methods
(1)	(2)	(3)	(4)
I. NATURAL CONDITIONS			
1.1	Geographic location	Place name, geo-references and geographic conditions of project site. Administrative position and transportation	Project document of National Atlas
1.2	Topographic and Geomorphologic	Describe topographic features of project site in	Project documents of Geographic and geologic

	features	detail (mountains, hill, plain, etc.)	documents related to project site
1.3	Climatic, meteoric, hydrological features	<ul style="list-style-type: none"> Temperature Rainfall, moisture Wind regimes Abnormal phenomena of weather stream, lagoon, lake ation, flow-regime). 	Documents from regional meteoric, hydrological stations and monitoring data in the field.
II. SOCIO-ECONOMIC CONDITIONS			
2.1	Population-Labor	Pay attention to state of income of population, who live in project site and in the impacted areas of project.	Statistical data of region and survey documents and questionnaire information.
2.2	Economics	Project development in relation to Economic Development Planning for region, province.	
2.3	Social Situation	<ul style="list-style-type: none"> Health services and health of communities Respiratory diseases (particularly silicate disease) Education system and educational situation. Employment and Unemployment. 	Like as 2.2
2.4	Culture, history	<ul style="list-style-type: none"> Valued cultural, historical works and tourist sites located in implement area of project or in adjacent areas will be impacted by project. Fine custom, customs and habits of native population can affect implementation of project. 	
III. NATURAL RESOURCES			
3.1	Land resource	<ul style="list-style-type: none"> Total natural area and quality of land State of land use (for agriculture, forestry, special use, domestic, other purposes, unused land). 	Like 2.2
3.2	Surface water resource	<ul style="list-style-type: none"> Features of hydrological system in location (river, lake, canal, ditch) State of surface water resource use in location. 	- Collect information and data from the basic surveys in location and supplementary surveys.
3.3	Groundwater resource (and mineral water)	Geologic and hydrological features of location (aquifer, reserve, and ground water quality).	

		State of exploitation and use	
3.4	Fauna and flora resources	Data on vegetation and fauna, flora in project site. Particularly focus on endemic species of region of species are listed in the Red Book	
IV. INFRASTRUCTURE AND SERVICES			
4.1	Transportation	Characteristics of transport route (waterway or roadway) in relation to transport activities of project Traffic accident and break-down.	Documents of authorities and local administrative agencies.
4.2	Service	State and capability of service supply and trade	
V. STATE OF PHYSICAL ENVIRONMENT			
5.1	Land quality	Organic content Total Nitrogen Total Phosphorus PH value Heavy metals Pesticide Residues	Mohrau Titration Method after oxidization with Kali Potassium Bicromat. Kjeldahl nitrogen method Photometric method PH meter Atomic absorption spectrometry Gas chromatographic method
5.2	Surface, ground water quality	Temperature PH value Suspended matter content Turbidity Electrical conductivity Total mineralization Dissolved Oxygen (DO) Biochemical Oxygen Demand (BOD5) Chemical Oxygen Demand (COD) Ammonium (NH ₄ ⁺) Nitrate (NO ₃)	Thermometer PH meter with glass electrode Filtration, dry at 105 ⁰ C Turbidity meter Electrical conductivity meter Mineralization meter Winkler method or oxygenous electrode. Consumed oxygen after 5 days at 20 ⁰ C Oxidization by K ₂ Cr ₂ O ₇ Nessler/ Colorimetric (photometric)

		Nitrite (NO_2) Phosphate (PO_4^{3-}) Total Iron (Fe) Heavy metals (Pb, Fe, etc.) Pesticides (total organic Cl) Oil content	Cadmium decline method. Diazotization/ Colourimetric (photometric) Hydrogenation till Ortho-phosphate, Colourimetry (photometric method) Colourimetry of Variable Spectrometry Atomic absorption spectrometry Gas chromatographic method
		Total coliform	Gas chromatographic method under TCVN 5070-1995. Filtration through filter and seeding at 43°C
5.3	Air quality	CO SO ₂	Gas chromatographic method under TCVN 5972-1995 or Folin-Ciocalteu Test Tetracloromercurat method (TCM/pararosanilin) under TCVN 5971-1995.
		NO ₂ HC Lead vapor and dust (Pb) Total suspended particles (TSP) Suspended particle has diameter under $10\mu\text{m}$	Griss-Saltman Method under ISO 6768/1995 Gas chromatographic method Atomic absorption spectrometry, under ISO-1855/1993. Weigh method, under TCVN 5067-1995 PM10 meter
5.4	Noise	L ₅₀ L _{eq} -L _{max}	Noise level equivalent to integrate meter Like above Like above
5.5	Vibrations	Accelerate Velocity Frequency	Vibration meter Like above Like above

IV. ENVIRONMENTAL IMPACT PREDICTION AND ASSESSMENT OF THE PROJECT

- Description of potential environmental impacts of the project on the proposed project area:

In this section, scope, magnitudes, nature, changes of possible impacts by the time as described in Chapter 4 of this guidelines must be included and compared with scenario without the project.

- Assessment of possible changes in the environmental quality during the implementation of the project:
 - Analysis of environmental changes correspondent to each alternatives proposed for the project;
 - Prediction of possible damages to the environment and natural resources according to each alternative; description of remediation options;
 - Comparison of Loss/Gain and Benefits/Damages in terms of socio-economic and environmental aspects according to each alternative proposed.
- General Assessment:

General assessment should be given to the reliability of each prediction as assessment of environmental impacts. Further surveys and measurements should be conducted in order to make necessary adjustments or modifications to future EIA investigations.
- Recommendations and Project Implementation Alternatives
 - Recommendations should be made in the selection of the project implementation options in favor of environmental protection;
 - Recommendations on environmental protection measures should be includes with selected alternatives of the project implementation;

IV.1 ASSESSMENT PRINCIPLES

- a. Identification of environmental impacts of the transportation project shall be conducted according to three stages of the project implementation:
 - selection of routes and site preparation;
 - construction of the project; and
 - operation of the project.
- b. Evaluation of environmental protection options selected by the project during feasibility design stage must be carried out to timely adjust, improve or supplement new appropriate options with the goal of meeting environmental protection standards. If necessary, changes in partly or fully the feasibility design option of the project can be made.

IV.2 POTENTIAL SOURCES OF ENVIRONMENTAL POLLUTION AND DEGRADATION

In response to the said requirements for EIA of the project, affected areas of the project must first be screened. For the transportation projects including roads and railways, the affected area is usually along proposed routes with the width of 50 to 100 meters depending on the grades of routes. However, for the purpose of environmental, socio-economic assessments, a scope of investigation may be larger.

Table IV.1 generalizes potential sources of environmental pollution and degradation experienced in the assessment of the transportation project.

Table IV.1 Potential contributors of the transportation project to environmental pollution.

No.	Project Activities	Contributors to environmental degradation
1	Routing and site preparation	<ul style="list-style-type: none"> - Change in land use; - Resettlement; - Forest degradation and biodiversity decline - Alteration of surface hydrological regime
2	Road construction	<ul style="list-style-type: none"> - Dust, toxic gases (CO, SO₂, NO₂, C_nH_m, lead gas), noise level; - Solid wastes; - Waste water containing oil, grease, SS; - Domestic wastes from workers; - Narrowing of river flows, river bank erosion, river water pollution, noise levels, vibration

3	Operation	<ul style="list-style-type: none"> - Dusts, noise levels; toxic gases (CO, SO₂, NO₂, C_nH_m, Lead gas); - Increased traffic and increased circulation
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IV.3 EIA OF ROUTING AND SITE PREPARATION PHASE

Options for routing and site preparation of roads and railways will have very significant and long-term implications to the environment, natural resources and socio-economic conditions. Different impacts would be caused by different routings over different areas. Environmental impacts of routing and site preparation include alternation of hydraulic regimes of surface and ground water resources, increased erosion and sedimentation, land deterioration, surface water contamination, losses of vegetation and natural habitats of wild animals, increased accesses to forest resources; possible adverse impacts on historical, cultural heritage and scenery; disturbance of local communities if routing passing through villages, communes, residential areas, farming fields, and especially through remote rural areas where ethnic minorities live.

IV.3.1 Hydraulic regimes

Road and railway projects that would run through larger regions could cut cross-rivers, streams, farming fields, and wetlands, etc. Such projects are likely to cause flow diversion leading to inundation or aridity in two sides of the roads; particularly obstruction of natural run-offs in rainy season causing changes in surface water hydraulics and in water penetration in soil leading to state of round water environment. These potential impacts need to be carefully assessed.

IV.3.2 Soil erosion and sedimentation

Soil erosion and sedimentation impacts and workloads of excavation are dependent on options of routing.

Key impacts of land are associated with soil excavation and erosion. Soil excavation would cause impacts on agricultural and forestry productions and landscapes. Soil erosion would cause sedimentation of rivers, channels and sewerage leading to interim inundation and floods and surface water quality degradation and adverse impacts on aquatic ecosystems. Soil erosion by heavy rains are likely to cause landslides, subsidence and cracks.

Routing on hillside areas is likely to cause landslides and subsidence and particularly in rainy season, strong soil erosion occurred leading to traffic accidents, destruction of land environment and subsequently sedimentation and pollution of surface water bodies.

It is therefore needed to accurately assess impact levels of soil excavation and erosion on valuable natural resources, aquatic and terrestrial ecosystems and adjacent projects and works.

IV.3.3 Impacts on biological resources

Routing and site preparation would have significant and long term impacts on regional biological resources in areas that roads and/ or railways may run through. These potential impacts need to be carefully assessed.

a. Aquatic biota:

Species of fish in particular and aquatic ecosystems in general are likely to be effected by:

- soil erosion and sedimentation caused by site preparation, construction and operations;
- spills of gasoline and oil by motor vehicles;
- spills and leak of hazardous transports; and
- alternation of hydrological regimes in a given water body.

b. Forest Resources

Direct of indirect potential impacts caused by the transport project on forest resources include:

- Disturbance of the integrity and homogeneity of forest ecosystems by land occupation and separation for road construction;
- Forest clearance for paving the ways and/or traffic safety corridors which would facilitate local dwellers' access to forests leading to increased deforestation (such as lashes and burns, logging for fuel wood, and agricultural expansion;
- Forests would be likely to be destroyed due to the established transport routes, which would be accompanied with the establishment of residential, commercial and industrial areas adjacent to the forest.

c. Wild Fauna

Like forests, species of wild fauna will be affected by the transport projects. Similarly, increased access to rare and endangered species of wild fauna will be caused by the transport project through (mainly hunting) and disturbance of natural habitats. Species of wild fauna and flora will be isolated if routing is taken place through forests and mountains causing to losses of breeding and feed sources and their migratory roads leading to decline of wild animal population and loss of biodiversity resources.

IV.3.4 Assessment of impacts of routing and site preparation on use values in the project area.

a. Navigation traffics

Road and/or railways projects may cause obstruction to navigation traffics if routing through rivers, channels, lagoons and straits. It is necessary to check the clearance of bridges in order to make sure no obstruction to the navigation traffics.

b. Land use

Local land use may be changed due to the implementation of the transport project, for example, conversion of forestry land to agricultural land, or agricultural land is converted to urban and industrial uses. Therefore, regional land use of the project must be described in EIA report, including:

- Current land use of agricultural land, agricultural ecosystems; irrigation systems, products and productivity;
- Current industrial production and projections of future industrialization and urbanization driven by the project.;
- Current mineral exploitation and future exploitation triggered by the project.

These environmental impacts of changes in land use and socio-economic conditions must be assessed and respective options for environmental protection should be proposed.

IV.3.5 Impacts of the project on values of human life quality

a. Economic and socio-values

The transport project may bring in benefits by industrial development, increased services including hotels, restaurants, shops and circulation of commodities and other economic services. Contrary, these potential developments would cause increased generation of waste volumes to the environment. The transport project may increase values of land use and may accelerate urbanization in adjacent areas leading to newly established markets and residential areas along the roads. Separation of expressways from residential and market areas are needed. Physical impacts of the project on road side residential areas are significant particularly noise and vibration pollution, which are likely to cause adverse impacts on community health. These potential impacts must be described in details and carefully assessed in order to develop respective mitigation measures.

b. Land clearance for the project

Land clearance for the project implementation is complex and likely to impose physical, socio-economic impacts on local communities. Land clearance includes relocation of housings, residential areas, schools, hospitals, shops, markets, graves, historical-cultural heritage sites, existing electric systems, water supply and drainage and sewerage systems, and communication systems, etc. within the traffic safety

corridors. Land clearance for the project would be accompanied with resettlement, and new construction works for compensation. Land clearance would cause significant damages for affected people including costs of relocation and resettlement and even their long-term livelihoods in new settlement areas.

Sufficient inventories of housings and projects to be relocated (including scale, sizes, nature and values) must be conducted together with EIA of the resettlement and moving. Socio-economic policies and measures on land clearance proposed by the project must be described in the EIA report.

c. Community Health

Noise, vibration and air pollution of the transport project are key impacts on the community health, particularly on residential areas adjacent to the project site and along the future roads. Noise and vibration levels may be characterized by daily maximum noise and vibration average level (day and night time). Other health impacts include leaks and spills of hazardous substances and materials during transportation or traffic accidents. Special attention should be given to assessment of the potential impacts on “sensitive” environments such as hospitals, schools etc. Current state of community health must be described, and respective recommendations should be made to protect community health and prevent traffic accidents.

IV.3.6 Aesthetics and landscapes

Aesthetics and landscapes may be impacted by the transport project, particularly its activities including excavation. Aesthetics and landscapes must be protected particularly when the project is implemented through hills and mountains. Along the future routes, aesthetics and landscapes may be improved by artificial works such as bridges over rivers and streams. Beautiful landscapes must be preserved by alternatives including fly roads or even tunnels instead of excavations.

IV.3.7 Historical and archaeological sites

Historical and archaeological impacts by the project must be described and assessed and issues to be assessed including locations, kind of works, dynastic years, and spiritual and material values of the works, even minor impacts as cracks or subsidence.

Preservation plans and measures for these historical and archaeological heritage must be recommended. They may include alternative routing to avoid them, in cases that no alternatives available, replacement of these heritage must be subject to permit issued by the Ministry of Culture and Information and the agreement of local communities.

IV.4 EIA IN CONSTRUCTION PHASE

IV.4.1 Land environment is disturbed by excavations

In flatland and particularly in floodplains where a huge volume of earth, sand and rock and gravel required. On the contrary, in hill and mountainous areas where leveling of hills is sometime required. Huge volume of broken stone is required to construct a railway. Earth excavation and quarrying for road construction would cause potentially negative impacts on the local land environment leading losses of vegetation, forest and agricultural lands and particularly causing landslides and settlement and subsidence, sedimentation, water pollution, potential impacts on local ecosystems and local socio-economic conditions.

In cases that such raw material supplies are exploited from other areas. A separated EIA report on raw material exploitation should be required.

IV.4.2 Impacts on water environment

During construction phase of the transport project, run-offs may cause soil erosion particularly in excavated areas leading to sedimentation of flows and water pollution as well as reduction in surface water quality. Additionally, storm water or run-offs may wash off pollutants and domestic wastewater from construction site into receiving bodies. Those surfaces water bodies are likely to be polluted by spills or leak of oil, gasoline and liquid materials from transport by motor vehicles. These potential impacts may cause a decline in aquatic animal and plant populations and reduction in benefits to water uses for domestic, industrial, agricultural, fishery and other purposes.

Apart from the said analysis, this section must contain quantitative calculations of:

- Total volume of domestic wastewater, storm water by time and by rainfalls;
- Compositions, concentrations and loads of pollutants in each category of wastewater;
- Location and capacity of receiving bodies;
- Assessment of possibility of pollutant dispersion on water environment.

IV.4.3 Impacts Air environment

During the construction phase, there are two major sources of air pollution such as mobile sources including motor vehicles transporting material (earth, rocks, cement, steels etc.) and fixed sources including construction machinery (air compressors, excavators, hammers, rollers, fresh concrete and asphalt mixers). Dust is a major pollutant and other gases exhausted from vehicles and construction machinery. Toxic gases from vehicles include NO_x , CO , SO_2 , Hydrocarbons (H_mC_n) and lead gas. Concentrations of these gases in the air need to be determined and assessed according to daily mean value and hourly maximum value. Special attention should be given to potential air environmental impacts of construction activities of the transport projects on “sensitive” environments along the route, such as schools and hospitals, resorts and residential areas.

Following contents should be clarified in this section.

- dust and toxic gas generation sources;
- compositions, concentration and loads of air pollutants;
- Computation of dust and toxic gas dispersion (models: Sutton, Gausse, Screen 3, IGM).

IV.4.4 Vibration and Noise pollution during the construction phase

Assessment of noise impacts caused by the construction phase of the transport project is indispensable. During the construction phase, there are several potential sources of noise generation: operations of vehicles, air compressors, excavators, concrete mixers and even explosion, etc. These sources and noise levels need to be inventoried and assessed. It is necessary to define operational schedules by these sources through for example ban on operation of the potential noise level sources at nighttime. Due attention must be paid to distances between noise generation sources (air compressors, concrete mixing stations) and “sensitive” receptors (schools, hospitals, residential areas, prohibited forests and wildlife conservation areas, etc.).

Significant vibration generation source during the construction phase is hammering machines. Such vibration levels may damage adjacent projects and works.

It is therefore, necessary to determine:

- Noise generation sources and noise intensity;
- Computation of noise transmission within the area;

(For example, noise level prediction of transport means: the noise level of a vehicle is dependent on average level of noise energy generation and on specific vehicle type. Noise level of a traffic flow is equal to noise level of a typical vehicle plus additional factor of the noise level of traffic flow.

Additional factor of traffic flow is dependent on a number of vehicles passing in one hour (N_i), typical distance from traffic flow to measuring point at roadside, with the height of between 1.5-2m ($D_o=7.5m$, a noise level is defined by a formula:

$$10 \log (N_i D_o) / (S_i \cdot T) \quad (5.2)$$

Reduction in noise level according an actual distance from (D) source, is defined as follow:

$$\text{- For road source: } \Delta L = 10 \log (D_o / D)^{1+a} \quad (5.3)$$

$$\text{- For point source: } \Delta L = 20 \log (D_o / D)^{1+a} \quad (5.4)$$

Where (a) is terrain factor

a=0 for flat and non obstacle terrain;

a=0.1 for grass surface;

a= -0.1 for concrete or asphalt surface.

IV.4.5 Environmental impacts of worker's camps

Camps at project site are provisional accommodation of the workers and therefore are potential sources generating environmental pollution by domestic waste water, fresh night soil, solid waste; logging that may be occurred for fuel wood; and social crimes and communicable disease that are likely to be broken out.

IV.4.6 Solid wastes

Solid wastes mainly contain rocks and earth, building materials, cement, steel scraps, etc. and the volumes depend on typical works and the managerial qualification of the project management. To assess impact level of solid wastes, it is necessary to define:

- Total volume and compositions of solid wastes generated from construction;
- Total volume and compositions of solid wastes generated from domestic sources.

IV.5 EIA IN THE OPERATION PHASE

IV.5.1 Noise and vibration pollution during the operation phase

Noise pollution is a potential impact to be caused during the operation phase of a transport project. Noise pollution is dependent on individual vehicles, traffics, velocity, quality of roads, terrain, architecture works along the road, and distance between road and "sensitive" receptors. These impacts need to be predicted and carefully assessed in order to develop control and mitigation measures as well as monitoring programs during the operation phase.

Variation of vibration level is characterized by three quantities: amplitude (m), velocity (m/s) and accelerator (m/s^2). Vibration levels caused by transport means not only associate with the nature of traffic flow, but also depend on the characteristics of road foundation and adjacent areas. It is necessary to monitor vibration levels caused by transport means and establish a modeling for future prediction, and propose measures to mitigate vibration levels for "sensitive" receptors such as community health and historical heritage sites, etc.

Major sources of vibration during the operation phase is heavier trucks. Vibration level caused by train is many times higher than automobiles. Vibration impacts on human health are similar to noise impacts and therefore it is necessary to assess vibration impacts on residential area, hospitals, schools, etc.

IV.5.2 Air Environmental Impacts

Dust and toxic gases such as SO₂, NO₂, CO, CO₂ are generated from gasoline combusted automobiles and coal/diesel burned locomotives. But lead contained dust and gas are also released by motor vehicles. Dusts are generated from motor vehicles much higher than trains as additional dusts generated by friction between road surface and tires. Due attention must be given to prediction and assessment of air environmental impacts caused by transport means to “sensitive” receptors such as schools and hospitals, and residential areas., etc.

- Sources of generating dusts and toxic gases;
- Compositions, concentrations and loads of air pollutants;
- Computation of dust and toxic gas dispersion (by models Suttong, Gausse, Screen3, IGM).

IV.5.3 Impacts on land and water environments along the roads

Land and water contamination along the roads can be attributed to run-offs, which washes out gasoline, grease and hazardous substances spilled during transportation.

Land and water environments contaminated by gasoline, oil and grease and lead dusts impose adverse effects on aquatic organisms, plants and vegetable grown along the roads. Lead contaminated fish and/or vegetables are dangerous for human health. Therefore, it is necessary to assess:

- Total volume of storm water run-off by time and after rains with maximum rainfall day;
- Compositions and concentrations and loads of pollutants in run-offs;
- Location and capacity of receiving effluents by the area.
- Assessment of possibility of dispersion of pollutants and contamination levels to land and water environments.

IV.5.4 Pollution by Solid wastes from transport means

Pollution by solid wastes from transport means is mainly caused by passengers through throwing away empty can, bottles, packages, waste foods, and other wastes, etc.

IV.5.5 Traffic Accidents

Transport accidents usually cause serious damages for human beings and well-beings.

Traffic accidents used to be occurred at narrow, slope, curve sections and crossing sections, and particularly in roads that operation of combined transport means (motor vehicles with bikes and pedestrians) are allowable.

V. NEGATIVE IMPACT MITIGATION MEASURES OF THE PROJECT ON THE ENVIRONMENT

All the proposed negative environmental mitigation measures including technological-engineering, institutional and executing ones must be included in this section.

Comparison of costs incurred and benefits gained for each respective alternative.

Proposed mitigation measures must ensure following principles:

- Mitigation measures must be appropriate to the project scales and available financial sources;
- Environmental protection measures must be taken through all the stages of the project, from preparatory, construction and operation phases.
- Appropriate options should be developed to cope with unrecoverable environmental impacts.

Following are suggestions for mitigation measures to be considered:

V.1 Negative impact mitigation measures for routing and site preparation

- Routing must not convert flows of run-offs and alter the existing irrigation systems in the areas. Size of bridges must be designed to avoid narrowing river and stream flows. Sewer size and layouts must be adequate to facilitate drainage and hydrological balances between the two sides of the road;
- Routing must avoid densely construction works, densely inhabited and commercial and service areas, especially in areas where ethnic minorities reside;
- Routing must consider minimizing works of excavation, vegetation clearance, and re-planting of trees and re-vegetation in damaged areas, and measures of adjustment of flows and velocity to avoid soil erosion. Measures on stabilizing upper slopes by technical options such as concrete laid or geo-textile covered or improved drainage systems, must be developed in order to minimize soil erosion;
- Resettlement action plans must be developed in order to ensure affected people who will be provided with housings and other essential conditions for their life stability and livelihoods as in the displaced. Relevant compensation must be paid to all the damages to their land, housing, gardens and subsidies must be provided for affected people for their changes in lifestyles and new employment in long run.

- Mitigation measures for biological resources may be:
 - Routing must avoid forests, particularly areas adjacent to conserved forests;
 - Routing must avoid high “sensitive” areas for wild fauna and flora;
 - Exploitation of building materials are prohibited in wetlands and/or high sensitive forests;
 - In cases that routing through forests or areas adjacent to forests, is unavoidable, forest protection measures including buffer zones, or separate walls, parking and honking bans, and speed limits, should be developed;
 - Wildlife trails through forests must be preserved.

V.2 Negative impact mitigation measures for the construction phase

- Mitigation measures of negative impacts on land environment:
 - Agricultural and forest lands must be preserved from exploitation of earth and sand;
 - Areas adjacent to dikes and riversides are protected from exploitation of earth and sand;
 - Prior to exploitation of earth and sand, top surface soils must be preserved in order to use for filling up after decommissioned exploitation; in cases that excavation is required, deep holes must be used for aquacultural development;
 - Measures on soil erosion and sedimentation controls have been described in item 5.2.2.
- Mitigation Measures of negative impacts on water environment
 - Flow narrowing and conversion must be avoided, and navigation clearance must be ensured;
 - Measures on soil erosion control as described in item 5.2.2 must be applied;
 - Drainage system must be designed during the construction phase, and domestic wastewater drainage systems must not discharge into water bodies which are used for water supplies for domestic and industrial purposes;
 - Hazardous substance storage must be kept far from water supply sources;
 - Oil and hazardous substance spills must be prevented and managed;
- Mitigation measures of impacts on air environment (toxic gases and noise levels):

- Dust is minimized by watering on the ground;
- Obsolete vehicles must not be used and over-loaded transportation is avoided;
- Leaks or spills of liquid materials and fuels must be prevented and minimized;
- Fresh concrete and asphalt mixing stations must not be located near residential areas, schools and hospitals;
- Operation of excavators, hammering machines, bulldozers, heavy trucks and explosion, must be prohibited at night;
- Walls and trenches must be built to separate hammering areas in order to prevent any settlement or crack of architectural works nearby.
- Impact mitigation measures of the workers' camps
 - Local available manpower should be used and accommodation at inns or hotels nearby in order to reduce the size of camps;
 - Sanitary facilities including latrines, bathrooms, solid waste disposal sites must be adequately provided;
 - Cooking fuels must be sufficiently provided for construction workers;
 - Living rules in the camps must be developed to manage workers in out service time.

V.3 Negative impact mitigation measures during the operational phase

- Noise and vibration pollution mitigation measures
 - Architectural works are not allowed to build up in traffic safety corridors;
 - Noise level control and monitoring of the traffics must be conducted according to TCVNs;
 - Traffic speed control and honking must be banned at road sections passing by noise and vibration sensitive areas;
 - If necessary, sound break walls must be built up;
 - Tree belts must be grown along the roads.
- Mitigation measures of air environmental impacts:
 - Vehicle emissions must be monitored and controlled according to TCVNs;
 - Tree belts must be grown along the roads;

- Buffer zones must be developed in a suitable distance between architectural works and roads;
- Road surface clean up and watering must be conducted.
- Mitigation measures of impacts on land and water environments
 - Non-lead gasoline is used;
 - Oil and gasoline spills and leaks must be prevented;
 - Spills or leaks of hazardous substances during transportation must be prevented by enhancing transport safety of these liquid substances.
- Solid waste management measures
 - Sanitary facilities should be adequately provided at vehicle garages, parking areas and transfer station;
 - Garbage baskets should be arranged in long distance transport means;
 - Regular collection of garbage at parking areas, service sections and garages must be conducted.
- Traffic accident presentation and remediation measures
 - Traffic safety measures at areas where accidents are likely to be occurred, must be monitored and checked on the regular basis;
 - Traffic lanes and separators should be arranged;
 - Traffic congestion must be minimized by fly roads or tunnels;
 - Traffic signaling systems must be installed.

VI. FOLLOW-UP ENVIRONMENTAL MONITORING AND MANAGEMENT

The recommendations must ensure following principles:

- *Environmental management proposals must be specific and appropriate to available managerial and institutional levels of units;*
- *Proposals on environmental monitoring must focus on potentially affected environmental components by the project;*
- *It is noted that all costs incurred in the implementation of these said activities must be borne by the proponents and because of that, in this section, cost estimation for these proposed measures to be taken must be included in the report.*

VI.1 Environmental management programs

In this section, following issues should be given priority in the environmental management activities proposed for the environmental protection by the project:

- Institutional arrangement and manpower for environment management;
- Environmental management and protection plans must be developed for respective phases of site preparation, construction and operation;
- Environmental awareness promotion, education and training programmes.

VI.2 Environmental monitoring programs

Environmental monitoring and pollution control must be organized in a continuous manner through the operation phase. The environmental monitoring and pollution control programme must clarify:

- Target parameters to be monitored and controlled;
- Monitoring frequency and duration;
- Monitoring equipment procurement;
- Monitoring manpower;
- Monitoring funding.

Locations of monitoring and/or sampling points should be marked on relevant maps with accuracy and sampling values must be updated and stored.

VI.2.1 Target Parameter and Environmental Components must be controlled during the construction phase.

During the construction phase, the proponent of the transport project must regularly monitor environmental quality focusing on following issues:

- Protection and maintenance of all flows of irrigation, water supply and drainage system;
- Measures on landslide, soil erosion and sedimentation control during the construction phase;
- Maximum protection of existing vegetation and forests;
- Preservation of historical-cultural, religious heritage, graves and scenery along the road;
- Waste control of fresh concrete and asphalt mixing stations;
- Pollution control of quarrying and earth excavation areas;

- Air emission control of CO, NO₂ and SO₂, Oil and gasoline vapor, lead contained dust and gas at construction sites;
- Noise and vibration pollution control particularly in hammering areas to ensure no disturbance by noise level at night time;
- Monitoring and check of environmental remediation and recovery along the roads and at two ends of the bridges and decommissioned quarrying and earth exploitation areas;
- Monitoring of replanting grass vegetation and trees along the roads.

VI.2.2 Environmental monitoring during the operation phase

During the operation phase, particularly at the initial operation of the roads, regular environmental monitoring must be conducted.

The environmental monitoring activities include monitoring of physical environment in order to monitor ambient environmental degradation compared to permissible levels and the effectiveness of environmental protection measures. Key physical environmental parameters monitored include:

- Noise and vibration pollution;
- Air pollutants (dust, CO, NO₂, SO₂, gasoline gas and lead gas);
- Surface water pollution in areas where bridges or ferry labors are located;
- Floods in rainy season;
- Soil erosion and sedimentation in rainy season.

a. Environmental monitoring duration and frequency

Environmental monitoring must be conducted according to established monitoring frequencies and duration throughout the implementation of the transport project. The environmental quality monitoring programs must be specifically developed and the monitoring frequency is usually a sampling campaign every three months for the first operational year and every six months for subsequent operational years.

b. Estimated costs for environmental quality monitoring programme

It is necessary to persevere funding for environmental monitoring programme. Therefore in this section, relevant costs must be estimated in details adequately for respectively specific activities of the programme.

VII. CONCLUSIONS AND RECOMMENDATIONS

- + Brief conclusions of possible environmental impacts of the project;

- Analysis and determination of environmental benefits or positive impacts of the project;
- + Recommendations are made to the stated management agencies(s) of environmental protection for the implementation of proposed environmental protection measures;
- + Commitments are stated by the proponent in the undertaking of environmental protection measures prior to the project implementation.

VIII. LIST OF REFERENCES

References for setting up the EIA report must be listed in the alphabetic order.

IX. ANNEXES ATTACHED TO THE EIA REPORT

1. Documents and data of field surveys and measurements and values from analytical and computation processes;
2. Relevant legal documents relating the project (Decision on the approval of Economic-technical feasibility studies of reports); Decisions on technical design and budget allocation; Investment license; Permits relating to land use or tenure; permits relating to mining and other resource utilization, etc.);
3. Photographs of the proposed project areas; photographs of proposed project sites; and photographs of natural resource investigation activities.

TA No. 4050-VIE

**KUNMING – HAIPHONG TRANSPORT CORRIDOR PROJECT
UPGRADING HANOI – LAO CAI RAILWAY**

Feasibility Study and Preliminary Design

DRAFT FINAL REPORT

Technical Appendix B.2

SUMMARY INTITIAL ENVIRONMENTAL EXAMINATION

July 2006

CURRENCY EQUIVALENTS
(05 MAY 2006)

Currency Unit	–	Vietnamese Dong (VND)
VND 1.00	=	\$ 0.00006272
\$1.00	=	VND 15,950

ABBREVIATIONS

ADB	-	Asian Development Bank
AFD	-	Agence Française de Développement
AP	-	Affected People
BCR	-	Benefit cost ratio
BOD	-	Biological oxygen demand
CAD	-	Computed Aided Design
CARB	-	Compensation and Resettlement Board
COD	-	Chemical oxygen demand
CPC	-	Commune People's Committee
CPI	-	Consumer Price Index
DFR	-	Draft Final Report
DGTPE	-	Direction Générale du Trésor et de la Politique Economique
DMC	-	Developing Country Member (of ADB)
DPC	-	District People's Committee
EA	-	Executing Agency
EIA	-	Environmental Impact Assessment
EIRR	-	Economic internal rate of return
EMP	-	Environmental Monitoring Plan
EMSA	-	Ethnic Minority Special Actions
EPB	-	Environmental Protection Bureau
EPMD	-	Environmental Protection and Management Division
ErPP	-	Erosion Prevention Plan
GDP	-	Gross Domestic Product
GOV	-	Government of Vietnam
GSO	-	General Statistical Office
GTZ	-	Gesellschaft für Technische Zusammenarbeit
IBRD	-	International Bank for Reconstruction and Development (World Bank)
ICB	-	International competitive bidding
IEE	-	Initial Environmental Examination
IoL	-	Inventory of Loss
IP	-	Indigenous People
IPDP	-	Indigenous Peoples' Development Plan
IMO	-	Independent Monitoring Organization
IPSA	-	Initial Poverty and Social Analysis
IRR	-	Internal rate of return
ISA	-	Initial Social Assessment
LURC	-	Land Use Rights Certificate
MOF	-	Ministry of Finance
MONRE	-	Ministry of Natural Resources and Environment
MOSTE	-	Ministry of Science, Technology and Environment
MOT	-	Ministry of Transport
MPI	-	Ministry of Planning and Investment
NGO	-	Non Government Organization
NPV	-	Net present value
OCR	-	Ordinary Capital Resources (of ADB)

ABBREVIATIONS

O-D	-	Origin Destination
ODA	-	Official Development Assistance
OSPF	-	Office of the Special Project Facilitator
PIB	-	Project Information Booklet
PPTA	-	Project Preparatory Technical Assistance
PRC	-	People's Republic of China
PSA	-	Participatory Social Appraisal
RALC	-	(Department of) Resettlement and Land Clearance
RoW	-	Right of way
RP	-	Resettlement Plan
RPI	-	Retail Price Index
RPUC	-	Railway Public Utility Company
RPMU	-	Railway Projects Management Unit
RRP	-	Report and Recommendation of the President (to ADB Board of Directors)
SAP	-	Severely Affected People
SES	-	Socio-Economic Survey
SIEE	-	Summary Initial Environmental Examination
SS	-	Suspended solids
TA	-	Technical Assistance
VOC	-	Vehicle operating costs
VNR	-	Vietnam Railways
vpd	-	Vehicles per day
VRA	-	Vietnam Roads Authority

WEIGHTS AND MEASURES

Metric system

NOTES

1. In this report, "\$" refers to US dollars.

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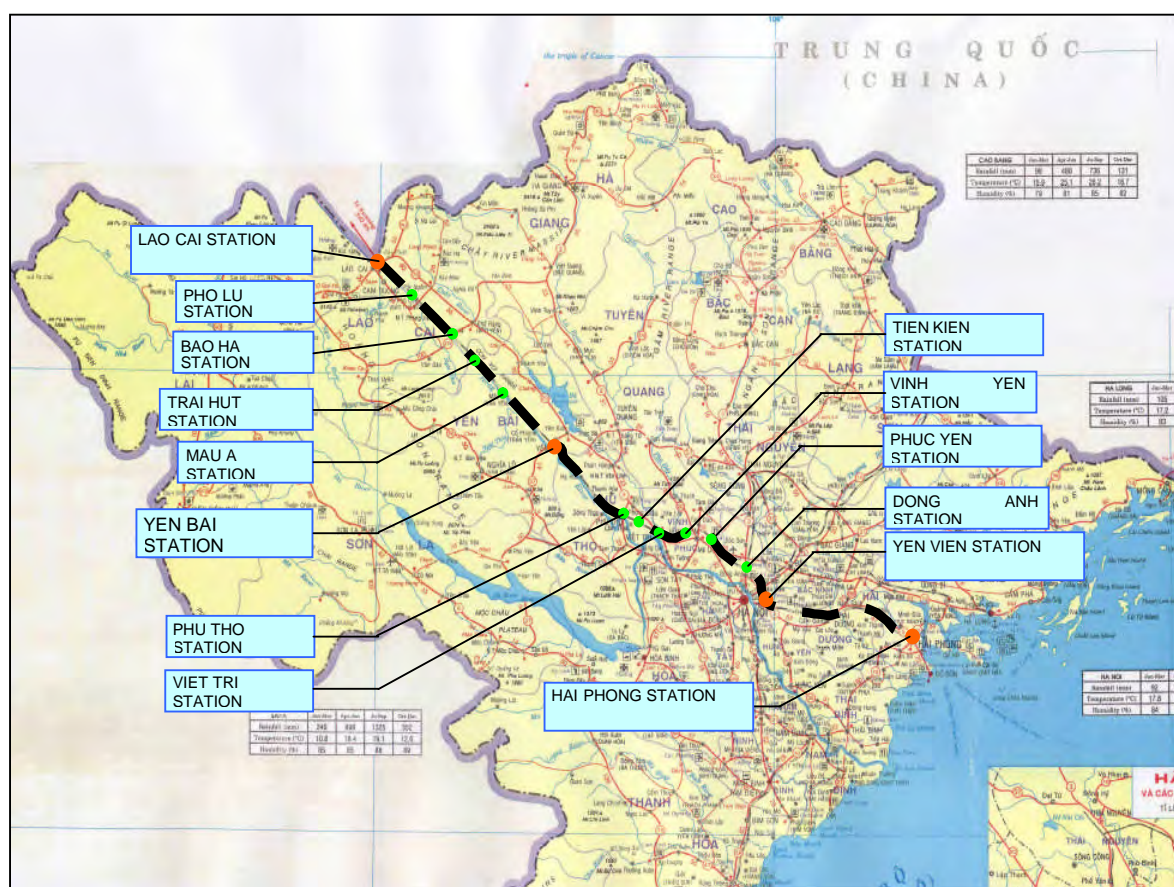
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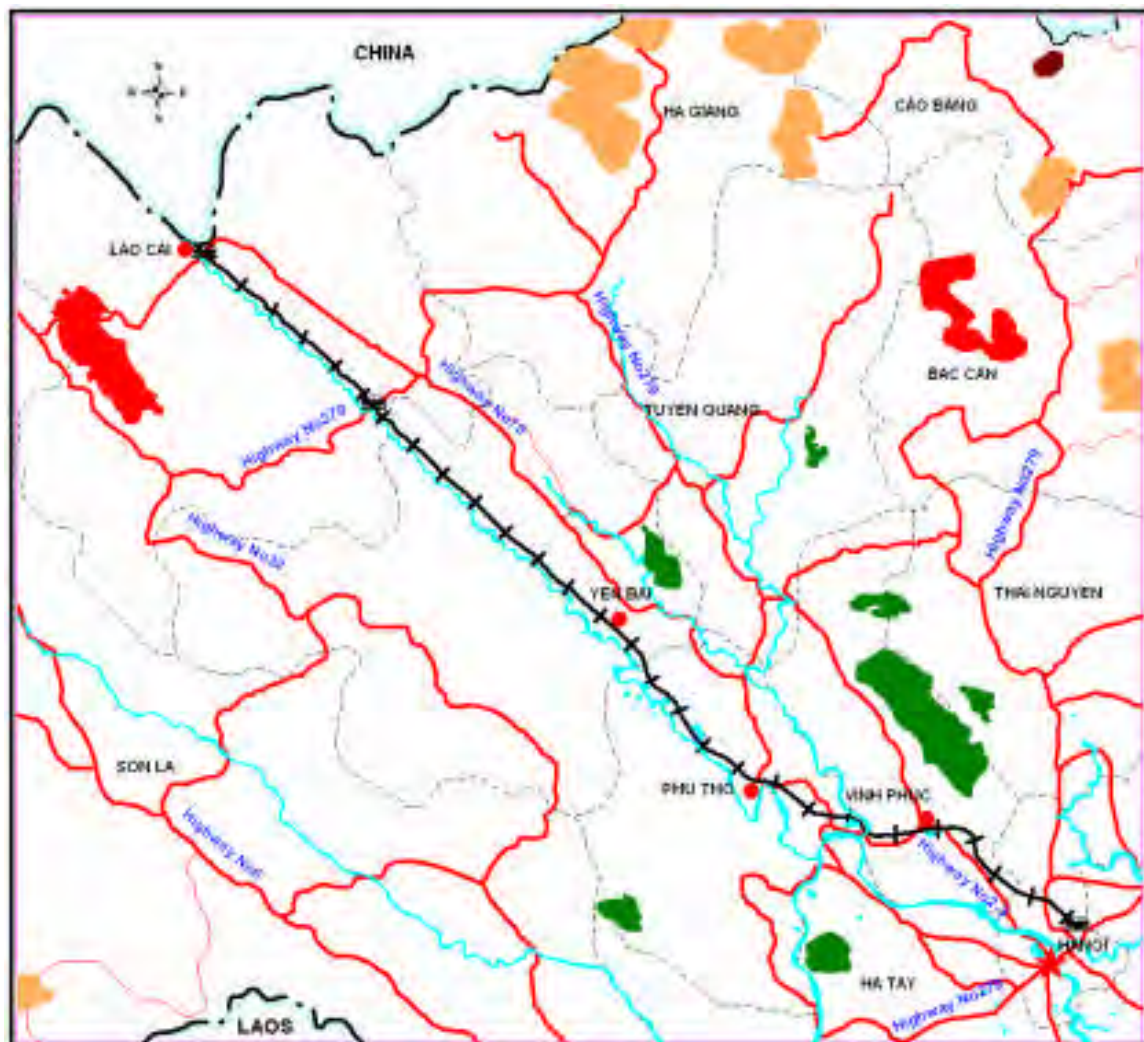
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A	Technical Survey and Prioritization of Interventions
A.1	Operations
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A.5	Topographical Survey
A.6	Geological Survey
B	Environment
B.1	Initial Environmental Examination
B.2	Summary Initial Environmental Examination
C	Resettlement
D	Socio-Economic
D.1	Socio-Economic Survey
D.2	Summary Poverty Reduction & Social Strategy
E	Preliminary Project Design
E.1	Preliminary Design Drawings
E.2	ToR for Design & Supervision
E.3	ToR for Technical Assistance
F	Economic and Financial Analysis
F.1	Economics
F.2	Financial

Map 1: Alignment and Main Stations between Lao Cai and Yen Vien.

Map 2: Land Use, National parks, Natural Reserves and Historical and Cultural Sites**Legend**

The road



The track



Capital, city and town



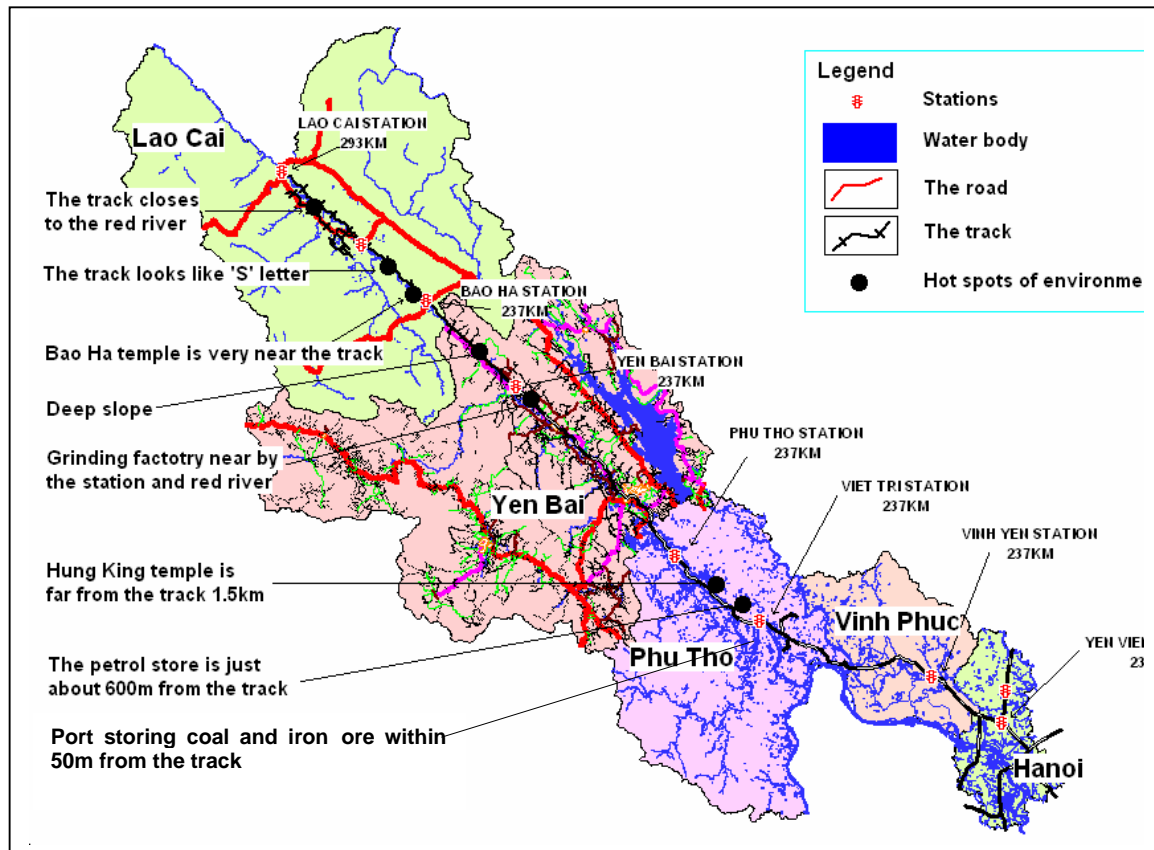
Historic and cultural sites



National park



Natural reserves

Map 3: Environmental Hot Spots along the Track from Yen Vien to Lao Cai

1 INTRODUCTION

This is the summary of 'Initial Environmental Examination' (SIEE) of the Kunming - Hai Phong Transport Corridor Project (Supplementary GMS Hanoi - Lao Cai Railway Upgrading) proposed by Viet Nam Railways (VNR). It presents the environmental benefits, adverse effects, and recommended mitigation and monitoring measures related to construction and operation stages of the project. This SIEE is based on the studies conducted by Wilbur Smith Associates in association with DE-Consult and Vietnam Transport Engineering Consultancy Centre, during April 2006.

The environmental components of the project have been assessed according to ADB's safeguard policy and guidelines 2003. The SIEE is based on (i) inputs derived from pre-feasibility study conducted during December 2003, (ii) discussions with railway experts of the project team and Railway Project Management Unit (RPMU) of Viet Nam Railways, (iii) primary observations and secondary data on various environmental components collected during the reconnaissance survey of 5 kilometers on either side of the alignment by experts and (iv) information collected from potentially affected citizens and local government officials and railway employees at stations along the alignment

2 DESCRIPTION OF THE PROJECT

The rail corridor improvement and upgrading project traverses about 285 km in North Westerly direction from Yen Vien near Hanoi, along the left (northeast) bank of the Red River to Lao Cai on the border with People's Republic of China (PRC) (Map 1). The purpose of the proposed project is to rehabilitate and partially upgrade the railway along its present alignment to increase the capacity of the line from the current 19 pairs to 36 pairs of trains per day, and also increase the speed of passenger trains from the current 45 km/hour to 70 km/hour. The railway line is seen as link between the Western mountainous Provinces, the midland and Delta provinces at the north band of Red River, reaching to Hanoi.

The need for the project is due to: (i) insufficient capacity of the existing railway infrastructure from Lao Cai to Yen Vien to meet the increasing traffic demand up to 2020 and (ii) the existing train operations not considered entirely safe, since the railway line was built at the beginning of 20th century.

The rail improvement and upgrading will include, (i) selective improvement of the horizontal and vertical alignment and track layout, (Yen Bai to Lao Cai); (ii) stabilization of embankments and sliding slopes (at km 200-295); (iii) upgrading by girder replacement and minor works on substructure of 40 bridges and replacement of 6 bridges between Yen Vien to Lao Cai; (iv) improvements to track-work including turnouts (at about 141 locations); (v) improvements to safety at selected at grade level crossings (including a new fly-over road bridge Dong Anh); (vi) constructing a new station of Mai Tung in Phu Tho province; (vii) upgrading of 2 stations (Van Phu and Lao Cai); (viii) extension of passing loops at 8 stations (Viet Tri, Phu Duc, Co Phuc, Mau A, Lam Giang, Thai Van and Xuan Giao) for train loads up to 1200 tons and train length of 400 m with the total extension length of 1,196m; and (ix) additional passing loops at 9 stations (Thach Loi, Huong Canh, Tien Kien, Chi Chu, Vu en, Mai Tung, Van Phu, Mau Dong and Lang Thip).

3 DESCRIPTION OF THE ENVIRONMENT

3.1 PHYSICAL ENVIRONMENT

Climate

There are two meteorological stations located along the alignment. The study area belongs to the North-west and North-east climate zones of Vietnam and has the monsoon tropical climate type with the annual average temperature of 24°C, the hottest month being June and the coldest month being January; annual average rainfall is 121 mm, the highest rainfall being in July and the lowest rainfall being in October; the annual average humidity is 80.2 %, the driest month is October and wettest month is August.

Topography

There is considerable variation along the existing alignment, from broad flat plains from Hanoi to Viet Tri; narrow valleys in the midlands in Vinh Phuc and Phu Tho provinces, denuded low mountains and hills near Yen Bai; typical loose masses, deeply incised slopes, eroded gullies and then high mountainous uplands between Yen Bai and Lao Cai. There are landslides/slips and abandoned quarried sites all along mountainous regions.

Geology

It is not of complex nature except for evidence of folding and prominent faulting in the mountainous regions in the Lao Cai province. Thick layers of sediments have accumulated along the Red River delta between Phu Tho and Yen Bai provinces. The mountainous regions between Yen Bai and Lao Cai exhibit underlying materials of limestone and mudstones.

Water Resources

Ground water resources along the alignment are limited, fairly dispersed and marginally exploited. Its quality is reported to be good and generally within National standards, though affected in the mining areas between Yen Bai to Lao Cai. The surface water along the alignment mainly consists of Red River and its tributaries, many of which have seasonal flow. The Red River is the main river running along the line and in places is within 10m of the track, but the railway never crosses the river anywhere along the entire alignment. The river water is reported polluted near Viet Tri exceeding Standards. It receives a mix of treated, untreated municipal wastewater and wastewaters from nearby Railway stations. No stations along the alignment have wastewater treatment facilities. They either discharge it on the land or into the nearby water streams or the Red River.

Soil Erosion

It is a major environmental issue, especially in the mountainous areas of Yen Bai and Lao Cai provinces with steep slopes without any vegetative cover. These are repeatedly cut by railway construction earthworks and are eroded and become unstable resulting in deep land slips and landslides at various places along the alignment. However in the plains between Hanoi to Yen Bai it is moderate.

Seismic Activity

The alignment between Hanoi to Yen Bai is located in the low seismic zone of 4.0 - 4.9. Two earthquakes of the intensity of $M = 5.4$ of moderate level were reported in the Luc Yen region of Yen Bai province during 1954. There is a seismic station located near Sa Pa recording the seismic activity. However no earthquakes are reported from the vicinity of existing alignment.

Solid Waste

Its management is very poor along the alignment, even in the railway stations with heaps of solid waste seen in and around stations. No identified landfill site or hazardous disposal site are present in the vicinity of the alignment.

Air and Noise Quality

Air quality ranges from poor to moderate in industrial areas and urban locations, near Mau A, Van Phu and Viet Tri exceeding standards, although it is of generally of good quality in the rural and mountainous regions. Open yard storages of coal, ores and ground limestone near stations have resulted in air pollution. Open transportation of ores, cement and ground stone without any cover is the mobile sources of air pollution. There are considerable baseline levels of noise and vibration caused by the movement of freight and passenger trains along the existing alignment.

3.2 ECOLOGICAL ENVIRONMENT

Land Use

According to statistics Office number of General, the land use is not much diversified and is as shown below:

Forestry Land: Yen Bai and Lao Cai are 41.6% and 43.1%; Hanoi and Vinh Phuc- are 7.2% and 22%.

Agricultural Land: Yen Bai and Lao Cai are 10.2% and 11.6%; Hanoi and Vinh Phuc are 45.4% and 48.1%.

There are 26 protected forest area systems in Viet Nam. Out of them, the 2 National parks one each in Vinh Phuc and Hai Phong provinces, and two protected reserves one each in Yen Bai and Phu Tho province, in the alignment region, are more than 5 km away from the existing alignment, as seen in Map 2. There are some industrial areas, near Viet Tri, open storage yards and petrol storage complex in the vicinity of the alignment as seen in Map 3.

Flora and Fauna

They are of normal type and not much biodiversity, with no protected or endangered species of flora or fauna reported in the study area. There are recently grown plantations of bamboo, litchi, eucalyptus, banana, pear, mango etc along the slopes of mountainous between Yen Bai and Lao Cai regions. But for some trees of medium growth within 10 to 20 m of the existing track and few ancient trees located about 30-50 m away from the track, there are no thick forests near the alignment. Terraced tea gardens and rice fields are located in the steep locations. No migrant wild fauna are reported along the study area. There are normal livestock, especially maintained by ethnic minorities in the mountainous regions

Sensitive and Protected Areas

There are no sensitive or protected areas within 5 km on either side of the proposed alignment (Map 2), except for the protected monuments of Bao Ha temple and King's Hung temple complexes along the alignment, which are within 600m and 2000m away from Bao Ha and Tien Kien stations (Map 3).

3.3 SOCIO ECONOMIC ENVIRONMENT

There are dispersed, isolated and self-contained habitations of ethnic minorities (reportedly from Laos, Thai etc.) with their own lifestyle, which is atypical of Vietnamese. The main agricultural products are bamboo, cassava, tea and rice. Most of the provinces especially Yen Bai, Lao Cai, Phu Tho are rich in mineral deposits like iron, limestone, apatite and coal. The well-known 'Sa Pa' tourist location is about 35 km by road from Lao Cai. Because of the scenic nature and cool weather conditions in summer in the region, especially near Lao Cai, some private tourist resorts are under construction.

4 FORECASTING ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Table 4.1: Anticipated Environmental Impacts and Mitigation Measures : Construction Phase

Environmental Parameter/Issue	Anticipated Impacts	Mitigation Measures	Degrees of impact	Implementation agency
Soil	Disposal of excess earthworks	To use for soil embankments	Significant Negative Impact for entire construction period at all construction sites	Contractor with the help of Soil conservation department
	Loss of top soil	Stripping & storing and reuse for rehabilitation works		
	Damage to temporarily acquired land and failure to rehabilitate borrow areas	Appropriate rehabilitation works		
	Soil erosion and siltation	Planting of shrubs and grass, Suitable compaction, placement of geo-synthetics, construction of berms and dikes		
	Contamination by fuel and lubricants	Oil separators at washing areas and installing secondary containment at fuel storage areas		
Water	Improper erosion control and disposal run-off entering the Red River.	Proper embankment, stabilization, seeding with grass.	Major Negative impact, site specific	Contractor with the help of Water resource department and local EPB
	Wash water from workshops	Pass through separator prior to discharge		
	Sanitary wastewater effluent from work camps	Use of septic tanks and primary treatment before discharge to nearby watercourse No direct discharge of untreated waste water to surface water body like Red River		
Air Quality	Particulate dust from construction vehicles and activities	Use of water spray trucks to wet down roads	Minor Negative Impact, site specific	Contractor with the help of local EPB
Noise and Vibration	Impact of noise on residential areas will be noise from, maintenance workshops, construction vehicles, and earthmoving equipment.	Within 200 m of the nearest habitation, construction work such as crushing, concrete mixing and batching, mechanical compaction etc. will be stopped between 2200 and 0600 hours. Plant and equipment used in construction will strictly conform to National noise standards. Equipment	Major Negative Impact for entire construction period at all construction sites.	Contractor with the help of local EPB.

Environmental Parameter/Issue	Anticipated Impacts	Mitigation Measures	Degrees of impact	Implementation agency
		will be properly maintained to minimize noise emissions.		
	Impact from vibration to buildings from heavy earthmoving equipment.	Pneumatic installation of equipment wheels to reduce vibration during movement. Proper lubrication of moving arms equipments to reduce wobbling.		
Solid & Hazardous Waste	Domestic and construction waste from work camps.	Temporary storage and regular disposal of the waste to the identified disposal sites proposed by local EPB officials.	Minor Negative Impact. Site specific. Short period.	Contractor to identify the disposal sites and with the help of local EPB.
		No on-site development of landfills.		
	Hazardous waste from work sites	Collected and stored on-site in approved facilities as per relevant standards. Then remove from site to the site approved by local EPB officials.		
	Spoil and muck from cuts	Used for filling embankments and excess quantity stored with containment walls for future use	Minor Negative Impact, site specific.	
Hazardous Materials	Accidental spillages affecting soil, groundwater and adjacent water bodies especially in regions very close to Red River.	Installing appropriate hazardous storage facilities wherever required and their disposal at identified sites.	Minor Negative Impact site specific.	Contractor to identify sites for disposal with the help.
Erosion	Increase in the levels of erosion, particularly in areas where the soil types and topography are susceptible to erosion.	Follow the mitigation measures suggested in the Erosion Prevention Plan (ErPP) prepared for the project as part of Pre Feasibility studies.	Major Negative Impact during the entire construction period at various locations along the alignment.	Contractor with the help of Soil conservation department.
Seismic Activity	Liquefaction of soils primarily in the mountainous regions between Yen Bai and Lao Cai and subsequent loss of foundation bearing capacities	Extending slopes, widening sub-grade surfaces a adding dual-direction geotechnical gratings in the crushed stone layer	Minor negative Impact, site specific	Contactore
Flora and Fauna	Minimal impact in the plains between Yen Vien and Yen Bai. Some loss of re-vegetated and plantation areas very close to the existing track between km 277 to 280 towards Lao Cai.	Development on no agricultural land of a 30m green belt on both sides of the proposed rail track. Additional land will be seeded with grass.	Minor Negative Impact becoming positive after green belt is developed.	Contactore with the help of officials of Forest Department
	Loss of small number of median sized		Minor Negative impact for short	

Environmental Parameter/Issue	Anticipated Impacts	Mitigation Measures	Degrees of impact	Implementation agency
	trees very close to the existing track (within 20m) coming in the way of construction work. No loss of ancient trees since they are about 50-60 m away from the existing track. Cutting of firewood and poaching by construction workers	Loss of trees compensated by planting of similar species in the proposed green belt on either side of the new track. Providing cooking fuel to workers	period, site specific	
	Impact to aquatic ecology during construction of bridge, as pile driving will increase sedimentation in the waterways below	Engineering design to minimize solid storage discharge to the water column below	Minor Negative Impact, site specific, short term	
Environmentally sensitive areas	No impacts	None	Nil	
Historical, Cultural and Archeological Sites	No impacts	None		
Public Safety and Health	Increased risk of construction workers spreading sexually transmitted diseases and HIV/AIDS	A public Health officer will regularly inspect work camps and disseminate appropriate information	Minor Negative Impact site specific	Contractor and EA
	Normal activities of the industries and petrol storage complexes, as seen near Van Phu station, Viet Tri and Phu Duc stations, may hamper during the construction phase of the project.	Make them know about the proposed construction activities and their duration		
Induced Impacts	Increased potential of employment opportunities for local unskilled workers for employment during construction work	Encourage hiring of local unskilled workers, especially from the ethnic minorities, in construction sites at mountainous regions	Major Positive Impact	

Table 4.2: Anticipated Environmental Impacts and Mitigation Measures: Operation Phase

Environmental Parameter/Issue	Anticipated Impacts	Mitigation Measures	Degrees of impact	Implementation agency
Solid	Spillage of hazardous wastes and materials including hydrocarbons.	Collection and proper disposal at identified site.	Minor Negative, site specific	EPMD with the help of WRB and local EPB
Water	Waste water from shops, maintenance facilities and stations	Establishing waste water treatment facilities at major stations	Major Negative, site specific	
	Major pollutants will be suspended solids, petroleum, COD and BOD	Treatment will include septic tank, oil separators and electro dialysis for heavy metals. Comply with National standards		
Air quality	Dust and particulate matter from open and uncovered transportation of ores, coal and grinded limestone	Transportation in closed containers. During open transportation they will be fully covered	Minor Negative, site specific	EPMD with the help of local EPB
Noise and Vibration	Noise from train movements, stations and switching yards	Installation of sound barriers or insulating windows at noise generating locations and regular noise monitoring at these locations to check compliance to National standards	Major Negative Impact during train movements	EPMD with the help of local EPB
	Excess levels of vibration result in damage to buildings very close to the track	Installing low vibration slab tracks and continuous welded rail. Vibration level monitoring for compliance with National standards		
Solid Waste	Domestic and industrial waste from stations and maintenance facilities	Development of Solid Waste Management System. Disposal at identified and approved sites. Sludge from treatment facilities recycled as fertilizer	Major negative impact	EPMD with the help of local EPB
Hazardous materials	Accidental spillage during transportation of chemicals and hazardous materials	Trains conveying toxic or hazardous chemicals shall comply with transportation procedures in accordance with National standards	Minor, but significant impact at specific locations	EPMD with the help of local EPB
Soil Erosion	No significant erosion is expected out of project activities	Regular supervision of the nearby embankments close to the track	No impact	EPMD with the help of soil conservation department
Seismic Activity	Probable liquefaction of soils	Periodic seismic tests and supervision	Minor Negative	EPMD with the help of Department of Geology
	Probable impact on aquatic ecology by	Proper treatment and disposal of	No impact	EPMD with the

Environmental Parameter/Issue	Anticipated Impacts	Mitigation Measures	Degrees of impact	Implementation agency
Flora and Fauna	discharge of untreated waste water	wastewater.		help of Department of Forest
Environmentally sensitive areas	No impacts are expected out of project activities	None	No impacts	
Historical, Cultural and Archeological sites.	None	None	No impacts	
Public Safety and Health	Chance of accidents at illegal crossings during the train movement at high speeds Increase in sound and vibration levels affecting people with low hearing levels and staying near close to the track.	Close supervision by concerned station officials and closure if essential Complying with noise mitigation measures and regular noise monitoring. Prevent honking by Locomotives especially near Hospitals and Schools, Establish signals at such locations	Major, irreversible negative impact for long time.	EPMD and RPMU with the help of local Railway stationmaster.
Induced Impacts	Increase in industrial activity leading to increased water and air pollution.	Complying with relevant emission and discharge standards.	Minor negative impact but site specific.	EA and Urban Planning Department.
	Excessive commercialization affecting natural tourist locations in the mountainous regions.	Planned growth and thrust on natural conservation.		
	Threat of construction camp workers continuing to stay even after construction is over	Immediate demobilization of construction camps by contractors.		
	Major positive benefits like significant reduction on the road traffic, reduced transportation cost, growth in tourism potential especially the 'Sa Pa' region, upgradation of tourist facilities, enhanced direct and indirect employment opportunities, preservation of aesthetics of the area etc.	Proper infrastructure and their maintenance, planned growth, good environmental planning etc.	Significant Positive Impact.	

5 INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MONITORING PLAN

5.1 ENVIRONMENTAL MANAGEMENT

The Railway Project Management Unit (RPMU) will be the Executing Agency (EA) for the project, and thus has overall responsibility for ensuring that all environmental standards and procedures are followed. The EA will establish an Environmental Protection and Management Division (EPMD) that will ensure implementation of environmental management and monitoring plan during the construction and operation phases of the project. A project manager and at least three technical personnel will staff the EPMD. The EA will translate the summary initial environmental examination into Vietnamese language and provide copies to relevant parties, including local authorities and bidding contractors. RPMU and EPMD will ensure that the impacts and mitigation measures suggested for the construction phase and operation phase are included in all the bidding documents and operating contracts. The EA and EPMD will ensure that the contractors comply with the mitigating measures suggested during the construction and operation phases. The EMPD will be especially responsible to ensure the implementation of mitigation measures during the construction period.

5.2 ENVIRONMENTAL MONITORING PLAN

The EMPD will prepare a detailed environmental monitoring plan for the project prior to commencement of bidding for construction contracts. The environmental monitoring plan will be included in all bidding contractor documents and construction contracts. The EMPD will ensure that the environmental monitoring plan is updated, as required, during project construction and operation. Environmental monitoring will be undertaken by a range of relevant authorities, local environmental protection bureaus (EPB), the forestry department, the relics bureaux, and others. The EMPD will be responsible for coordinating all environmental monitoring activities, including collation of all monitoring results.

The provincial EPB are competent enough to take up the environmental monitoring; they could be hired on deputation basis by EA. A framework of the environmental monitoring plan and approximate cost for the same is suggested in the Table 2.

The training needs are (1) field monitoring techniques for estimating the quality of various components like air, surface and ground water, noise and soil; (2) sampling and analysis methodology; (3) techniques for environmental survey; (4) waste water treatment techniques; (5) noise monitoring techniques; (6) soil sampling and analysis; and (7) conducting initial and detailed EIA studies etc. The interested officials of the EPB can be deputed for Training Courses/ Workshops frequently conducted by Local Universities/Research Institutions. RPMU in association with MoNRE and MoSTE can arrange for such training for selected EPB at least six months before the actual commencement of construction. RPMU has to work out an arrangement with them for monitoring work by meeting their requirements to certain extent by providing funds out of project cost. It will not be a difficult proposition since it is fund transfer from one Ministry to another within the same Government.

Table 5.1: Environmental Monitoring Framework

Area to Be Monitored	Competent Authority	Parameters to be monitored	Location	Approximate costing
Air Quality	EPMD and Local EPB	Sulphur oxides and Nitrogen Oxides, Suspended Particulate Matter (SPM). Once a Week through construction period.	At all locations of construction	Sampling and Laboratory test costs: US \$ 25 per sample
Air emissions from boilers	EPMD and Local EPB	Sulphur and Nitrogen Oxides and Ammonia once a month during operation period	Near workshops and switch yards	Sampling & Laboratory test costs: US \$ 25/sample
Water quality	EPMD and Local EPB	COD, BOD, SS and Coliform and Heavy metals once a month through construction period	Red River situated very close to existing track and water streams over which bridges are to be built/ repaired	Sampling & Laboratory costs: US \$ 50 per sample
Noise levels	EPMD and EPB	Noise levels with Sonometers, twice a week through construction period and once a week during operation especially during train movements	Regions very close to residential areas at all construction locations and station areas during operation	US \$ 10 per sample
Vibration levels	EPMD and Local EPB	Horizontal and Vertical vibrations twice a week through construction period and once a week during operation phase	Regions very close to residential areas at all construction locations and station areas during operation	US \$ 10 per measurement
Aquatic ecology	EPMD and EPB	SS and Coliform Once a month through construction period	Water of streams below the bridges that are being built/ repaired	Sampling and Laboratory tests US \$50/ sample
Forest, plantation areas and agricultural fields	EPMD and Forestry and Agricultural Departments (provincial and local)	Status of proposed green belt development, ancient and firewood trees. Illegal felling or poaching by construction workers Once in two months during construction period and Semi	Regions very close to the alignment and construction camp areas	Agreed per diem and transport costs

Area to Be Monitored	Competent Authority	Parameters to be monitored	Location	Approximate costing
		annual during operation		
Disposal Muck and Spoil	EPMD and local Water Resources Bureau	Loss of arable land, impairment of visual quality. Semi annual	Regions very close to the alignment and construction camp areas	Agreed per diem costs and transportation costs
Erosion	EPMD and local Water / Soil Resources Bureau	Loss of land, Land slides/slips, embankment etc. Once in two months and semi annual during operation	Regions very close to the alignment and construction camp areas	Agreed per diem and transportation costs

EPB - Environmental Protection Bureau; EPMD - Environmental Protection and Management Division;
COD- Chemical Oxygen Demand; BOD- Biological Oxygen Demand, SS- Suspended Solids.

6 PUBLIC CONSULTATION AND DISCLOSURE

The basic purpose of conducting the stakeholder consultation was to involve the local people into the process of project implementation and to incorporate the appropriate environmental concerns into the process. Moreover, the Asian Development Bank Guidelines specify that the Public Consultation process shall be integral part of the Environmental Assessment. This section presents the essence of the stakeholder consultation process.

6.1 PRE - IEE MEETINGS

These Consultation meetings were conducted during the survey from 7th to 10th March, 2006 and 13th to 14th March, 2006, following the reconnaissance survey during 22nd and 23rd February, 2006. Individual and group discussions were conducted in the rural areas, especially with ethnic minority individuals, and at urban sites along the proposed rail alignment. Also discussions were conducted with officials of the various Railway Stations and project management officials, regarding the proposed project and their views were elicited. The objective of the consultation was to disseminate the project information in order to ascertain probable environmental and social impacts that may arise due to implementation of the proposed project. The consultants apprised the stakeholder of the salient features of the project. The following were discussed during Consultation.

- Overall need of the project
- Project location
- Environmental Concerns and
- Social Concern.

At the meetings, the project was described in sufficient detail so that people became aware of the rail improvement locations and expected impacts on their respective areas. Then questionnaires (translated into Vietnamese language) were distributed to about 120 individuals, collected and analyzed. A breakdown of the response is presented in Table 6.1. A good cross section was achieved, with representations from various age groups, different educational levels and three occupational classifications: farmer, worker and career / professionals. The responses are summarized in Table 6.2.

Outcome

As there are no major environmental issues involved due to the project, no specific issues were brought out during this group discussion. However the following comments and suggestion were made by various stakeholders. These were mainly derived from the consultation conducted with people residing close to the rail alignment along the project and with officials of the railway.

- Most of the Stakeholder were of the opinion that since the project is envisaged to improve the connectivity, there would be rather a lot of positive impact and were also aware of the increased economic benefits due to the proposed up grading/ improvement of the rail corridor
- Some concerns were raised in terms of additional rail tracks since some of the proposed structures will be close to the existing roads, residential areas, commercial establishments and rice fields. Also concerns were raised regarding the safety of the

level crossings due to the proposed increase in the speed of new trains and also an increase in the frequency of traffic.

- The stakeholders also anticipated an impact on air and noise during the construction activities and increase in noise and vibration levels during the operational stages
- They also insisted for timely completion of project.

The stakeholder consultation reveals that the implementation of the present project i.e. upgrading of the Hanoi- Lao-Cai railway may not have any significant or adverse impact either on the natural environmental or socio-economic environment of the project area. However, the concern of the stakeholders, about (a) proximity of the new alignment and the laying of the new proposed railway track close to the residential areas, commercial establishments, existing parallel roads and rice fields, and (b) increase in noise and air pollution levels during the construction stage and increase in noise and vibration levels during operation stages needs to be taken into consideration by adopting the mitigation measures addressed in the environmental management plan.

Table 6.1: Characteristics of Participants at Public Consultation Meetings

(Total No. of Participants 120)

Age	18-30	31~40	41~50	>50
Subtotal	18/120	60 /120	30/120	12/120
Educational Background	Primary School	Junior Middle School	Senor Middle School	College and above
	45/120	25/120	22/120	28/120
Occupation	Farmer	Worker	Professional/Technical	Other
	20/120	35/120	45/120	20/120
Questionnaires Distributed	Rural Areas		Town Areas	
	55/120		65/120	

Source: Wilbur Smith Associates "Draft Initial Environmental Examination 2006".

Table 6.2: Responses to Questionnaire*(Total Number of Respondents 120)*

No	Issues	Response (individual)				
		Yes	Understand through the media	Do not know		
1	Are you aware of the project?	55	45	20		
2	Are you satisfied with the current transportation?	Satisfied	Not very	Not satisfied		
		40	55	25		
3	What is the effect of the Project on local transportation?	Good	Bad	Do not know		
		65	4	51		
4	How are the environmental conditions where you live?	Good	Average	Bad		
		35	65	20		
5	What environmental problems will be generated by the Project?	Water pollution	Air pollution	Noise and vibration	Ecological damage	Other
		10	25	65	12	8
6	What is the degree of impact of the Project on local environment?	Major	Minor	Do not know		
		15	55	50		
7	What are the methods you prefer to alleviate railway noise?	Vegetation	Sound barrier	Sound window	Village away from railway	Removal
		15	45	-	9	51
8	What are the ways you prefer to prevent water and soil loss, and protect ecological condition?	Proper alignment	Check dam	Vegetation	Windbreak and sand fixation	Enhance management
		35	15	10	-	60
9	What is the best way to protect Nature Reserve as the railway will pass through it?	Vegetation and protection	Control during construction	Others		
		55	45	20		
10	With this new alignment, the number of crossing roads is going to reduce. How do you think about it's effect?	Good	Don't mind	Not good		
		35	40	45		
11	With this new alignment, a number of trees close to the track will be cut. Do you agree with that?	Agree	Don't mind	Disagree		
		25	35	60		
12	During the construction, there is going to be a lot of noise. Do you agree if the construction is done during day and night?	Agree	Only during day	Disagree		
		15	75	30		
13	Do you support the setting of construction worker's camp near your area?	Yes	Don't mind	No		
		15	25	80		
14	Are you satisfied with local economic development?	Satisfied	Not very	Not satisfied		
		20	40	60		
15	How is waste water discharge and solid waste disposal at railway station?	Satisfactory	Very bad	Not satisfactory		
		15	85	20		
16	If removal is required, what is your view on	Money compensation	Land recovery in other place	Job opportunity		

No	Issues	Response (individual)		
	resettlement?	55	25	40
17	What is the effect of the new railway on your life?	Good	Bad	Do not know
		65	15	40
18	What is your general view on the Project?	Support	Against	Do not know
		75	15	30

Source: Wilbur Smith Associates "Draft: Initial Environmental Examination 2006".

6.2 POST IEE - PUBLIC CONSULTATION.

In conformity with ADB Guidelines, an environmentally focused Public Consultation meeting was conducted on 4th April, 2006 at Yen Bai, the mid-point of the proposed alignment. The meeting was organized, in coordination with RPMU. About 35 people were specifically invited to the meeting, including officials from Environmental Protection Bureau, Forestry, Health, Construction Management Units of VNR and Women organizations from the provinces of Lao Cai, Yen Bai and Phu Tho. Brief details of the project were explained by the senior officials of RPMU. A PowerPoint presentation of the IEE studies and their findings were made and the opinions of the participants were elicited. The participants expressed concerns about:

- Likely increase in the levels of noise and vibrations during the movement of trains at increased speed and their impacts on nearby schools, clinics and hospitals and houses close to the track.
- Impact of increase in noise levels during construction especially during night hours.
- Safety at level crossings especially near the unmanned crossings.
- Absence of solid waste management and disposal systems at all the railway stations, especially at bigger stations and their premises.
- Leaking and discharge of waste water from the stations on to the land and nearby river and water streams.
- Seriousness of compliance of the suggested mitigation measures by the contractors at construction stage and by VNR during operation phase.
- Non de-mobilization of construction camps after completion of the work and continue to stay on permanently there after.
- Lack of institutional co-ordination between different departments like, EPB, urban planning, local public institutions and VNR resulting in environmental degradation.

Also some good suggestions made by the participants were:

- Totally banning the illegal crossings
- Declaring the 200 m distance on either side of the new track as 'no development zone' henceforth
- Erecting signs indicating the presence of hospitals and schools, along the alignment and ban the practice of honking of trains near the these places,
- Integration of railway development/ improvement plan with development plan of cities along the proposed alignment,
- Encourage or mandate the hiring of local people, especially those from the ethnic minorities, during the construction work in the mountainous regions near Lao Cai.

The concerns expressed and suggestions made were well addressed and noted by the consultants and RPMU. The consultants explained in detail the methods of mitigation and their serious monitoring during construction. The RPMU told that there is strong

political will at the top of the Government of Vietnam and VNR, to implement the transportation projects as per the best practices which would percolate down the line while implementing the project. All the participants were supportive of the proposed project and wanted its early implementation, which would bring the required socio-economic development of the region.

7 FINDINGS AND RECOMMENDATIONS

The IEE studies showed the major environmental issues out of the proposed project are (a) soil erosion and disposal, (b) water quality of Red River and (c) noise and vibration levels (d) waste water treatment and solid waste management.

7.1 SOIL EROSION AND DISPOSAL

Nearly half of the land area in the project is mountainous. The Con Voi mountain system exists between Red River and Chay River. With elevations of 400 to 1400 m in the mountainous areas, in Yen Bai and Lao Cai are characterized by steep slopes, which cut by railway construction earthworks are easily eroded, have become unstable causing land slides/landslips. Improper soil disposal could also cause severe sediment impacts, particularly where the soil is disposed of in steep areas, or where the soil is not properly stabilized. Careless disposal of cut soil could also result in the negative impacts on the adjacent watercourses like Red River, which runs close to the track (within 10 m) at certain locations. Hence, a proper '**Soil Erosion Prevention and Control**' study especially for the region between Yen Bai and Lao Cai, addressing issues like, (i) topography of the region, (ii) methodology for construction earthworks, (iii) selection of sites for disposal to control sediment impacts and (iv) standards for slope stabilization etc. is recommended

7.2 WATER QUALITY OF RED RIVER

The entire project area is a part of the Red River watershed. The improper erosion control and disposal run-off and already eroded embankments run the risk of affecting water quality in the sections of the alignment close to track. Added to this is the discharge of untreated wastewater from stations along the alignment. So there is a need for 'Red River Water Quality Management Plan' covering areas along the alignment and address issues like, (i) current water quality, (ii) siltation and sedimentation of the watercourse near the places of erosion and their control, (iii) estimation of waste water being discharged from the existing stations and workshops, (iv) impact of sudden floods on the track at places close to it. Though, some studies on the water quality of the river exist, no current data on the issues mentioned above is available.

7.3 NOISE AND VIBRATION

The alignment at various locations runs very close to the residential houses. No data on the noise level exists regarding them. There is a need for database of their levels along the entire length of alignment. This data would help in formulating a precise mitigation measure to be adopted especially at urban locations during the operation phase of the trains.

7.4 WASTE WATER TREATMENT AND SOLID WASTE MANAGEMENT AT RAILWAY STATIONS

This situation is very poor at all the railway stations and workshops along the alignment and could increase with the increase in frequency and traffic volume. It needs a study based on the current and future scenario, covering aspects like, (a) estimation of waste water generation for the present and future (water balance), (b) type of treatment facility required and their discharge points, (c) estimation of current and expected increase in solid waste, (d) their existing and future handling, collection and disposal methods.

But for the above-mentioned issues, there are no major long-term significant impacts out of the proposed project. The IEE study, at this juncture of feasibility study is sufficient, without the requirement of detailed study or EIA. The above-mentioned

studies could be taken as projects, independent of this study, by the project proponents (VNR), before implementing the project.

However, there is a need to comply with the requirements of MoNRE. As per the list of projects requiring EIA studies stipulated by them, all the Railway Projects of more than 50 km in length, do require an investment license by them based on the EIA studies and report. The IEE studies, which forms a chapter of the Feasibility study (preliminary design stage), are sufficient for 'making an application for Investment License', which is called **Stage I**. After getting permission to apply for investment license, while submitting detailed design (**stage II**), for obtaining Investment License, a detailed EIA (as per the guidelines and format stipulated by MoSTE for Transport Related Projects) is required.

8 CONCLUSION

The proposed Kunming - Hai Phong Transport Corridor Project (supplementary GMS Hanoi- Lao Cai Railway upgrading) is a link between the Western mountainous provinces, the midland and delta provinces at the north bank of the Red River, reaching Hanoi. The proposed project will (i) improve transport infrastructure in an area rich in natural resources, (ii) augment a vital corridor for the national movement of passengers and freight, (iii) improve the link between the port of Hai Phong in Vietnam and Kunming in Yunnan province of the People Republic of China (PRC) for bilateral trade and (iv) enhance social and economic development and raise the living standard of the local inhabitants.

Potential environmental impacts from the proposed project arise from (i) earthwork disposal; (ii) soil erosion; (iii) site specific degradation of surface water quality; (iv) noise, pollution and vibration. No sensitive environmental sites were identified in the impact corridor of 5 km on either side of the alignment. Appropriate mitigation measures have been developed to minimize the degree of impacts.

The environmental benefits directly associated with the project include improvements in air pollution and improved energy efficiency. Transporting passengers and freight by trains generate significantly less total air pollution than does road transport. Rail transport is considerably more energy efficient than equivalent truck transport, particularly for freight transport.

Based on the results of the present IEE, the adverse environmental impacts out of the project can be minimized with suggested Institutional requirements and Environmental Monitoring Plan resulting in completion of EIA.

ANNEX 1 SUMMARY OF RESETTLEMENT PLAN

Scope of Land Acquisition and Minimization of Resettlement

The Resettlement Plan for the Kunming-Haiphong Transport Corridor Project TA 4050-VIE (hereafter referred to as the “Project”) covers all project components permanently impacting on land used by Affected Persons¹. Resettlement impacts were minimized by selecting engineering options that affected the least number of persons, while providing the most operational gains in safety and efficiency for the railway line. This included the general application of a policy of attrition for clearing the Construction Corridor (7m from edge of embankment) and Safety Corridor (15m from edge of embankment). Persons and their properties will *not* be evacuated from the corridors by the Project, but persons will not be allowed to move into the corridor in the future.

Affected Persons (AP) are persons who will lose land, fixed assets or income as a result of land acquisition by the Project. The land area acquired by project components is referred to here as the project’s **Area of Impact**. The Resettlement Plan also covers land acquired for the establishment of resettlement sites for AP relocating from Lao Cai Rail Station. The total number of AP covered in the Resettlement Plan is 2,378 in 591 households.

Severely Affected Persons (SAP) are persons that will lose more than 10% of their productive assets or they are required to relocate their residence². A total of 207 SAP households were identified in the project’s Area of Impact, of which 93 households will lose more than 10% of their productive assets and 122 households will be required to relocate; while all 180 households in the resettlement sites were identified as SAP.

Vulnerable Groups are persons from a particular social or economic group who face elevated risks of impoverishment as a result of resettlement. The vulnerable groups identified in the project’s Area of Impact and resettlement sites were 33 ethnic minority households, 84 single female-headed households with dependents, 25 poor households, eight (8) households whose primary income earner is elderly or physically disabled, and twelve (12) households who are landless or whose current land tenure is unstable.

The main types of land loss as a result of the Project will be agricultural land, residential land, garden or pond land, forest land and common lands. In the project’s Area of Impact, 131 AP households will lose agricultural land, of which 43 will be marginally affected (<10% loss) and 88 will be severely affected (>10% loss). A total of 282 AP households will lose residential land, of which 118 will reorganize on their remaining land and 122 will relocate.

Of the households required to relocate, 74% are from Lao Cai Rail Station and for whom two resettlement sites in Lao Cai City have been planned. A total of 88 AP households will lose garden land and 8 households will lose forest land. Only 5 households were renting land and 18 households were identified as illegal land-users. In the resettlement

¹ Temporary impacts will be covered in the civil works contracts of contractor companies after the detailed designs for the Project are prepared.

² The two categories of SAP are non-exclusive, as one household can belong to both categories. Hence, the total SAP is less than the sum of the two categories.

sites, a total of 180 households will lose residential land, all of whom will relocate³. Among them, 114 households will also lose garden land.

The total area of land acquired from AP households in the project's Area of Impact will be approximately 155,000 sq.m, consisting of 29,000 sq.m of residential land, 42,000 sq.m of agricultural land, 60,000 sq.m of garden or pond land, 19,000 sq.m of forestland and 5,000 sq.m of common land. In the resettlement sites, the total area of acquired land will be approximately 69,000 sq.m, consisting of 16,000 sq.m of residential land and 53,000 sq.m of garden land⁴. A total of 177 houses will be impacted in the Area of Impact, of which 57 houses will be partially affected and 120 houses will be left structurally unsound and, hence, entirely affected. Another 163 houses will be impacted in the resettlement sites, all of which will be entirely affected. A total of 554 structures will be impacted in the Area of Impact and 379 structures in the resettlement sites. An approximate total area of 45,000 sq.m of annual crops and 8,600 trees will be impacted in the Area of Impact and an approximate 6,000 sq.m of annual crops and 2,900 trees in the resettlement sites. In the Area of Impact, 46 businesses will be affected, of which 41 will be able to re-build on the AP's remaining land and 5 would be required to relocate. The employment of 40 persons will also be affected as a result of the Project, of which 18 are employees of affected businesses and 22 are sharecroppers. In the resettlement sites, ten (10) businesses would be required to relocate and two (2) employees in these businesses will be affected. In the Area of Impact, 268 AP households will be entitled to income rehabilitation assistance, 207 of these households will also be entitled to the subsistence allowance and 119 of these households will further be entitled to the transport allowance, while all 180 households in the resettlement sites will be entitled to all three allowances.

Impacts on Trees and Crops

An approximate total area of 45,000 sq.m of annual crops and 8,600 trees will be impacted in the Area of Impact (Table 1.10) and an approximate 6,000 sq.m of annual crops and 2,900 trees in the resettlement sites (Table 1.15). Not surprisingly, the project components impacts on most crops and trees will be in the rural areas of Mai Tung (16,000 sq.m crops, 579 trees) and the realignment sections km 169-171 (7,800 sq.m crops, 658 trees) and km 283-292 (54,290 sq.m crops, 2,258 trees). The resettlement site in Van Hoa will impact on 6,000 sq.m of crops and 2,534 trees.

Socio-Economic Information

Basic socio-economic information on AP was gathered through an Inventory of Losses (IOL) administered on 100% of AP households (n=591) and a Socio-Economic Survey (SES) administered on 20% of Affected Households (n=118) (Tables 2.1 and 2.2). At least one AP household was sampled for the SES, even for project components that impacted less than five AP households. The main purpose of collecting socio-economic information was to establish baseline data for monitoring project impacts on the living standards and productive capacity of AP, as well as address particular social and economic issues related to gender and ethnic minorities. Both surveys were administered by the Survey Teams from the Railway Public Utilities Company (RPUC) Vinh Phu and Yen Lao from March to June 2006.

³ AP currently located in the area designated for the resettlement sites will be given first priority for acquiring residential plots in the resettlement areas. However, they are still defined as relocating AP, as the resettlement will require the complete reorganization of current land use in the resettlement area.

⁴ Agricultural land in residential areas is classified as garden land under Vietnamese legislation, usually with higher compensation prices than the highest category of agricultural land.

Legal and Policy Framework

The legal and policy framework relevant to resettlement for this Project are based on the relevant laws of the Government of Viet Nam (GoV) and ADB policies. The main national laws relevant to resettlement are Decree 17/2006/ND-CP, Decree 197/2004/ND-CP, Circular 116/2004/TT-BTC and the 2003 Land Law. The main ADB policies relevant to resettlement are the Policy on Involuntary Resettlement (1995), Policy on Indigenous Peoples (1998), Policy on Gender and Development (1998), Policy on Public Communications (2005) and the ADB Accountability Mechanism (2003).

Project Principles and Policies

To ensure the achievement of national laws and ADB policies, the Project has adopted specific principles and policies for resettlement. The Project's main principles are that resettlement will be avoided or minimized by exploring all viable options; all AP are entitled to compensation and other benefits to assist them to maintain or improve their pre-project living standards and production levels; lack of legal rights will not bar an AP from project entitlements; compensation shall be paid at least at replacement cost in current markets; efforts will be made to preserve existing social and cultural ties in the case of population relocation; planning and implementation of the Resettlement Plan will be carried out with the participation and consultation of AP; compensation will be paid out directly to AP prior to awarding civil contracts; and compensation and rehabilitation assistance will be carried out with respect for the needs of ethnic minorities, women and other vulnerable groups.

Eligibility and Entitlements

The eligibility cut-off date for the Project will be the date of the Detailed Measurement Survey. Project entitlements for all types of AP and all types of losses are defined in the Entitlement Matrix.

Public Consultation and Disclosure of the Resettlement Plan

Because the project's Area of Impact has many project sites with generally few AP households in each site, the first **Orientation Meeting** was carried out simultaneously with the IOL and SES and facilitated with 100% of AP households. The primary purpose of the first Orientation Meeting was to familiarize AP with basic information on the Project, policies and principles for resettlement, and the process for developing the Resettlement Plan. After the draft Resettlement Plan is complete, the Project will convene a second **Orientation Workshop**. One workshop will be held in Lao Cai Rail Station covering all project components within the Yen-Lao RPUC; and another workshop will be held at the Vinh Phu RPUC for all project components within its jurisdiction, as well as the fly-over bridge in Dong Anh under the Ha Thai RPUC. The primary purpose of the Orientation Workshop will be to disclose the Resettlement Plan and gain feedback from local authorities, AP representatives and other relevant stakeholders. The **Project Information Booklet** and the ADB's **Information Guide** on public consultation and the ADB accountability mechanism will also be circulated at the Orientation Workshop, as well as copies delivered to each of the project sites for circulation to all AP.

Comments and concerns raised at the Orientation Workshops will be incorporated into the final Resettlement Plan. Once the Resettlement Plan is approved, copies will be distributed to each RPUC and Provincial, District and Commune People's Committees with project components. The Resettlement Plan will be made available for public

consultation by AP, in coordination with the RPUC or the relevant People's Committee. A copy of the final Resettlement Plan will also be posted on the ADB's website.

Grievance and Complaints

AP may address their grievances and complaints through the national system and/or the ADB's Accountability Mechanism. In the national system, the AP should begin by filing their complaint with the Commune People's Committee. If still unsatisfied with the resolution, then the AP may pursue their complaint through the District People's Committee, the provincial People's Committee and, finally, the national court system. All legal and administration fees for filing complaints will be waived for AP, except for cases filed in the national court system. The AP may also file their complaints directly with the ADB by writing a letter to the Office of the Special Project Facilitator (OSPF). Under the **ADB's Accountability Mechanism**, the OSPF has a responsibility to respond to the complaint, investigate it and pursue its resolution until all of the concerned parties are agreed on its termination.

Resettlement and Rehabilitation Strategy

The primary strategy for ensuring that AP are able to maintain or improve pre-project living standards and production levels is **replacement value compensation** in cash or in kind (e.g., replacement land) for all losses in land, fixed assets and income. In addition, **special assistance allowances** will be awarded to Severely Affected Persons (SAP) and vulnerable groups (as defined above) to support them in re-establishing their income sources and production bases. The specific application of funds designated for **income rehabilitation assistance** will be decided together with the relevant People's Committee and the eligible AP households, depending on the income opportunities available in the locality and the specific needs and interests of the AP. Examples of uses for these funds are training, micro-credit funds and start-up materials and equipment for new businesses. Because nearly all project sites counted less than five SAP, the specific strategy for their rehabilitation will be determined on a case-by-case basis together with local authorities during implementation of the Resettlement Plan.

However, a more elaborate rehabilitation strategy has been developed for project components at the new Rail Station at Mai Tung and Lao Cai Rail Station, as well as at both resettlement sites. Based on consultations with local authorities, RPMU and RPUC, the rehabilitation strategies in Mai Tung and Lao Cai qill emphasize replacement land where available, notably at Mai Tung; finding new employment, such as by assisting AP to secure jobs at the new Rail Station in Mai Tung or Industrial Zones currently being developed in Lao Cai; developing non-land based businesses, such as by reserving land spaces at the Rail Station for AP to build small service sector businesses; and integrating rehabilitation efforts with the social and economic development programs and policies of local government and NGOs present in the area, such as the Vocational Training and Support Centres in Lao Cai City.

The Lao Cai City People's Committee has also planned Resettlement Sites to accommodate the 90 AP households who will relocate from Lao Cai Rail Station. The People's Committee is currently preparing several different resettlement sites in and around Lao Cai City to accommodate displaced persons from various economic development projects, such as the upgrading of the Lao Cai Rail Station. The particular resettlement sites that will be used by the Project are located in Pho Moi Ward and Van Hoa Commune in Lao Cai City. The resettlement site in Pho Moi Ward will comprise an area of approximately 47,000 sq.m and it will be able to accommodate 110 households. The resettlement site in Van Hao Commune will comprise an area of approximately 61,000 sq.m and accommodate 220 households. The resettlement sites will provide

each incoming household with a residential land plot of 80-100 sq.m, as well as make investments in road access, residential electricity, residential water supply and drainage. AP will be required to purchase the residential plots with their compensation money, if they so wish. The Lao Cai City People's Committee will engage in amortization schemes with households who may not have sufficient money to purchase a plot in the resettlement sites, whereby the AP would pay-off the purchase price over a period of time determined together with the People's Committee.

Gender and Ethnic Minority Issues

In accordance with ADB policy, special provisions have been made to help prevent discrimination against women and ethnic minorities in the implementation of the Resettlement Plan. Ethnic minorities were under-represented in the AP population, comprising only 5% (32 households) of AP households compared to the 14% that ethnic minorities comprise in the national population. Furthermore, no large groups of even more than 10 (ten) ethnic minority AP households were found living together as a single community in the project's Area of Impact or the resettlement sites. Socio-economic data indicated that ethnic minority AP earned less annual income than the general AP population, but showed better educational achievement and security over land use than their Kinh counterparts. Women and girls comprised exactly 50% (1,179 AP) of the AP population, while single female-headed households comprised 14% (81 households) of AP households. Socio-economic data showed that female-headed households tended to earn less annual income and were less likely to have their lands registered under their names when compared with the general AP population. To address the special risks and needs facing ethnic minorities and women as a result of resettlement, **gender and ethnic minority specific actions** have been outlined in the Resettlement Plan.

Monitoring and Evaluation

Monitoring for the Resettlement Plan will be both internal and external. The RPMU will be responsible for **Internal Monitoring** together with the Provincial People's Committees through regular supervision of the Compensation and Resettlement Boards. The RPMU will also prepare quarterly and bi-annual Progress Report for submission to Vietnam Railways and the Ministry of Transport. Internal monitoring will be ongoing throughout the period of project implementation.

External Monitoring and Evaluation will be carried out by an Independent Monitoring Organization (IMO) contracted to the RPMU. An IMO can be a university, research institution, non-governmental organization (NGO) or other organization that is legally and administratively independent from government. The IMO will be primarily responsible for assessing whether AP have been able to maintain their pre-project living standards and productive levels, as well as whether resettlement activities have been implemented in quality, quantity and timeliness according to the Resettlement Plan. The IMO will report directly to the Ministry of Transport and the ADB. External monitoring will be carried out every six (6) months during the first two years of implementation of the Resettlement Plan and then every year until all AP have been relocated. The IMO will conduct further evaluations at the first, second and fifth years after land acquisition and relocation of AP. The IMO should also organization evaluation missions to coincide with the finalization of the updated Resettlement Plan, the period between payment of compensation and evacuation, and within three months of the AP's relocation to the resettlement sites.

Institutional Organization and Implementation Schedule

The main institution responsible for executing the Resettlement Plan will be the RPMU, under the supervision of Vietnam Railways and the Ministry of Transport and in close coordination with the relevant Provincial People's Committees. The Provincial People's Committees will establish the Compensation and Resettlement Boards at the provincial and district levels for updating and implementation of the Resettlement Plan. The Project will also hire one international and one national Resettlement Specialist with expertise in ethnic minority issues, as well as one international Gender and Social Development specialist.

Implementation Schedule and Budget

The envisioned timeframe for implementing the Resettlement Plan is 10 months. All costs for resettlement will be financed by the Government of Vietnam. The total cost for implementing the Resettlement Plan is estimated at 82.6 billion VND (approx. 5.1 million USD), of which 37.2 billion VND (approx. 2.3 million USD) is for compensation costs in the project's Area of Impact and 9.4 billion VND (approx. 0.6 million USD) for compensation costs in the resettlement sites.

ANNEX 2 PHOTOGRAPHS OF PRE - IEE PUBLIC CONSULTATION MEETINGS

Public consultation with the vendors in front of Lao Cai station



Public consultation with the vendors in front of Yen Bai station



Public consultation at Bao Ha temple



Discussion at station-master's office at Yen Bai station

TA No. 4050-VIE

KUNMING – HAIPHONG TRANSPORT CORRIDOR PROJECT

UPGRADING HANOI – LAO CAI RAILWAY

DRAFT FINAL REPORT

Technical Appendix C

DRAFT RESETTLEMENT PLAN

July 2006

CURRENCY EQUIVALENTS
(05 MAY 2006)

Currency Unit	–	Vietnamese Dong (VND)
VND 1.00	=	\$ 0.00006272
\$1.00	=	VND 15,950

ABBREVIATIONS

ADB	-	Asian Development Bank
AFD	-	Agence Française de Développement
AP	-	Affected People
BCR	-	Benefit cost ratio
CAD	-	Computed Aided Design
CARB	-	Compensation and Resettlement Board
CPC	-	Commune People's Committee
CPI	-	Consumer Price Index
DFR	-	Draft Final Report
DGTPE	-	Direction Générale du Trésor et de la Politique Economique
DMC	-	Developing Country Member (of ADB)
DPC	-	District People's Committee
EA	-	Executing Agency
EIRR	-	Economic internal rate of return
EMSA	-	Ethnic Minority Special Actions
EPMD	-	Environmental Protection and Management Division
GDP	-	Gross Domestic Product
GOV	-	Government of Vietnam
GSO	-	General Statistical Office
GTZ	-	Gesellschaft für Technische Zusammenarbeit
IBRD	-	International Bank for Reconstruction and Development (World Bank)
IEE	-	Initial Environmental Examination
IoL	-	Inventory of Loss
IP	-	Indigenous People
IPDP	-	Indigenous Peoples' Development Plan
IMO	-	Independent Monitoring Organization
IPSA	-	Initial Poverty and Social Analysis
IRR	-	Internal rate of return
ISA	-	Initial Social Assessment
LURC	-	Land Use Rights Certificate
MOF	-	Ministry of Finance
MONRE	-	Ministry of Natural Resources and Environment
MOT	-	Ministry of Transport
MPI	-	Ministry of Planning and Investment
NGO	-	Non Government Organization
NPV	-	Net present value
OCR	-	Ordinary Capital Resources (of ADB)
O-D	-	Origin Destination
ODA	-	Official Development Assistance
OSPF	-	Office of the Special Project Facilitator
PIB	-	Project Information Booklet
PPTA	-	Project Preparatory Technical Assistance
PRC	-	People's Republic of China
PSA	-	Participatory Social Appraisal
RALC	-	(Department of) Resettlement and Land Clearance

ABBREVIATIONS

RoW	-	Right of way
RP	-	Resettlement Plan
RPI	-	Retail Price Index
RPMU	-	Railway Projects Management Unit
RPUC	-	Railway Public Utility Company
RRP	-	Report and Recommendation of the President (to ADB Board of Directors)
RRP	-	Report and Recommendation of the President (to ADB Board of Directors)
SAP	-	Severely Affected People
SES	-	Socio-Economic Survey
SIEE	-	Summary Initial Environmental Examination
TA	-	Technical Assistance
VOC	-	Vehicle operating costs
vpd	-	Vehicles per day

WEIGHTS AND MEASURES

Metric system

NOTES

1. In this report, "\$" refers to US dollars.

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Executive Summary

Scope of Land Acquisition and Minimization of Resettlement

The Resettlement Plan for the Kunming-Haiphong Transport Corridor Project TA 4050-VIE (hereafter referred to as the “Project”) covers all project components permanently¹ impacting on land used by Affected Persons. Resettlement impacts were minimized by selecting engineering options that affected the least number of persons, while providing the most operational gains in safety and efficiency for the railway line. This included the general application of a policy of attrition for clearing the Construction Corridor (7m from edge of embankment) and Safety Corridor (15m from edge of embankment). Persons and their properties will *not* be evacuated from the corridors by the Project, but persons will not be allowed to move into the corridor in the future.

Affected Persons (AP) are persons who will lose land, fixed assets or income as a result of land acquisition by the Project. The land area acquired by project components is referred to here as the project’s **Area of Impact**. The Resettlement Plan also covers land acquired for the establishment of resettlement sites for AP relocating from Lao Cai Rail Station. The total number of AP covered in the Resettlement Plan is 2,378 in 591 households.

Severely Affected Persons (SAP) are persons that will lose more than 10% of their productive assets or they are required to relocate their residence. A total of 207 SAP households were identified in the project’s Area of Impact, of which 93 households will lose more than 10% of their productive assets and 122 households will be required to relocate²; while all 180 households in the resettlement sites were identified as SAP.

Vulnerable Groups are persons from a particular social or economic group who face elevated risks of impoverishment as a result of resettlement. The vulnerable groups identified in the project’s Area of Impact and resettlement sites were 33 ethnic minority households, 84 single female-headed households with dependents, 25 poor households, eight (8) households whose primary income earner is elderly or physically disabled, and twelve (12) households who are landless or whose current land tenure is unstable.

The main types of land loss as a result of the Project will be agricultural land, residential land, garden or pond land, forest land and common lands. In the project’s Area of Impact, 131 AP households will lose agricultural land, of which 43 will be marginally affected ($\leq 10\%$ loss) and 88 will be severely affected ($> 10\%$ loss). A total of 282 AP households will lose residential land, of which 118 will reorganize on their remaining land and 122 will relocate. Of the households required to relocate, 74% are from Lao Cai Rail Station and for whom two resettlement sites in Lao Cai City have been planned. A total of 88 AP households will lose garden land and 8 households will lose forest land. Only 5 households were renting land and 18 households were identified as illegal land-users. In the resettlement sites, a total of 180 households will lose residential land, all of whom will relocate³. Among them, 114 households will also lose garden land.

¹ Temporary impacts will be covered in the civil works contracts of contractor companies after the detailed designs for the Project are prepared.

² The two categories of SAP are non-exclusive, meaning that one household can belong to both categories. Hence, the total SAP is less than the sum of SAP in the two categories.

³ AP currently located in the area designated for the resettlement sites will be given first priority for acquiring residential land plots in the resettlements sites (i.e., same general area). However, they are still defined as relocating AP because the resettlement site will require the complete reorganization of current land use in those sites.

The total area of land acquired from AP households in the project's Area of Impact will be approximately 155,000 sq.m, consisting of 29,000 sq.m of residential land, 42,000 sq.m of agricultural land, 60,000 sq.m of garden⁴ or pond land, 19,000 sq.m of forestland and 5,000 sq.m of common land. In the resettlement sites, the total area of acquired land will be approximately 69,000 sq.m, consisting of 16,000 sq.m of residential land and 53,000 sq.m of garden land. A total of 177 houses will be impacted in the Area of Impact, of which 57 houses will be partially affected and 120 houses will be left structurally unsound and, hence, entirely affected. Another 163 houses will be impacted in the resettlement sites, all of which will be entirely affected. A total of 554 structures will be impacted in the Area of Impact and 379 structures in the resettlement sites. An approximate total area of 45,000 sq.m of annual crops and 8,600 trees will be impacted in the Area of Impact and an approximate 6,000 sq.m of annual crops and 2,900 trees in the resettlement sites. In the Area of Impact, 46 businesses will be affected, of which 41 will be able to re-build on the AP's remaining land and 5 would be required to relocate. The employment of 40 persons will also be affected as a result of the Project, of which 18 are employees of affected businesses and 22 are sharecroppers. In the resettlement sites, ten (10) businesses would be required to relocate and two (2) employees in these businesses will be affected. In the Area of Impact, 268 AP households will be entitled to income rehabilitation assistance, 207 of these households will also be entitled to the subsistence allowance and 119 of these households will further be entitled to the transport allowance, while all 180 households in the resettlement sites will be entitled to all three allowances.

Socio-Economic Information

Basic socio-economic information on AP was gathered through an Inventory of Losses (IOL) administered on 100% of AP households (n=591) and a Socio-Economic Survey (SES) administered on 20% of Affected Households (n=118) (Tables 2.1 and 2.2). At least one AP household was sampled for the SES, even for project components that impacted less than five AP households. The main purpose of collecting socio-economic information was to establish baseline data for monitoring project impacts on the living standards and productive capacity of AP, as well as address particular social and economic issues related to gender and ethnic minorities. Both surveys were administered by the Survey Teams from the Railway Public Utilities Company (RPUC) Vinh Phu and Yen Lao from March to June 2006.⁵

Legal and Policy Framework

The legal and policy framework relevant to resettlement for this Project are based on the relevant laws of the Government of Viet Nam (GoV) and ADB policies. The main national laws relevant to resettlement are Decree 17/2006/ND-CP, Decree 197/2004/ND-CP, Circular 116/2004/TT-BTC and the 2003 Land Law. The main ADB policies relevant to resettlement are the *Policy on Involuntary Resettlement* (1995), *Policy on Indigenous Peoples* (1998), *Policy on Gender and Development* (1998), *Policy on Public Communications* (2005) and the *ADB Accountability Mechanism* (2003).

Project Principles and Policies

To ensure the achievement of national laws and ADB policies, the Project has adopted specific principles and policies for resettlement. The Project's main principles are that resettlement will be avoided or minimized by exploring all viable options; all AP are entitled to compensation and other benefits to assist them to maintain or improve their

⁴ Agricultural land in residential areas is classified as "garden" land under Vietnamese legislation, usually with a higher compensation price than the highest category of agricultural land.

⁵ The survey at Lao Cai are due to be carried out in early May

pre-project living standards and production levels; lack of legal rights will not bar an AP from project entitlements; compensation shall be paid at least at replacement cost in current markets; efforts will be made to preserve existing social and cultural ties in the case of population relocation; planning and implementation of the Resettlement Plan will be carried out with the participation and consultation of AP; compensation will be paid out directly to AP prior to awarding civil contracts; and compensation and rehabilitation assistance will be carried out with respect for the needs of ethnic minorities, women and other vulnerable groups.

Eligibility and Entitlements

The eligibility cut-off date for the Project will be the date of the Detailed Measurement Survey. Project entitlements for all types of AP and all types of losses are defined in the Entitlement Matrix.

Public Consultation and Disclosure of the Resettlement Plan

Because the project's Area of Impact has many project sites with generally few AP households in each site, the first **Orientation Meeting** was carried out simultaneously with the IOL and SES and facilitated with 100% of AP households. The primary purpose of the first Orientation Meeting was to familiarize AP with basic information on the Project, policies and principles for resettlement, and the process for developing the Resettlement Plan. After the draft Resettlement Plan is complete, the Project will convene a second **Orientation Workshop**. One workshop will be held in Lao Cai Rail Station covering all project components within the Yen-Lao RPUC; and another workshop will be held at the Vinh Phu RPUC for all project components within its jurisdiction, as well as the fly-over bridge in Dong Anh under the Ha Thai RPUC. The primary purpose of the Orientation Workshop will be to disclose the Resettlement Plan and gain feedback from local authorities, AP representatives and other relevant stakeholders. The **Project Information Booklet** and the ADB's **Information Guide** on public consultation and the ADB accountability mechanism will also be circulated at the Orientation Workshop, as well as copies delivered to each of the project sites for circulation to all AP.

Comments and concerns raised at the Orientation Workshops will be incorporated into the final Resettlement Plan. Once the Resettlement Plan is approved, copies will be distributed to each RPUC and Provincial, District and Commune People's Committees with project components. The Resettlement Plan will be made available for public consultation by AP, in coordination with the RPUC or the relevant People's Committee. A copy of the final Resettlement Plan will also be posted on the ADB's website.

Grievance and Complaints

AP may address their grievances and complaints through the national system and/or the ADB's Accountability Mechanism. In the national system, the AP should begin by filing their complaint with the Commune People's Committee. If still unsatisfied with the resolution, then the AP may pursue their complaint through the District People's Committee, the provincial People's Committee and, finally, the national court system. All legal and administration fees for filing complaints will be waived for AP, except for cases filed in the national court system. The AP may also file their complaints directly with the ADB by writing a letter to the Office of the Special Project Facilitator (OSPF). Under the **ADB's Accountability Mechanism**, the OSPF has a responsibility to respond to the complaint, investigate it and pursue its resolution until all of the concerned parties are agreed on its termination.

Resettlement and Rehabilitation Strategy

The primary strategy for ensuring that AP are able to maintain or improve pre-project living standards and production levels is **replacement value compensation** in cash or in kind (e.g., replacement land) for all losses in land, fixed assets and income. In addition, **special assistance allowances** will be awarded to Severely Affected Persons (SAP) and vulnerable groups (as defined above) to support them in re-establishing their income sources and production bases. The specific application of funds designated for **income rehabilitation assistance** will be decided together with the relevant People's Committee and the eligible AP households, depending on the income opportunities available in the locality and the specific needs and interests of the AP. Examples of uses for these funds are training, micro-credit funds and start-up materials and equipment for new businesses. Because nearly all project sites counted less than five SAP, the specific strategy for their rehabilitation will be determined on a case-by-case basis together with local authorities during implementation of the Resettlement Plan.

However, a more elaborate rehabilitation strategy has been developed for project components at the new Rail Station at Mai Tung and Lao Cai Rail Station, as well as at both resettlement sites. Based on consultations with local authorities, RPMU and RPUC, the rehabilitation strategies in Mai Tung and Lao Cai qill emphasize replacement land where available, notably at Mai Tung; finding new employment, such as by assisting AP to secure jobs at the new Rail Station in Mai Tung or Industrial Zones currently being developed in Lao Cai; developing non-land based businesses, such as by reserving land spaces at the Rail Station for AP to build small service sector businesses; and integrating rehabilitation efforts with the social and economic development programs and policies of local government and NGOs present in the area, such as the Vocational Training and Support Centres in Lao Cai City.

The Lao Cai City People's Committee has also planned Resettlement Sites to accommodate the 90 AP households who will relocate from Lao Cai Rail Station. The People's Committee is currently preparing several different resettlement sites in and around Lao Cai City to accommodate displaced persons from various economic development projects, such as the upgrading of the Lao Cai Rail Station. The particular resettlement sites that will be used by the Project are located in Pho Moi Ward and Van Hoa Commune⁶ in Lao Cai City. The resettlement site in Pho Moi Ward will comprise an area of approximately 47,000 sq.m and it will be able to accommodate 110 households. The resettlement site in Van Hao Commune will comprise an area of approximately 61,000 sq.m and accommodate 220 households. The resettlement sites will provide each incoming household with a residential land plot of 80-100 sq.m, as well as make investments in road access, residential electricity, residential water supply and drainage. AP will be required to purchase the residential plots with their compensation money, if they so wish. The Lao Cai City People's Committee will engage in amortization schemes with households who may not have sufficient money to purchase a plot in the resettlement sites, whereby the AP would pay-off the purchase price over a period of time determined together with the People's Committee.

Gender and Ethnic Minority Issues

In accordance with ADB policy, special provisions have been made to help prevent discrimination against women and ethnic minorities in the implementation of the Resettlement Plan. Ethnic minorities were under-represented in the AP population, comprising only 5% (32 households) of AP households compared to the 14% that ethnic minorities comprise in the national population. Furthermore, no large groups of even

⁶ Note that Lao Cai City People's Committee is currently preparing two resettlement sites in Van Hao Commune. The one that is proposed for use by the Project is located along Road M12.

more than 10 (ten) ethnic minority AP households were found living together as a single community in the project's Area of Impact or the resettlement sites. Socio-economic data indicated that ethnic minority AP earned less annual income than the general AP population, but showed better educational achievement and security over land use than their Kinh counterparts. Women and girls comprised exactly 50% (1,179 AP) of the AP population, while single female-headed households comprised 14% (81 households) of AP households. Socio-economic data showed that female-headed households tended to earn less annual income and were less likely to have their lands registered under their names when compared with the general AP population. To address the special risks and needs facing ethnic minorities and women as a result of resettlement, **gender and ethnic minority specific actions** have been outlined in the Resettlement Plan.

Monitoring and Evaluation

Monitoring for the Resettlement Plan will be both internal and external. The RPMU will be responsible for **Internal Monitoring** together with the Provincial People's Committees through regular supervision of the Compensation and Resettlement Boards. The RPMU will also prepare quarterly and bi-annual Progress Report for submission to Vietnam Railways and the Ministry of Transport. Internal monitoring will be ongoing throughout the period of project implementation.

External Monitoring and Evaluation will be carried out by an Independent Monitoring Organization (IMO) contracted to the RPMU. An IMO can be a university, research institution, non-governmental organization (NGO) or other organization that is legally and administratively independent from government. The IMO will be primarily responsible for assessing whether AP have been able to maintain their pre-project living standards and productive levels, as well as whether resettlement activities have been implemented in quality, quantity and timeliness according to the Resettlement Plan. The IMO will report directly to the Ministry of Transport and the ADB. External monitoring will be carried out every six (6) months during the first two years of implementation of the Resettlement Plan and then every year until all AP have been relocated. The IMO will conduct further evaluations at the first, second and fifth years after land acquisition and relocation of AP. The IMO should also organization evaluation missions to coincide with the finalization of the updated Resettlement Plan, the period between payment of compensation and evacuation, and within three months of the AP's relocation to the resettlement sites.

Institutional Organization and Implementation Schedule

The main institution responsible for executing the Resettlement Plan will be the RPMU, under the supervision of Vietnam Railways and the Ministry of Transport and in close coordination with the relevant Provincial People's Committees. The Provincial People's Committees will establish the Compensation and Resettlement Boards at the provincial and district levels for updating and implementation of the Resettlement Plan. The Project will also hire one international and one national Resettlement Specialist with expertise in ethnic minority issues, as well as one international Gender and Social Development specialist.

Implementation Schedule and Budget

The envisioned timeframe for implementing the Resettlement Plan is 10 months. All costs for resettlement will be financed by the Government of Vietnam. The total cost for implementing the Resettlement Plan is estimated at 82.6 billion VND (approx. 5.1 million USD), of which 37.2 billion VND (approx. 2.3 million USD) is for compensation costs in the project's Area of Impact and 9.4 billion VND (approx. 0.6 million USD) for compensation costs in the resettlement sites.

1 SCOPE OF LAND ACQUISITION AND MINIMIZATION OF RESETTLEMENT

1.1 UPGRADING THE YEN VIEN - LAO CAI RAILWAY LINE

With loan assistance from the Asian Development Bank (ADB), the Government of Viet Nam is currently preparing the Kunming-Haiphong Transport Corridor Project (TA 4050-VIE) to upgrade and rehabilitate transport infrastructure from the Haiphong Port in Vietnam to Kunming City in Yunnan Province in the People's Republic of China. The project sub-component for upgrading the Yen Vien – Lao Cai Railway Line will upgrade a section of railway line that traverses 285 km in a northwestern direction from Yen Vien Station near Hanoi to Lao Cai Station on the border with China (hereafter referred to as the "Project"). This section of railway line passes through the four provinces of Lao Cai, Yen Bai, Phu Tho and Vinh Phuc and the City of Hanoi. Line improvements will consist mainly of:

- Selective improvement of the horizontal and vertical alignment and track layout;
- Stabilization of embankments and sliding slopes;
- Improvements of track-work including turnouts;
- Upgrading of bridges;
- Improvements of safety of selected at-grade level crossings;
- Upgrading of stations and passing loops for train loads up to 1,200 tons and train length of up to 400m; and
- Modernization of auxiliary facilities and provision of maintenance equipment and facilities, as well as rolling stock.

Overall responsibility for the Project is with the Railway Project Management Unity (RPMU) in Vietnam Railways, working in close collaboration with the Railway Public Utility Companies (RPUC) for Ha Hai, Ha Thai, Vinh Phu and Yen Lao (see Map 1). A Feasibility Study for the Project is currently in process, which includes engineering surveys, railway operations analyses, social and environmental impact assessments, resettlement plans, preliminary design and costing, economic and financial appraisal, prioritization and selection of engineering alternatives, and recommendations.

The Resettlement Plan has been prepared for all Project Components requiring land acquisition (i.e., **Area of Impact**), as well as for two resettlement sites in Lao Cai City that will be used by the Project and that will also impact on persons currently using land there (see Table 1.1). All impacts covered by this resettlement plan are permanent, except for impacts on businesses and employment which may be permanent or temporary. All other temporary impacts will be determined during completion of detailed technical designs and they will be covered directly in the civil works contracts. Sketches of resettlement impacts for project components in the Area of Impact are available in Annex 1.

Table 1.1: Project Components and Resettlement Sites Requiring Land Acquisition

Location	Works	Unit	Amount
HANOI CITY			
Dong Anh District	Fly-over bridge	Item	1
VINH PHUC PROVINCE			
Thach Loi Rail Station	New loop	Item	1
Huong Canh Rail Station	New loop	Item	1
PHU THO PROVINCE			
Viet Tri Rail Station	Extension of passing loop	m	96
Phu Duc Rail Station	Extension of passing loop	m	98
Tien Kien Rail Station	New loop	Item	1
Chi Chu Rail Station	New loop	Item	1
Vu En Rail Station	New loop	m	1
Mai Tung Commune	New station	Item	2
YEN BAI PROVINCE			
Co Phuc Rail Station	Extension of passing loop	m	56
Mau A Rail Station	Extension of passing loop	m	110
Mau Dong Rail Station	New loop	Item	1
Lam Giang Rail Station	Extension of passing loop	m	100
Lang Thip Rail Station	New loop	Item	1
Van Phu Rail Station	New loops	Item	3
Realignment km169-171	Realignment	m	2,973
LAO CAI PROVINCE			
Thai Van Rail Station	Extension of passing loop	m	93
Thai Nien Rail Station	Extension of 3 passing loops	m	563
Xuan Giao Rail Station	Extension of passing loop	m	80
Lao Cai Rail Station	New loops	Item	9
Realignment km283-291	Realignment	m	6,073
Pho Moi Ward	Resettlement Site	sq.m	46,700
Van Hoa Commune	Resettlement Site	sq.m	61,000

1.2 SCOPE OF LAND ACQUISITION AND RESETTLEMENT

1.2.1 Affected Persons

Affected Persons (AP) are persons who will lose land, fixed assets or income as a result of land acquisition by the Project. Two main groups of AP were identified for the Project, (1) AP in the project's Area of Impact and (2) AP in the resettlement sites. A total of 1,772 AP in 411 households were identified in the Area of Impact (Table 1.2), while 606 AP in 180 households were identified in the resettlement sites (Table 1.3). Hence, **the total number of AP for the Project is 2,378 AP in 591 households**. All AP will be equally entitled to cash compensation and other project benefits, as defined by the Entitlement Matrix in Chapter 5.

Severely Affected Persons (SAP) are AP that will lose more than 10% of their productive assets or they are required to relocate from their residences. A total of 207 SAP households were identified in the project's Area of Impact, of which 93 households will lose more than 10% of their productive assets and 122 households will relocate⁷;

⁷ The two categories of SAP are non-exclusive, meaning that one household can belong to both categories. Hence, the total SAP is less than the sum of SAP in the two categories.

while all 180 households in the resettlement sites were identified as SAP. Households required to relocate will receive special assistance allowances for income rehabilitation, subsistence in transition, and transport, as described in Chapter 5. Households losing more than 10% of productive assets will receive special assistance allowances for income rehabilitation and subsistence in transition.

Vulnerable Groups are persons from a particular social or economic population group who face elevated risks of impoverishment or other negative impacts as a result of resettlement. The vulnerable groups identified in the project's Area of Impact and resettlement sites were 32 ethnic minority households, 84 single female-headed households with dependents, 25 poor households⁸, eight (8) households whose primary income earner is elderly or physically disabled, and twelve (12) households who are landless or whose current tenure over their lands is insecure. All AP households from a vulnerable group will receive a special assistance allowance for income rehabilitation, as described in Chapter 5. Specific actions have also been devised for ethnic minority and gender issues, as described in Chapter 9 and 10.

⁸ The number of poor households is probably under-estimated for Lao Cai Rail Station because most of the households there are not registered with Lao Cai City's People's Committee and, hence, would not show up on the People's Committee list of poor households. However, all of these households are considered as Severely Affected Persons and, therefore, will receive Income Rehabilitation Assistance the same as AP households from vulnerable groups.

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Table 1.2: Affected Persons in Area of Impact (No.)

Area of Impact	Persons	Households	Vulnerable Groups						SAP	
			Sgl.FHH	Disabled	Elderly	Poor	Landless	EM	>10%	Relocating
HANOI	231	50	3	0	0	0	0	0	2	3
Dong Anh	231	50	3	0	0	0	0	0	2	3
VINH PHUC	20	4	0	0	0	0	0	0	4	0
Thach Loi	11	2	0	0	0	0	0	0	2	0
Huong Canh	9	2	0	0	0	0	0	0	2	0
PHU THO	420	82	2	0	0	4	0	0	49	3
Viet Tri	21	4	1	0	0	1	0	0	3	0
Phu Duc	6	1	0	0	0	0	0	0	0	0
Tien Kien	13	3	0	0	0	0	0	0	0	0
Chi Chu	50	9	0	0	0	0	0	0	5	0
Vu En	45	7	0	0	0	1	0	0	4	0
Mai Tung	285	58	1	0	0	2	0	0	37	3
YEN BAI	518	129	48	1	4	9	4	4	25	26
Co Phuc	39	8	1	0	0	0	1	1	0	0
Mau A	32	8	6	0	0	0	0	3	4	1
Mau Dong	28	7	2	0	0	0	0	0	0	0
Lam Giang	24	6	2	0	0	0	0	0	6	0
Lang Thip	102	21	5	0	1	7	2	0	2	2
Van Phu	69	23	8	1	2	1	1	0	0	17
Realignment km169-171	224	56	24	0	1	1	0	0	13	6
LAO CAI	583	146	25	0	2	12	8	23	13	90
Thai Van	11	2	1	0	0	0	0	0	1	0
Thai Nien	11	2	1	0	0	1	0	1	0	0
Xuan Giao	46	7	0	0	0	1	4	5	3	0
Lao Cai	329	92	16	0	0	6	0	10	1	90
Realignment km283-291	186	43	7	0	2	4	4	7	8	0
TOTAL	1772	411	78	1	6	25	12	27	93	122

Table 1.3: Affected Persons in Resettlement Sites (No.)

Resettlement Sites	Persons	Households	Vulnerable Groups						SAP	
			Sgl.FHH	Disabled	Elderly	Poor	Landless	EM	>10%	Relocating
Pho Moi	155	50	4	0	0	0	0	3	4	50
Van Hoa	451	130	2	0	1	0	0	2	6	130
TOTAL	606	180	6	0	1	0	0	5	10	180

1.2.2 Land Acquisition

The main types of land loss as a result of the Project are agricultural land, residential land, garden or pond land, forestland and common lands. By Vietnamese legislation, there is no commercial land. Land used for commercial activities is categorized as residential land, although the compensation price for residential land in commercial areas is usually higher. In the project's Area of Impact, 131 households will lose agricultural land, of which 43 will be marginally affected ($\leq 10\%$ loss) and 88 will be severely affected ($> 10\%$ loss) (Table 1.4). A total of 227 households will lose residential land, of which 105 will reorganize on their remaining land and 122 will relocate. Of the households required to relocate, 74% are from Lao Cai Rail Station. A total of 88 AP households will lose garden land and 13 households will lose forest land. Two areas in Van Phu will also lose common land, for whom the proprietors are a local school and factory. Only 5 households were renting land and 18 households were identified as illegal land-users.

The Project will use two resettlement sites currently being prepared by the Lao Cai City People's Committee for AP households relocating from Lao Cai Rail Station. The establishment of the resettlement sites will impact on another 180 households, all of whom will relocate⁹ (Table 1.6). All of them will lose residential land and 114 households will also lose garden land.

In the project's Area of Impact, the total area of land acquired from AP households will be approximately 155,000 sq.m, consisting of 29,000 sq.m of residential land, 42,000 sq.m of agricultural land, 60,000 sq.m of garden¹⁰ or pond land, 19,000 sq.m of forestland and 5,000 sq.m of common land (Table 1.5). In the resettlement sites, the total area of acquired land will be approximately 69,000 sq.m, consisting of 16,000 sq.m of residential land and 53,000 sq.m of garden land (Table 1.7). The project components that will require the most land are the Lao Cai Rail Station (15,000 sq.m), which is entirely residential land mixed with garden and pond land; and the new station at Mai Tung (30,000 sq.m) and realignments sections km 169-171 (46,000 sq.m) and km 283-292 (45,000 sq.m), which are mostly agricultural land. Substantial areas of land will also be acquired for the resettlement sites, particularly in Van Hoa (60,000 sq.m)

⁹ AP currently located in the area designated for the resettlement sites will be given first priority for acquiring residential land plots in the resettlements sites (i.e., same general area). However, they are still defined as relocating AP because the resettlement site will require the complete reorganization of current land use in those sites.

¹⁰ Agricultural land in residential areas is classified as "garden" land under Vietnamese legislation, usually with a higher compensation price than the highest category of agricultural land.

Table 1.4: Land Loss by Affected Person in Area of Impact (No.)

Area of Impact	Agricultural Land			Residential Land			Garden/ Pond	Forest	Common Lands	Renters	Illegal Users
	Marginal	Severe	Total	Reorganize	Relocate	Total					
HANOI	0	0	0	44	3	47	3	0	0	0	0
Dong Anh	0	0	0	44	3	47	3	0	0	0	0
VINH PHUC	0	4	4	0	0	0	0	0	0	0	4
Thach Loi	0	2	2	0	0	0	0	0	0	0	2
Huong Canh	0	2	2	0	0	0	0	0	0	0	2
PHU THO	26	49	75	9	3	12	12	0	0	0	7
Viet Tri	0	3	3	1	0	1	2	0	0	0	2
Phu Duc	1	0	1	0	0	0	0	0	0	0	0
Tien Kien	0	0	0	3	0	3	1	0	0	0	1
Chi Chu	4	5	9	0	0	0	1	0	0	0	3
Vu En	2	4	6	0	0	0	0	0	0	0	0
Mai Tung	19	37	56	5	3	8	8	0	0	0	1
YEN BAI	12	23	35	40	26	66	39	5	2	5	0
Co Phuc	8	0	8	0	0	0	0	0	0	0	0
Mau A	4	4	8	0	1	1	0	0	0	0	0
Mau Dong	0	0	0	2	0	2	5	0	0	2	0
Lam Giang	0	6	6	0	0	0	0	0	0	0	0
Lang Thip	0	0	0	14	2	16	3	0	0	3	0
Van Phu	0	0	0	3	17	20	0	0	2	0	0
Realignment km169-171	0	13	13	21	6	27	31	5	0	0	0
LAO CAI	5	12	17	12	90	102	34	8	0	0	7
Thai Van	1	1	2	1	0	1	1	0	0	0	0
Thai Nien	0	0	0	2	0	2	1	0	0	0	0
Xuan Giao	4	3	7	1	0	1	0	0	0	0	0
Lao Cai	0	0	0	0	90	90	6	0	0	0	7
Realignment km283-291	0	8	8	8	0	8	26	8	0	0	0
TOTAL	43	88	131	105	122	227	88	13	2	5	18

Table 1.5: Area of Land Acquisition in Area of Impact (sq.m)

Area of Impact	Residential	Agricultural						Garden /Pond	Forest	Common Land	Renter	Illegal	TOTAL
		I	/Pond	III	IV	V	TOTAL						
HANOI	2,052	0	0	0	0	0	0	1,071	0	0	0	0	3,123
Dong Anh	2,052	0	0	0	0	0	0	1,071	0	0	0	0	3,123
VINH PHUC	0	0	0	0	0	0	0	0	0	0	0	322	0
Thach Loi	0	0	0	0	0	0	0	0	0	0	0	212	0
Huong Canh	0	0	0	0	0	0	0	0	0	0	0	110	0
PHU THO	1,945	2,775	14,717	191	0	0	17,682	11,932	0	0	0	879	31,559
Viet Tri	0	8	0	0	0	0	8	18	0	0	0	282	26
Phu Duc	0	92	0	0	0	0	92	0	0	0	0	0	92
Tien Kien	31	0	0	0	0	0	0	108	0	0	0	108	139
Chi Chu	0	462	0	191	0	0	653	105	0	0	0	439	758
Vu En	0	519	496	0	0	0	1,015	0	0	0	0	0	1,015
Mai Tung	1,914	1,694	14,221	0	0	0	15,915	11,701	0	0	0	50	29,530
YEN BAI	10,361	12,780	1,160	849	0	0	14,789	24,827	3,200	4,991	91	0	58,169
Co Phuc	0	0	0	849	0	0	849	0	0	0	0	0	849
Mau A	50	0	759	0	0	0	759	0	0	0	0	0	809
Mau Dong	76	0	0	0	0	0	0	841	0	0	75	0	917
Lam Giang	0	80	401	0	0	0	481	0	0	0	0	0	481
Lang Thip	1,199	0	0	0	0	0	0	716	0	0	16	0	1,915
Van Phu	2,651	0	0	0	0	0	0	0	0	4,991	0	0	7,642
Realign. km169-171	6,385	12,700	0	0	0	0	12,700	23,270	3,200	0	0	0	45,555
LAO CAI	14,918	8,350	906	400	0	260	9,916	21,763	15,449	0	0	753	62,046
Thai Van	165	0	0	0	0	260	260	350	0	0	0	0	775
Thai Nien	119	0	0	0	0	0	0	238	0	0	0	0	357
Xuan Giao	0	0	906	0	0	0	906	0	0	0	0	0	906
Lao Cai	10,704	0	0	0	0	0	0	4,554	0	0	0	753	15,258
Realign. Km283-291	3,930	8,350	0	400	0	0	8,750	16,622	15,449	0	0	0	44,751
TOTAL	29,276	23,905	16,782	1,440	0	260	42,387	59,593	18,649	4,991	91	1,954	154,896

Table 1.6: Land Loss by Affected Person in Resettlement Sites (No.)

Resettlement Sites	Agricultural Land			Residential Land			Garden/ Pond	Forest	Common Lands	Renters	Illegal Users
	Marginal	Severe	Total	Reorganize	Relocate	Total					
Pho Moi	0	0	0	0	50	50	7	0	0	0	0
Van Hao	0	0	0	0	130	130	107	0	0	2	0
TOTAL	0	0	0	0	180	180	114	0	0	2	0

Table 1.7: Area of Land Acquisition in Resettlement Sites (sq.m)

Area of Impact	Residential	Agricultural						Garden /Pond	Forest	Common Land	Renter	Illegal	TOTAL
		I	II	III	IV	V	TOTAL						
Pho Moi	4,017	0	0	0	0	0	0	4,300	0	0	0	0	8,317
Van Hoa	12,234	0	0	0	0	0	0	48,635	0	0	520	0	60,869
TOTAL	16,251	0	0	0	0	0	0	52,935	0	0	520	0	69,186

1.2.3 Impacts on Houses and Structures

In the Area of Impact, 177 houses will be affected, of which 49 houses will be partially affected and 128 houses will be left structurally unsound or entirely affected (Tables 1.8 and 1.13). Another 163 houses will be impacted in the resettlement sites, all of which will be entirely affected.

A total of 554 structures will be impacted in the project's Area of Impact and 379 structures in the resettlement sites (Tables 1.9 and 1.14). The project component that will affect the most structures is at Lao Cai Rail Station (287), while improvements at Dong Anh (42), Mai Tung (49), Lang Thip (32) Van Phu (84) and realignment section km 169-171 (30) will also impact on many structures. The resettlement sites will impact on 91 structures in Pho Moi and 288 structures in Van Hoa.

1.2.4 Impacts on Trees and Crops

An approximate total area of 45,000 sq.m of annual crops and 8,600 trees will be impacted in the Area of Impact (Table 1.10) and an approximate 6,000 sq.m of annual crops and 2,900 trees in the resettlement sites (Table 1.15). Not surprisingly, the project components impacts on most crops and trees will be in the rural areas of Mai Tung (16,000 sq.m crops, 579 trees) and the realignment sections km 169-171 (7,800 sq.m crops, 658 trees) and km 283-292 (54,290 sq.m crops, 2,258 trees). The resettlement site in Van Hoa will impact on 6,000 sq.m of crops and 2,534 trees.

1.2.5 Impacts on Businesses and Income

In the Area of Impact, businesses were identified only in Dong Anh, Tien Kien, Mau Dong, Lang Thip and Lao Cai. A total of 46 businesses will be affected, of which 41 will be able to re-build on the AP's remaining land and five (5) would be required to relocate (Table 1.11). Of these 46 businesses, eleven (11) are already legally registered. The employment of 40 persons will also be affected as a result of the Project, of which 18 are employees of affected businesses and 22 are sharecroppers. In the resettlement sites, ten (10) businesses were identified (Table 1.16). All of them would be required to relocate and two (2) employees in these businesses will be affected. None of the businesses in the resettlement sites were legally registered at the time of the Inventory of Losses.

1.2.6 Special Assistance Allowances

Special assistance allowances will be provided to SAP and vulnerable groups to help eliminate risks of impoverishment as a result of resettlement. **Income rehabilitation assistance** will be awarded in kind at a value of 3,000,000 VND for one male and one female member in each household that is an SAP or vulnerable group. Income rehabilitation assistance may take the form of training, preferential credit, start-up materials or other technical or material needs, as described below. An allowance for **subsistence** in transition will be awarded in cash or in kind to SAP households at a minimum value of 30 kg rice per household member for six months. A **transport** allowance will be awarded in cash to relocating households at a value ranging from two (2) to five (5) million VND, as determined by the Provincial People's Committee. In the Area of Impact, 268 AP households will be entitled to income rehabilitation assistance, 207 of these households will also be entitled to the subsistence allowance and 119 of these households will further be entitled to the transport allowance (Table 1.12). All 180 households in the resettlement sites will be entitled to all three allowances (Table 1.17).

Table 1.8: Impacts on Houses in Area of Impact (No.)

Area of Impact	Category of House								
	C3		C4		Temp		TOTAL		
	Pt	En	Pt	En	Pt	En	Pt	En	TT
HANOI	3	4	10	3	0	1	13	8	21
Dong Anh	3	4	10	3	0	1	13	8	21
PHU THO	1	2	0	3	1	1	2	6	8
Tien Kien	1	0	0	0	0	0	1	0	1
Mai Tung	0	2	0	3	1	1	1	6	7
YEN BAI	6	2	20	10	5	0	31	12	43
Lang Thip	0	0	0	10	0	0	0	10	10
Van Phu	5	1	8	0	3	0	16	1	17
Realignment km169-171	1	1	12	0	2	0	15	1	16
LAO CAI	0	6	1	83	2	13	3	102	105
Thai Van	0	1	0	0	0	0	0	1	1
Thai Nien	0	0	1	0	0	0	1	0	1
Lao Cai	0	5	0	82	0	9	0	96	96
Realignment km283-291	0	0	0	1	2	4	2	5	7
TOTAL	10	14	31	99	8	15	49	128	177

Table 1.9: Impacts on Structures in Area of Impact

Area of Impact	Bath-room	Court/Floor		Fence			House Fndtn	Grave	Hut	Kitchen	Kitchen Counter	Roof	Animal Stables	Toilet	Wall	Water Piping	Water Tank	Well		TOTAL
		Tiled	Concr.	Steel	Living	Concr												Drilled	Ground	
		sq.m	sq.m	sq.m	sq.m	sq.m		Item	sq.m	sq.m	sq.m	sq.m	sq.m	sq.m	sq.m	m	cu.m	m	Item	No.
HANOI	0	0	1,135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42
Dong Anh	0	0	1,135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42
VINH PHUC	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Thach Loi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Huong Canh	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
PHU THO	18	98	305	16	0	24	0	1	17	425	3	0	179	232	76	445	11	0	5	63
Viet Tri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Phu Duc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Tien Kien	2	0	0	16	0	0	0	0	0	7	0	0	0	0	0	0	0	0	1	8
Chi Chu	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Vu En	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	375	0	0	0	2
Mai Tung	14	98	305	0	0	24	0	0	17	419	3	0	179	232	76	70	11	0	4	49
YEN BAI	56	34	266	0	38	1	60	0	0	465	0	133	127	277	370	0	162	3	19	146
Co Phuc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mau A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mau Dong	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lam Giang	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lang Thip	4	34	246	0	38	1	60	0	0	8	0	133	64	22	88	0	3	3	1	32
Van Phu	52	0	0	0	0	0	0	0	0	149	0	0	37	57	282	0	147	0	14	84
Realign km169-171	0	0	20	0	0	0	0	0	0	308	0	0	26	199	0	0	12	0	4	30
LAO CAI	17	0	702	17	12	0	0	0	27	547	0	59	104	377	113	0	19	0	55	300
Thai Van	0	0	42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Thai Nien	0	0	24	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Xuan Giao	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lao Cai	17	0	616	17	0	0	0	0	27	513	0	59	84	377	113	0	19	0	52	287
Realign km283-291	0	0	20	0	0	0	0	0	0	34	0	0	20	0	0	0	0	0	2	9
TOTAL	91	132	2,407	58	49	25	60	1	44	1,437	3	192	410	886	559	445	192	3	79	554

Table 1.10: Impacts on Crops and Trees in Area of Impact

Area of Impact	Annual Crops (sq.m)								Trees			
	Rice	Corn	Sugar Cane	Cas-sava	Sweet Potato	Herbs /Leaves	Gourd /Vines	TOTAL	Fruit	Timber/ Bamboo	Shade/ Décor.	TOTAL
HANOI	0	0	0	0	0	0	0	0	39	70	5	114
Dong Anh	0	0	0	0	0	0	0	0	39	70	5	114
VINH PHUC	212	0	0	0	0	50	0	262	4	9	0	13
Thach Loi	212	0	0	0	0	0	0	212	0	0	0	0
Huong Canh	0	0	0	0	0	50	0	50	4	9	0	13
PHU THO	15,570	105	0	35	492	1,785	104	18,091	586	826	291	1,703
Viet Tri	0	0	0	0	217	65	0	282	2	0	0	2
Phu Duc	0	0	0	0	0	0	0	0	0	0	0	0
Tien Kien	0	0	0	0	0	0	0	0	3	2	0	5
Chi Chu	621	0	0	0	193	330	0	1,144	2	22	0	24
Vu En	164	0	0	0	0	268	0	432	0	512	0	512
Mai Tung	14,785	105	0	35	82	1,122	104	16,233	579	290	291	1,160
YEN BAI	4,553	300	300	4,102	70	744	100	10,169	931	2,097	6	3,014
Co Phuc	542	0	0	0	0	0	0	542	0	0	0	0
Mau A	719	0	0	0	0	0	0	719	0	0	0	0
Mau Dong	0	0	0	562	0	0	0	562	22	253	0	275
Lam Giang	332	0	0	0	0	0	0	332	15	0	0	15
Lang Thip	0	0	0	20	0	0	0	20	114	13	6	113
Van Phu	0	0	0	0	0	204	0	204	122	0	0	122
Realignment km169-171	2,960	300	300	3,520	70	540	100	7,790	658	1,831	0	2,489
LAO CAI	9,856	150	2	3,531	0	2,638	154	16,330	2,686	1,154	0	3,780
Thai Van	200	0	0	0	0	5	0	205	10	20	0	30
Thai Nien	0	0	2	325	0	0	0	327	8	2	0	10
Xuan Giao	906	0	0	0	0	0	0	906	0	0	0	0
Lao Cai	0	0	0	56	0	543	4	603	410	30	0	440
Realignment km283-291	8,750	150	0	3,150	0	2,090	150	14,290	2,258	1,102	0	3,300
TOTAL	30,190	555	302	7,668	562	5,216	358	44,851	4,246	4,147	302	8,624

Table 1.11: Impacts on Businesses and Employment in Area of Impact

Area of Impact	Businesses (No. AP HH)																								Employment (No. pers.)				
	Store /Shop		Hair Salon		Mech- anic		Resta- urant		Guest House		Café/ Karaoke		Phar- macy		Fruit Stand		Phone /Elec.		Other		TOTAL			Lic.					
	B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L	tt	B	L	T	P	S	tt
HANOI	6	1	0	0	3	0	0	0	1	0	1	0	1	0	0	0	0	0	18	1	30	2	32	7	0	10	0	0	10
Dong Anh	6	1	0	0	3	0	0	0	1	0	1	0	1	0	0	0	0	0	18	1	30	2	32	7	0	10	0	0	10
PHU THO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	2	2	0	8	0	1	9
Tien Kien	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	2	2	0	8	0	1	9
YEN BAI	3	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	4	0	9	2	11	0	2	0	0	21	21
Mau Dong	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
Lang Thip	3	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4	0	8	2	10	0	2	0	0	21	21
LAO CAI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0
Lao Cai	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0
TOTAL	9	3	0	0	3	0	2	0	1	0	1	0	1	0	0	0	0	0	24	2	41	5	46	9	2	18	0	22	40

Note: B=Rebuild; L=Relocate; T=Temporarily Affected Employees; P=Permanently Affected Employees; S=Sharecroppers; tt=Total

Table 1.12: Special Assistance Allowances in Area of Impact (No. AP HH)

Area of Impact	Income Rehab Assistance		
		Subsistence	
			Transport
HANOI	6	3	0
Dong Anh	6	3	0
VINH PHUC	4	4	0
Thach Loi	2	2	0
Huong Canh	2	2	0
PHU THO	52	50	3
Viet Tri	4	3	0
Phu Duc	0	0	0
Tien Kien	0	0	0
Chi Chu	5	5	0
Vu En	4	4	0
Mai Tung	39	38	3
YEN BAI	83	48	26
Co Phuc	3	0	0
Mau A	8	5	1
Mau Dong	2	0	0
Lam Giang	6	6	0
Lang Thip	13	2	2
Van Phu	17	16	17
Realign km169-171	34	19	6
LAO CAI	123	102	90
Thai Van	2	1	0
Thai Nien	2	0	0
Xuan Giao	6	3	0
Lao Cai	90	90	90
Realign km283-291	23	8	0
TOTAL	268	207	119

Table 1.13: Impacts on Houses in Resettlement Sites (No.)

Resettlement Sites	Category of House								
	C3		C4		Temp		TOTAL		
	Pt	En	Pt	En	Pt	En	Pt	En	TT
Pho Moi	0	0	0	39	0	5	0	44	44
Van Hoa	0	6	0	61	0	52	0	119	119
TOTAL	0	6	0	100	0	57	0	163	163

Table 1.14: Impacts on Structures in Resettlement Sites

Resettlement Sites	Bath-room	Court/Floor		Fence			House Fndtn	Grave	Hut	Kitchen	Kitchen Counter	Roof	Animal Stables	Toilet	Wall	Water Piping	Water Tank	Well		TOTAL
		Tiled	Concr.	Steel	Living	Concr												Drilled	Ground	
		sq.m	sq.m	sq.m	sq.m	sq.m												m	Item	
Pho Moi	0	0	61	0	0	0	0	0	0	230	0	0	71	168	0	0	9	0	5	91
Van Hoa	52	0	1,302	0	0	0	0	0	0	1,284	0	192	626	35	0	0	49	0	56	288
TOTAL	52	0	1,363	0	0	0	0	0	0	1,514	0	192	697	203	0	0	58	0	61	379

Table 1.15: Impacts on Crops and Trees in Resettlement Sites

Resettlement Sites	Annual Crops (sq.m)								Trees			
	Rice	Corn	Sugar Cane	Cas-sava	Sweet Potato	Herbs /Leaves	Gourd /Vines	TOTAL	Fruit	Timber/ Bamboo	Shade/ Décor.	TOTAL
Pho Moi	0	0	0	0	0	1,300	0	1,300	178	2	13	193
Van Hoa	0	0	0	0	0	4,697	0	4,697	2,534	219	3	2,756
TOTAL	0	0	0	0	0	5,997	0	5,997	2,712	221	16	2,949

Table 1.16: Impacts on Businesses and Employment in Resettlement Sites

Resettlement Sites	Businesses (No. AP HH)																								Employment (No. pers.)				
	Store /Shop		Hair Salon		Mech- anic		Resta- urant		Guest House		Café/ Karaoke		Phar- macy		Fruit Stand		Phone /Elec.		Other		TOTAL			Lic.					
	B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L	B	L	tt	B	L	T	P	S	tt
Pho Moi	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	0	0	0	0	0	0
Van Hoa	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	6	6	0	0	2	0	0	2
TOTAL	0	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	5	0	10	10	0	0	2	0	0	2	

Note: B=Rebuild; L=Relocate; T=Temporarily Affected Employees; P=Permanently Affected Employees; S=Sharecroppers; tt=Total

Table 1.17: Special Assistance Allowances in Resettlement Sites (No. Ap HH)

Resettlement Sites	Income Rehab Assistance		
		Subsistence	Transport
Pho Moi	50	50	50
Van Hoa	130	130	130
TOTAL	180	180	180

1.3 MINIMIZATION OF RESETTLEMENT

Resettlement impacts were minimized, first, by selecting the engineering designs that affected the least number of persons, while providing the most operational gains in railway line safety and efficiency. For example, track extensions and passing loops could have been added on either side of the Rail Station, but site surveys by project consultants determined which areas impacted the least impacts on persons and communities. In Huong Canh Rail Station, a protective wall was designed to prevent the railway line's embankment from encroaching onto a rural road. Second, the Project will generally apply a policy of attrition for clearing the Construction Corridor (7m from edge of embankment) and Safety Corridor (15m from edge of embankment), unless certain structures or land-uses create special safety risks to line operation. This means that persons and their properties will *not* be evacuated from these corridors for project components. However, persons currently using land in these corridors will retain a future option for compensation and new persons will not be allowed to move into the corridors. This approach was deemed appropriate for the national context, as clearing of the Construction and Safety Corridors is inconsistent along the entirety of the railway line. The main exceptions will be for the sections of realignment, where clearing the Construction Corridor was deemed necessary for the safety of operations.

2 SOCIO-ECONOMIC INFORMATION

2.1 SURVEY METHODOLOGY

Basic socio-economic information on AP was gathered through the Inventory of Losses (IOL) (Annex 2) that was administered on 100% of AP households (n=591); and the Socio-Economic Survey (SES) (Annex 3) that was administered on 20% of Affected Households (n=118) (Tables 2.1 and 2.2). The respondents for the SES were randomly sampled at intervals of every fifth AP household. At least one AP household was sampled for the SES, even for project components that impacted less than five AP households. The main purpose was to establish baseline data for monitoring and evaluating project impacts on the living standards and productive capacity of AP, as well as address particular social and economic issues related to gender and ethnic minorities. Information specifically relevant to the latter is presented in chapters 9 and 10.

Both surveys were administered by the Survey Teams from the Railway Public Utilities Company (RPUC) Vinh Phu and Yen Lao, carried out from March to June 2006.¹¹ The resettlement specialists prepared data collection formats for the surveys and then facilitated half-day training for the Survey Teams, followed up by field-testing at one or two stations:

RPUC	Dates	Field-Testing Sites
Vinh Phu	March 16-17	Thach Loi, Huong Canh
Yen Lao	March 20-21	Co Phuc

All data and statistical analyses were conducted by the resettlement specialists, using a database in MS Excel. Note that only a portion of the baseline data collected and analysed from the SES is presented here to give a general picture of the social and economic conditions of AP.

¹¹ The survey at Lao Cai are due to be carried out in early May

Table 2.1: SES Sample of AP Households in Area of Impact

Area of Impact	AP pop.	AP Sample	
	#	#	%
HANOI	50	10	20
Dong Anh	50	10	20
VINH PHUC	4	2	50
Thach Loi	2	1	50
Huong Canh	2	1	50
PHU THO	82	19	23
Viet Tri	4	1	25
Phu Duc	1	1	100
Tien Kien	3	1	33
Chi Chu	9	2	22
Vu En	7	2	29
Mai Tung	58	12	21
YEN BAI	129	25	19
Co Phuc	8	2	25
Mau A	8	2	25
Mau Dong	7	2	29
Lam Giang	6	2	33
Lang Thip	21	4	19
Van Phu	23	4	17
Realign km169-171	56	9	16
LAO CAI	146	34	23
Thai Van	2	1	50
Thai Nien	2	1	50
Xuan Giao	7	1	14
Lao Cai	92	23	25
Realign km283-291	43	8	19
TOTAL	411	80	19

Table 2.2: SES Sample of AP Households in Resettlement Sites

Resettlement Sites	AP pop.	AP Sample	
	#	#	%
Pho Moi Ward	50	11	22
Van Hoa Commune	130	27	21
TOTAL	180	38	21

2.2 SOCIO-ECONOMIC INFORMATION

2.2.1 General Project Area

The existing railway section from Yen Vien to Lao Cai has a total length of 285 km with 36 stations, including one station currently under construction. The railway section traverses 88 communes and 88 districts through the provinces of Lao Cai, Yen Bai, Vinh Phuc, Phu Tho and the City of Hanoi. The combined population along the line is estimated at 2.4 million, equivalent to 9% of the combined Red River Delta and North East Regions population or 3% of the national population. For more information on the general socio-economic conditions of the project area, please consult the Project's Socio-Economic Report.

2.2.2 Demographic Information

Average size of AP households was 4.3 persons (Table 2.3). AP households averaged 2.7 labourers, 1.0 children under 15 years of age and 0.4 elderly persons over 55 years of age per household. Hence, the average ratio of labourers (ages 15-55) to dependents in AP households was 1.7, where a ratio of one signifies one labourer for one dependent. In Vinh Phuc and Yen Bai provinces, AP households had, on average, at least 2 labourers per dependent.

Table 2.3: No. Household Members and Age Distribution in AOI

Province/City	TT years	15-55 years	<15 years	>55 Years	Ratio Lab:Dep
HANOI	4.6	2.9	1.4	0.4	1.6
VINH PHUC	5.0	3.5	0	1.5	2.3
YEN BAI	4.0	2.4	0.9	0.4	2.0
LAO CAI	4.0	2.6	1.0	0.3	1.8
TOTAL	4.3	2.7	1.0	0.4	1.9

The average age of the household head in AP households was 46 years in 2006 (Table 2.4). Seventy (70) percent of household heads were male and another 70% also did not graduate from high school, while 27% of households had completed secondary school and only 2% had attended a university or college. AP households in Dong Anh (Hanoi City) had the highest proportion of household heads that had attended a university or college at 12%, while no AP household head in Lao Cai or Vinh Phuc provinces had attended a university or college.

Table 2.4: Age, Gender and Education Level of AP Household Heads

Province/City	Age	Gender	Education Level (%)			
	Avg	% Male	ES	<HS	HS	Uni
HANOI	50	70	0	54	34	12
VINH PHUC	57	80	0	75	0	0
PHU THO	50	70	0	76	23	1
YEN BAI	44	70	1	73	25	1
LAO CAI	45	60	2	69	29	0
TOTAL	46	70	1	70	27	2

ES=Elementary School; SS=Secondary School; Uni=University or College

Ethnicity of AP households and the population of female AP are discussed in Chapters 9 and 10.

2.2.3 Land Holdings and Tenure

Because AP land holdings pass through both urban and rural areas, they have been presented here for each project component (Table 2.5) and resettlement site (Table 2.6). Average agricultural land holdings per AP household was 916 sq.m. However, this figure gives only a partial picture of the real situation because it includes AP households in both rural and urban areas, who are not necessarily dependent on large or any areas of agricultural land for their livelihoods. The average residential land holding per AP household was 319 sq.m the project's Area of Impact and 107 sq.m in the resettlement sites.

Table 2.5: AP Land Holdings in Area of Impact

Area of Impact	Agricultural		Residential	
	Total	Per HH	Total	Per HH
HANOI	0	0	2,454	245
Dong Anh	0	0	2,454	245
VINH PHUC	270	135	370	70
Thach Loi	270	270	70	70
Huong Canh	0	0	300	300
PHU THO	26,534	1,397	4,972	80
Viet Tri	0	0	80	80
Phu Duc	0	0	330	330
Tien Kien	0	0	192	192
Chi Chu	2,760	1,380	400	200
Vu En	2,880	1,440	370	185
Mai Tung	20,894	1,741	3,600	300
YEN BAI	18,703	748	9,610	415
Co Phuc	1,540	770	830	415
Mau A	957	478	510	255
Mau Dong	768	384	960	480
Lam Giang	738	369	595	298
Lang Thip	400	100	974	244
Van Phu	0	0	467	117
Realign km169-171	14,300	1,589	5,274	586
LAO CAI	27,760	816	8,085	400
Thai Van	360	360	400	400
Thai Nien	600	600	910	910
Xuan Giao	1,700	1,700	700	700
Lao Cai	0	0	2,425	105
Realign km283-291	25,100	3,138	3,650	456
TOTAL	73,267	916	25,491	319

Table 2.6: AP Land Holdings in Resettlement Sites

Resettlement Sites	Agricultural		Residential	
	Total	Per HH	Total	Per HH
Pho Moi Ward	0	0	822	75
Van Hoa Commune	0	0	3,233	120
TOTAL	0	0	4,055	107

The major proportion of AP households has or is in the process of obtaining a Land Use Rights Certificate (LURC) for their residential land (74%) and agricultural land (95%) (Table 2.7). One hundred percent, or close to, of AP households had LURC in Hanoi, Phu Tho and Yen Bai. Lower proportions of AP households had LURC in Lao Cai, Vinh Phuc and Yen Bai for agricultural lands. The lowest proportion of AP households without an LURC was in Lao Cai Province for residential lands (26%). This is largely

because the majority of AP households at Lao Cai Rail Station are without an LURC (13%), although the majority claim to possess a written contract of purchase (87%).

Table 2.7: Land Tenure of AP households

Province/City	Residential					Agricultural				
	LURC	Written	Verbal	Renting	Illegal	LURC	Written	Verbal	Renting	Illegal
HANOI	100%	0%	0%	0%	0%					
VINH PHUC	50%	50%	0%	0%	0%	0%	0%	0%	0%	25%
PHU THO	95%	5%	0%	0%	0%	100%	0%	0%	0%	0%
YEN BAI	100%	0%	0%	0%	0%	56%	0%	7%	0%	0%
LAO CAI	38%	59%	0%	0%	0%	26%	0%	0%	0%	0%
TOTAL	74%	26%	0%	0%	0%	95%	0%	3%	0%	3%

Note: The very few AP households that are renting land or illegal users in the project's Area of Impact (see Chapter 1) do not necessarily show up in this data set because the sample comprised only 20% of AP households.

2.2.4 Occupations and Living Standards

The main occupations of the majority of AP households (50%) were land-based, that is, based on agriculture or forestry (Table 2.8). A lesser proportion earned a primary or secondary income from businesses and services (13 and 18%, respectively). Other important primary or secondary sources of income were from industry and handicrafts, labourer or factory worker, civil servant, retirement pension or other.

Table 2.8: Main and Secondary Occupations of AP

Province/City	Agr-For		Ind-HCr		Bus-Ser		Lab-Fac		Civ Ser		Retired		Other	
	P	S	P	S	P	S	P	S	P	S	P	S	P	S
HANOI	2%	0%	0%	0%	68%	6%	2%	0%	10%	2%	16%	12%	2%	4%
VINH PHUC	25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	75%	0%	0%	100%
PHU THO	80%	9%	1%	0%	5%	0%	1%	0%	4%	13%	9%	9%	0%	70%
YEN BAI	75%	23%	0%	9%	6%	33%	4%	7%	9%	2%	3%	19%	2%	7%
LAO CAI	30%	20%	1%	8%	5%	8%	14%	8%	5%	4%	5%	4%	39%	48%
TOTAL	50%	16%	0%	6%	13%	18%	7%	5%	7%	6%	7%	16%	15%	33%

P=Primary; S=Secondary

The average annual income for AP households was approximately 21 million VND, while average annual expenses were approximately 18 million VND per year (Table 2.9). In most cases, however, AP households reported to spend more than they earned, as is evident for Vinh Phuc, Phu Tho and Yen Bai. The apparent discrepancy in these figures is probably due to the difficulty for AP to estimate accurately. Hence, figures on income and expenses should be interpreted as rough approximations only. Clearly, incomes and expenses were highest in Hanoi and then progressively decreased the further along the railway line from Hanoi.

Table 2.9: Average Annual Income and Expense of AP households

Province/City	Income	Expenses
	VND (000)	VND (000)
HANOI	65,180	45,240
VINH PHUC	21,600	29,500
PHU THO	17,909	27,014
YEN BAI	14,013	17,110
LAO CAI	14,758	10,593
TOTAL	21,354	17,720

Most AP households (85%) never lacked rice throughout the year, while some (12%) lacked rice for one to three months per year (Table 2.10). In Vinh Phuc, 50% of AP households were shown to lack rice for four to six months per year. However, in real numbers, this amounted to one household because the sample size for Vinh Phuc was only 2 households.

Table 2.10: Months per year AP households Lack Rice

Province / City	1-3 mo.	4-6 mo.	7-9 mo.	10-12 mo.	Never
HANOI	0%	0%	0%	0%	100%
VINH PHUC	0%	50%	0%	0%	50%
PHU THO	5%	0%	0%	0%	95%
YEN BAI	24%	5%	0%	0%	71%
LAO CAI	12%	0%	0%	0%	88%
TOTAL	12%	2%	0%	0%	85%

Most AP households (70%) also never borrow money to meet basic needs, although some households live off of borrowed money for less than two months per year (9%) or up to 5 months per year (10%) (Table 2.11). Twenty-six (26) percent of AP households in Phu Tho reported living off of borrowed money for more than 10 months per year.

Table 2.11: Months per year AP households Borrow Money for Basic Needs

Province/City	<2 mo.	3-5 mo.	6-10 mo.	>10 mo.	Never
HANOI	0%	0%	0%	0%	100%
VINH PHUC	0%	0%	50%	0%	50%
PHU THO	5%	11%	5%	26%	53%
YEN BAI	14%	14%	5%	0%	67%
LAO CAI	12%	12%	3%	0%	74%
TOTAL	9%	10%	5%	6%	70%

Among a list of common material possessions that included mosquito nets, electric fan, gas stove, refrigerator, radio, television, motorcycle and car, 64% of AP households owned 4-6 of these items, while 26% owned more than seven of them and 10% owned three or less (Table 2.12).

Table 2.12: Average Number of Selected Possessions in AP households

Province/City	0-3	4-6	7+
HANOI	0%	20%	80%
VINH PHUC	0%	50%	50%
PHU THO	5%	79%	16%
YEN BAI	12%	88%	0%
LAO CAI	15%	53%	32%
TOTAL	10%	64%	26%

AP houses were built primarily out of brick and cement (59%) (Table 2.13). In Hanoi and Vinh Phuc, 100% of AP houses were built out of brick and cement, while in Yen Bai and Lao Cai, about half of AP houses were built out of wood. In Lao Cai, 15% of houses were made of mud and bamboo, which was primarily at Lao Cai Rail Station and along the realignment sections km283-292.

Table 2.13: Building Materials of AP Houses

Province/City	Brick & Cement	Wood	Mud & bamboo	Scrap materials
HANOI	100%	0%	0%	0%
VINH PHUC	100%	0%	0%	0%
PHU THO	89%	11%	0%	0%
YEN BAI	45%	55%	0%	0%
LAO CAI	36%	48%	15%	0%
TOTAL	59%	35%	6%	0%

All AP households were connected to the national electricity grid, while 46% collect wood for fuel at an average distance of 6 km from their homes (Table 2.14). The areas with the largest proportion of fuelwood collectors were in the rural areas in Vinh Phuc (50%), Phu Tho (74%) and Yen Bai (60%).

Table 2.14: Electric Power and Fuelwood Collection in AP households

Province/ City	Electric Power			Fuelwood	
	Nat. Grid	Priv. Gen.	None	HH	Avg. km
HANOI	100%	0%	0%	0%	--
VINH PHUC	100%	0%	0%	50%	15
PHU THO	100%	0%	0%	74%	10
YEN BAI	100%	0%	0%	60%	2
LAO CAI	100%	0%	0%	21%	4
TOTAL	100%	0%	0%	46%	6

All or nearly all AP households got their water supply for drinking and residential-use from their own wells in Hanoi (100%), Vinh Phuc (100%), Phu Tho (89%), Yen Bai (100%) and Lao Cai (59%) (Table 2.15). Some AP households were connected to a water piping system in Phu Tho (11%) and Lao Cai (38%). A few AP households in Lao Cai (3%) retrieved water from a public well.

Table 2.15: Water Supply for AP households

Province/City	Drinking Water					Residential-Use Water				
	Piping System	Home Well	Water body	Rain	Public Well	Piping System	Home Well	Water body	Rain	Public Well
HANOI	0%	100%	0%	0%	0%	0%	100%	0%	0%	0%
VINH PHUC	0%	100%	0%	0%	0%	0%	100%	0%	0%	0%
PHU THO	11%	89%	0%	0%	0%	11%	89%	0%	0%	0%
YEN BAI	0%	100%	0%	0%	0%	0%	100%	0%	0%	0%
LAO CAI	38%	59%	0%	0%	3%	38%	59%	0%	0%	3%
TOTAL	17%	82%	0%	0%	1%	17%	82%	0%	0%	1%

2.2.5 Health and Education

Only two (2) of the AP households (2%) sampled by the SES reported a child suffering from malnutrition, while eight (8) households (7%) reported a household member with a chronic illness and one (1) household (1%) reported a physically disabled household member. However, a remarkable proportion of AP households reported symptoms of chronic ailments, particularly for headache (46%) and stomachache (29%) (Table 2.16). Although data on symptoms is not useful for diagnosing the health status of the AP population, it will be useful to monitor potential changes in health conditions before and after resettlement.

Table 2.16: Symptoms of Chronic Ailments among AP households

Province/City	Lung Infection	Headache	Eye or Earache	Chest Pains	Stomach Ache	Skin Irritation
HANOI	0%	20%	0%	10%	0%	0%
VINH PHUC	0%	0%	50%	0%	0%	0%
PHU THO	5%	37%	32%	0%	47%	0%
YEN BAI	8%	68%	4%	24%	32%	8%
LAO CAI	6%	32%	3%	3%	18%	6%
TOTAL	6%	46%	11%	10%	29%	5%

In the large majority of AP households, a household member visited a medical clinic or hospital less than five (5) times in the past six months (Table 2.17). Only 5% of households in Phu Tho and 27% in Yen Bai reported visiting a medical clinic or hospital more than five (5) times in the past six months.

Table 2.17: Number of Times AP visited Medical Services in Past 6 months

Province/City	<5	5-10	10-20	>20
HANOI	100%	0%	0%	0%
VINH PHUC	100%	0%	0%	0%
PHU THO	89%	5%	0%	5%
YEN BAI	73%	27%	0%	0%
LAO CAI	100%	0%	0%	0%
TOTAL	91%	8%	0%	1%

2.2.6 Access to Public Services and Infrastructure

AP households lived, on average, within 1.6km of a primary school, 2.2 km of a junior secondary school and 6.9 km of a senior secondary school (Table 2.18). They lived within 2.0 km of a medical clinic, 3.0 km of a hospital and 2.0 km of a post office; 2.1 km of the Commune People's Committee and 9.4 km of the District People's Committee; and 2.7 km of a paved road, 2.9 km of a provincial road, 1.6 km of a local market and 4.0 of a larger market or trading centre.

Table 2.18: Average Distance to Public Services and Infrastructure for AP households (km)

Province/City	Primary School	Jr. Sec. School	Sr. Sec. School	Med Clinic	Hospital	Post Off.	Commune	District	Paved Rd	Prov. Rd	Market	Trade Ctr.
HANOI	1.7	2.2	3.4	1.9	3.4	2.3	1.7	2.2	0.1	0.1	2.2	2.3
VINH PHUC	1.8	1.8	1.0	3.0	7.0	3.3	3.8	6.5	2.3	2.3	1.5	2.5
PHU THO	1.1	2.3	3.6	1.3	8.9	0.9	1.2	9.0	2.6	2.4	1.4	3.5
YEN BAI	1.5	1.7	11.1	2.3	13.0	2.2	2.6	14.9	4.0	5.5	1.0	5.8
LAO CAI	1.4	1.8	4.9	1.6	3.9	1.7	1.7	5.1	1.8	1.4	1.6	2.4
TOTAL	1.6	2.2	6.9	2.0	8.4	2.0	2.1	9.4	2.7	2.9	1.6	4.0

3 LEGAL AND POLICY FRAMEWORK

The Legal and Policy Framework relevant to land acquisition and resettlement for this Project are based on the laws of the Government of Viet Nam (GoV), notably the 2003 Land Law, Decree 197/2004/ND-CP and Circular 116/2004/TT-BTC, and relevant provincial legislation; and relevant policies of the Asian Development Bank, notably its Policy on Resettlement (1995).

3.1 NATIONAL LAWS ON LAND ACQUISITION AND RESETTLEMENT

There are several national laws guiding land acquisition and resettlement in Vietnam. The main ones are:

- a. The Land Law No. 13/2003/QH11, providing Viet Nam with a comprehensive land administration law. The 2003 Land Law supersedes earlier versions of 1987 and 1993.
- b. Decree No. 181/2004/ND-CP, guiding the implementation of the Land Law.
- c. Decree No. 197/2004/ND-CP, on compensation, rehabilitation and resettlement in the event of land recovery by the State.
- d. Circular 116/2004/TT-BTC, guiding the implementation of Decree 197.
- e. Decree No. 17/2006/ND-CP, amending Decree No. 181/2004/ND-CP, Decree No. 197/2004/ND-CP and other decrees.
- f. Decree No. 188/2004/ND-CP, specifying methods for land pricing and land price frameworks in the event of land recovery by the State.
- g. Circular 114/2004/TT-BTC, guiding the implementation of Decree 188.
- h. Decree No. 17/2003/ND-CP, promulgating the regulation on the exercise of democracy in communes, including requirements for consultation with and participation of people in communes.
- i. Decree No. 17/2001/ND-CP, on the management and use of Official Development Assistance (ODA).
- j. Direction 17/2004/CT-TTg, on speeding up the disbursement of ODA capital source

The 2003 Land Law is a comprehensive land administration law that gives people access to land through a system of land-user rights that is similar to private ownership. The main points relevant to land acquisition and resettlement are:

- a. The State reserves the right to allocate land and determine its usage;
- b. Families and individuals who have been allocated land have the right to exchange their land for another holding, transfer their right to use land to another party, and rent, bequeath, or use their land as collateral;
- c. The People's Committee at all levels (viz., province, district and commune) is responsible for land administration in its jurisdiction and managing land use;
- d. The State reserves the right to recover land for the purposes of defence security, national interest, and economic development, in which case the land user is entitled to compensation;
- e. The land user must be fully informed of the reasons for land recovery, time and plan for evacuation, and the overall schemes for compensation, ground clearance and resettlement land prior to land recovery by at least 90 days for agricultural land and 180 days for non-agricultural.

Decree 197 and Circular 116 are the main legal instruments for guiding regulating compensation and rehabilitation entitlements as a result of land recovery by the State. The provisions set out in Decree 197 are mostly consistent with ADB policy. Where differences may arise with the policies of international projects, Decree 197 states that

“where the international agreements which Vietnam has signed or acceded to contain provisions different from those of this Decree, the provisions of such international agreements shall apply” (Article 1, para. 2).

3.2 ADB POLICY ON INVOLUNTARY RESETTLEMENT

The main documents relevant to ADB policy on resettlement are:

1. Policy on Involuntary Resettlement (1995) and Section F2 in the Operations Manual (2003);
2. Policy on Indigenous Peoples (1998) and Section F3 in the Operations Manual (2003);
3. Policy on Gender and Development (1998) and Section C2 in the Operations Manual (2003);
4. Bank's Public Communications Policy (2005) and Section L3 in the Operations Manual (2003); and
5. Bank's Inspection Function Policy (1996) and Section L1 in the Operations Manual on the “ADB Accountability Mechanism” (2003).

The aim of the ADB *Policy on Involuntary Resettlement* is to avoid or minimize the impacts on people, households, businesses and others affected by the land acquisition required by the project. Where resettlement is not avoidable, the overall goal of the ADB policy is to compensate and assist affected people *to restore their living standards to levels equal to, if not better than, that which they had before the project*.

The main objectives and principles of the policy on involuntary resettlement are as follows:

- a. Involuntary resettlement should be avoided where feasible.
- b. Where population displacement is unavoidable, it should be minimized by exploring all viable project options.
- c. People unavoidably displaced should be compensated and assisted, so that their economic and social future would be generally as favourable as it would have been in the absence of the Project.
- d. Affected people (AP) should be informed fully and consulted in resettlement and compensation options.
- e. Existing social and cultural institutions of AP who must relocate should be supported and used to the greatest extent possible, and AP should be integrated economically and socially into host communities.
- f. Lack of legal rights to the assets lost or adversely affected will not prevent AP from entitlement to compensation and rehabilitation measures. Those without legal title to land occupied or used by them (e.g., non-titled AP) will be entitled to various kinds of resettlement assistance to improve their socio-economic status.
- g. Particular attention must be paid to the needs of the poorest AP and other vulnerable groups that may be at high risk of impoverishment. This may include AP without legal title to land or other assets, households headed by females, the elderly or disabled and other vulnerable groups, particularly ethnic minority peoples. Appropriate assistance must be provided to help them improve their socio-economic status.
- h. All stages of resettlement identification, planning, and management will ensure that gender concerns are incorporated, including gender-specific consultation and information disclosure. This includes special attention to guarantee women's assets, property, and land-use rights; and to ensure the restoration of their income and living standards.

- i. As far as possible, involuntary resettlement should be conceived and executed as part of the project.
- j. The full costs of resettlement and compensation should be included in the presentation of project costs and benefits.
- k. Cost of resettlement and compensation may be considered for inclusion in the Bank loan financing for the project.

The ADB *Policy on Indigenous Peoples* defines indigenous or ethnic minority peoples as “those with a social or cultural identity distinct from the dominant or mainstream society, which makes them vulnerable to being disadvantaged in the processes of development.” The Policy recognizes the potential vulnerability of ethnic minorities in the development process; that ethnic minorities must be afforded opportunities to participate in and benefit from development equally with other segments of society; and have a role and be able to participate in the design of development interventions that affect them.

The impacts of a project on ethnic minorities are considered significant if they positively or negatively (i) affect their customary rights of use and access to land and natural resources; (ii) change their socioeconomic status; (iii) affect their cultural and communal integrity; (iv) affect their health, education, livelihood, and/or social security status; and/or (v) alter or undermine the recognition of indigenous knowledge. In the event of significant negative impacts, an ethnic minority development plan (EMDP) must be prepared¹² to address relevant social issues of ethnic minority communities, and propose measures and strategies to ensure that project interventions are:

- a. consistent with the needs and aspirations of affected ethnic minorities;
- b. compatible in substance and structure with affected ethnic minorities’ culture and social and economic institutions;
- c. conceived, planned, and implemented with the informed participation of affected communities, including effective approaches to information dissemination and communication with ethnic minority communities;
- d. equitable in terms of development efforts and impact; and,
- e. do not impose the negative effects of development on ethnic minorities, but, if such effects are unavoidable, ensures appropriate and acceptable compensation.

The EMDP is prepared by the Government and submitted to ADB as part of the project appraisal process. It must identify the costs of the EMDP as an integral part of the overall cost of a project; and, set out an implementation schedule for recommended measures that is coordinated with the overall implementation schedule of the project.

In the event of a project that is expected to have limited impacts on ethnic minority peoples, the Government must incorporate specific actions into relevant plans such as the resettlement plan to address these impacts; specific actions will also be identified in the Report and Recommendations to the President (RRP) for ADB. The purpose of specific actions is to avoid any unnecessary distinctions or inequalities between ethnic minority and other project beneficiaries, and may take the form of:

- a. incorporating ethnic minorities (who might be excluded from the project) into the project beneficiary group,
- b. incorporating ethnic minorities’ specific needs (that may not be addressed by the project) into the project plan, and

¹² In the case of more limited negative impacts, specific actions to address ethnic minority issues must be included in the Report and Recommendation to the President (RRP) and in related plans such as the Resettlement Plan.

- c. a common community action plan where ethnic minority groups live with the non-indigenous peoples in the same project location.

The ADB *Policy on Gender and Development* adopts gender mainstreaming as a key strategy for promoting gender equity, and for ensuring that women participate in and that their needs are explicitly addressed in the decision-making process for development activities. For projects that have the potential to have substantial gender impacts, a gender plan is prepared to identify strategies to address gender concerns and the involvement of women in the design, implementation and monitoring of the project.

Public Communications Policy requires that the borrower or project sponsor makes available to AP:

- a. Draft Resettlement Plan before appraisal;
- b. Final Resettlement Plan after the Plan's approval; and
- c. Revised Resettlement Plan after revisions following from changes in the Project or technical designs, as appropriate

Information from these booklets should also be summarized and made available to AP in the form of brochures, leaflets or booklets in local languages. The ADB will also make these documents publicly available, such as by posting them on the internet.

The ADB *Accountability Mechanism* was designed to provide local communities or affected people with a formal mechanism for requesting an inspection or review of alleged policy violations in ADB-assisted projects. The Accountability Mechanism consists of two complementary functions, the consultation phase and the compliance review phase. In the consultation phase, the Special Project Facilitator will respond to the allegations of locally affected people through a range of informal and flexible methods and report to the ADB President. In the compliance review phase, the Compliance Review Panel will investigate these allegations and make specific recommendations directly to the Board to ensure conformity with ADB policy.

The ADB has also prepared an *Information Guide to Public Consultation and the ADB Accountability Mechanism*, which has been designed for local people as an easy-to-read instruction booklet on how to file complaints and grievances through the ADB Accountability Mechanism.

3.3 RECONCILIATION OF GOVERNMENT AND ADB POLICIES

With the promulgation of the 2003 Land Law and the adoption of Decrees No. 197/2004/ND-CP and No. 188/2004/ND-CP, the policies and practices of the Government of Vietnam (GoV) have become more consistent with the ADB policies for involuntary resettlement. Nonetheless, provisions and principles adopted in the Resettlement Plans for the Project will supersede the provisions of relevant decrees currently in force in Viet Nam wherever a gap exists, as provided for under Decree No. 197/2004/ND-CP.

Key strategies to reconcile differences include:

- (i) Non-legal land users: AP that are not eligible to obtain use rights to the land they occupy, are not entitled under the GoV framework to compensation for land and may not be entitled to compensation or full compensation for property on affected land. Under the Project policy, AP without legal or legalizable land use rights will not be compensated for land, but will receive compensation for lost crops, houses and other assets on that land at full replacement cost. Moreover, non-legal AP that

do not have other agricultural or non-agricultural land (as the case may be) will be allowed to continue to use or occupy any remaining land until the local authorities allocate other land and provide temporary or lease rights to AP.

- (ii) **Tenants:** Under the GoV framework, AP that rent State-owned housing may receive no compensation if they do not accept to relocate to available resettlement site housing, or may receive cash compensation that is less than 100% of their current rental rate; tenants in privately-owned housing may not receive any assistance beyond a removal allowance; and, AP renting affected land are not entitled to compensation, assistance or resettlement. Under the Project, all AP renting affected housing will be offered the choice of replacement housing in a resettlement site; or, if they choose to self-relocate, a rental allowance at current rental rates for 6 months and assistance to find alternate housing. AP renting affected land will receive cash compensation based on the replacement cost.
- (iii) **Small, non-registered businesses:** AP that operate small, non-registered businesses are not entitled to any assistance under the GoV framework. Under the Project, all AP will be compensated and/or assisted to restore living standards to pre-project levels in a manner consistent with their requirements.
- (iv) **Compensation pricing for affected assets:** The GoV framework recognizes the principle of compensation at rates equal to the value of land use rights under normal market conditions. The annual PPC prices for different types of land are used to establish compensation. Decree No. 17/2006/ND-CP stipulates that if the PPC prices are not close to market values, the PPC must determine an appropriate market value for compensation rates. As experience demonstrates that PPC prices are frequently well below actual market prices, the Project will also conduct replacement cost surveys and determine project-specific compensation rates equivalent to current market rates in different parts of the project area. In addition, compensation paid for affected assets will include the costs of all applicable taxes and fees and, in the case of structures, will not include any depreciation or deduction for salvaged materials.
- (v) **Income restoration:** Severely affected AP are defined under the GoV framework as those losing more than 30% of their productive assets. Under the Project, in order to facilitate the capacity of AP to restore living standards to pre-project levels, income restoration assistance will be available to severely affected AP that lose 10% or more of productive assets.
- (vi) **Vulnerable groups and ethnic minorities:** The GoV framework for compensation, assistance and resettlement acknowledges the special needs of poor households for assistance, but does not explicitly recognize other vulnerable groups due to ethnicity or other criteria. Under the Project, specific measures will be defined to ensure that all vulnerable groups are assisted to restore living standards to pre-project levels and in a manner that is culturally sensitive and appropriate.
- (vii) **Consultation, public disclosure and grievance redress:** The Project will strengthen existing provisions of the GoV framework in these areas to ensure that all AP are fully consulted and informed in a timely manner, have appropriate opportunities to participate in decisions regarding compensation and resettlement and secure, transparent means to lodge and redress complaints.
- (viii) **Monitoring:** The Project will establish indicators and procedures to ensure effective, transparent monitoring of resettlement implementation and, using independent monitors, to evaluate whether the project achieves resettlement objectives.

4 PROJECT PRINCIPLES AND POLICIES

4.1 PRINCIPLES

The Project Principles guiding resettlement planning and implementation are:

- a. Involuntary resettlement and loss of land, structures and other assets and incomes should be avoided or minimized by exploring all viable options.
- b. All AP are entitled to be compensated for their lost assets, incomes and businesses at replacement cost and provided with rehabilitation measures sufficient to assist them to improve or at least maintain their pre-project living standards, incomes and productive capacity.
- c. Lack of legal rights to the assets lost will not bar the AP from entitlement to such compensation and rehabilitation measures.
- d. Compensation for affected assets shall be provided at replacement cost.
- e. In the case of population relocation, efforts shall be made so that the existing social and cultural institutions of the people being resettled and host community should be maintained to the extent possible.
- f. Preparation of the Resettlement Plan and its implementation are to be carried out with participation and consultation of affected people.
- g. Schedule and budget for resettlement planning and implementation must be incorporated into the overall Project budget.
- h. Payment of compensation of affected assets and any resettlement to new locations must be completed prior to the award of civil works contracts for the Project and rehabilitation measures must also be in place, although not necessarily completed because they may be ongoing activities.
- i. Compensation and rehabilitation assistance for ethnic minorities, single female headed-households with dependents, households whose primary income-earners is elderly or disabled, and other vulnerable groups will be carried out with respect for their specific needs and cultural values.

4.2 POLICIES

For the implementation of these principles, the following project policies will apply:

- a. Land acquisition and resettlement will be avoided or minimized by identifying alternatives in Project designs that have the least adverse impact on populations.
- b. Where displacement is unavoidable, AP will be fully compensated and assisted to maintain or improve pre-project living standards and productive capacity.
- c. Compensation and/or rehabilitation assistance will be provided to AP who, as a result of the Project, are adversely affected in relation to their:
 - Living standards and productive capacity,
 - User rights and/or ownership over land and assets,
 - Businesses and/or employment incomes,
 - Place of residence, including for renters,
 - Social and cultural activities, and/or
 - Other losses that may be identified during resettlement planning.
- d. The Detailed Measurement Survey that was carried out during resettlement planning will determine the eligibility cut-off date for Project entitlements.
- e. AP will be directly involved in planning, implementing, monitoring and evaluating the Resettlement Plan.

- f. Compensation rates for land, houses and structures, and trees and crops will be calculated at replacement cost in local markets.
- g. Project entitlements will include not only immediate losses, but also foregone income opportunities, training for occupational change and special assistance to income losses during training programs.
- h. Where the main source of income of affected populations is land-based (e.g., farming), compensation by replacement land will be a priority, depending on local land availability and the individual preferences of each Affected Household.
- i. Replacement lands should be identified within the same District and they should be of equal or better (productive) value with similar access to public services and infrastructure as the land acquired by the Project.
- j. Where land or structures are partially impacted but whose remaining area is considered as non-viable, the AP will maintain the option to have the entire land plot or structure acquired by the Project.
- k. AP will be fully informed about the Project and consulted about their options, notably through the first and second Orientation Workshops, the Project Information Booklet and public dissemination of the draft and final versions of the Resettlement Plan.
- l. Adequate budget will be committed and available to cover the costs of land acquisition and resettlement, including costs for the administrative and surveying functions of the local Compensation and Resettlement Boards.
- m. Civil works contracts will not be awarded until compensation awards have been paid out in full directly to AP, along with other Project entitlements.
- n. AP will be assisted with transport and transition assistance during relocation.
- o. Host communities to displaced persons will also be involved in resettlement planning and sufficient measures will be taken to avoid or minimize potential negative social and environmental impacts caused by population displacement.
- p. Institutional arrangements for the resettlement process will be identified in the Resettlement Plan and they will be put in place prior to implementation, which will include adequate provisions for supervision, monitoring and evaluation
- q. An Independent Monitoring Organization (e.g., NGO, university or research institute) will be hired by the Project to monitor the resettlement process and the IMO will submit its reports directly to the Ministry of Transport and the Asian Development Bank.

5 ELIGIBILITY AND ENTITLEMENTS

5.1 ELIGIBILITY CUT-OFF DATE

The eligibility cut-off date for the Project will be the date of the Detailed Measurement Survey¹³. All persons who encroach on the Project Area after the eligibility cut-off date will *not* be entitled to compensation or other Project entitlements.

5.2 ENTITLEMENTS

The Entitlement Matrix presents a complete breakdown of project entitlements for all types of Affected Persons (AP) and all different levels of impacts.

Table 5.1: Entitlement Matrix

TYPE & LEVEL OF IMPACT	ENTITLED PERSONS	COMPENSATION POLICY	IMPLEMENTATION ISSUES
A. AGRICULTURAL LAND			
A.1: Temporarily Affected Agricultural Land			
Loss of use of the land for a period less than one year	User with permanent right (legal and legalizable)	Cash compensation for loss of crops and trees at current market prices AND compensation for loss of net income from subsequent crops that cannot be planted for the duration of the lease <u>AND</u> restoration of land to its previous or better quality <u>BUT</u> no compensation for land if returned to original user, although the Project will pay rent to AP during the temporary use of AP' land	If Project impacts last more than one year, AP have an option to (a) continue the temporary use arrangements or (b) permanent land acquisition at full replacement cost.
	User with lease or temporary right	Cash compensation for loss of crops and trees at current market prices AND compensation for loss of net income from subsequent crops that cannot be planted for the duration of the lease <u>AND</u> restoration of land to its previous or better quality <u>BUT</u> no compensation for land if returned to original user, although the Project will pay rent to AP during the temporary use of AP' land	
	Non-legal user	Cash compensation for loss of standing crops and trees at current market prices AND compensation for loss of net income from subsequent crops that cannot be planted for the duration of the lease <u>BUT</u> no compensation for land	

¹³ Note that eligibility cut-off date described in the Resettlement Plan contradicts the information given to AP during the first Orientation Meeting. However, this inconsistency has been corrected at the second Orientation Workshop.

TYPE & LEVEL OF IMPACT	ENTITLED PERSONS	COMPENSATION POLICY	IMPLEMENTATION ISSUES
	Land-Use/ Management Organization	Cash compensation for loss of standing crops and trees at current market prices <u>AND</u> compensation for loss of net income from subsequent crops that cannot be planted for the duration of the lease <u>AND</u> restoration of land to its previous or better quality <u>BUT</u> no compensation for land, although Project will pay rent to AP during the temporary use of AP' land	
A.2 Permanently Affected Agricultural Land			
Less than or equivalent to 10% total agricultural land or productive assets (i.e. Marginally AP)	User with permanent right (legal and legalizable)	Cash compensation for loss of standing crops and trees at current market prices <u>AND</u> Cash compensation for acquired land at full replacement cost.	
	User with lease or temporary right	Cash compensation for loss of standing crops and trees at current market prices <u>AND</u> Cash compensation for loss of net income for the remaining leased/assigned period <u>OR</u> Cash assistance at 30% of the replacement cost of the affected land, whichever is higher	
	Non-legal user	Cash compensation for loss of standing crops and trees at current market prices <u>BUT</u> no compensation for land	- Non-legal users will NOT be required to evacuate remaining plot of land
	Land-Use/ Management Organization	Cash assistance at 70% replacement cost of the affected land which will go to the commune budget after 30% of replacement cost of affected land is paid directly to AP <u>AND</u> cash compensation for loss of standing crops and trees at current market prices	
More than 10% of total agricultural land or productive assets (i.e., Severely AP)	User with permanent right (legal and legalizable)	Cash compensation for loss of standing crops and trees at current market prices <u>AND</u> special assistance allowances (see Item I.5 below) <u>AND</u> Full title to land of equal area and productivity acceptable to AP in the same or surrounding communes <u>OR</u> Cash compensation for acquired land at full replacement cost	Land-for-land compensation within the same or neighboring commune will be given priority

TYPE & LEVEL OF IMPACT	ENTITLED PERSONS	COMPENSATION POLICY	IMPLEMENTATION ISSUES
	User with lease or temporary right	Cash compensation for loss of standing crops and trees at current market prices <u>AND</u> special assistance allowances <u>AND</u> Cash compensation for lost income from the affected land for the remaining lease/assigned period <u>OR</u> Cash assistance at 30% of the replacement cost of the affected land, whichever is higher	Commune and District authorities will assist AP to secure replacement land with similar leasing or temporary use arrangements
	Non-legal user	Cash compensation for loss of standing crops and trees at current market prices <u>BUT</u> no compensation for land	Landless/Vulnerable AP will not be displaced until the District People's Committee and CARB has either (1) allocated replacement land for them or (2) established some kind of mechanism, such as a long-term amortization plan, to ensure that AP are not left without land or productive assets
	Land-Use/ Management Organization	Cash assistance at 70% replacement cost of the affected land which will go to the commune budget after 30% of replacement cost of affected land is paid directly to AP <u>AND</u> Cash compensation for loss of standing crops and trees at current market prices.	Commune and District authorities will assist LMOs to secure replacement land with similar leasing or temporary use arrangements
B. RESIDENTIAL AND COMMERCIAL LAND¹⁴			
<i>B.1. Temporarily Affected Residential and/or Commercial Land</i>			
Any type	All users	No compensation for land, although the Project will pay rent to AP during the temporary use of AP' land.	
<i>B.2. Permanently Affected Residential and/or Commercial Land</i>			
a) With no houses or major structures built thereon	User with permanent right (legal and legalizable)	Cash compensation for land lost at full replacement cost <u>OR</u> replacement land of equal value and acceptable to the AP	Land-for-land compensation within the same or neighboring commune will be given priority
	User with lease or temporary rights	Cash assistance at 30% of the replacement cost of the affected land.	
b) With houses or major structures built thereon with	User with permanent right (legal and legalizable)	Cash compensation for land lost at full replacement cost <u>AND</u> cash or assistance to repair or rebuild the structure in case of partial impact. <u>AND</u> special assistance allowances	

¹⁴ Commercial land is not recognized by Vietnamese legislation (see Chapter 2), but for the purposes of the Entitlement Matrix it has been listed here together with residential land.

TYPE & LEVEL OF IMPACT	ENTITLED PERSONS	COMPENSATION POLICY	IMPLEMENTATION ISSUES
remaining land sufficient to rebuild upon	User with lease or temporary right	Cash assistance at 30% of the replacement cost of the affected land. <u>AND</u> cash or assistance to rebuild/repair structure <u>AND</u> special assistance allowances	
	Non-legal user	Compensation at replacement cost in materials, cash or combination of both according to the actual loss <u>OR</u> , if partially affected, the cost of repairing or rebuilding the structure <u>BUT</u> no compensation for illegal land lost, although may rebuild on the remaining illegal land	Landless/Vulnerable AP will not be displaced until the District People's Committee and CARB has either (1) allocated replacement land/housing for them or (2) established some kind of mechanism, such as a long-term amortization plan, to ensure that AP are not left without an area of residence
c) With houses or major structures built thereon without sufficient remaining land on which to rebuild	User with permanent right (legal and legalizable)	Cash compensation for the lost land at full replacement cost <u>AND</u> assistance from local authorities and CARB to locate possible plots for relocation <u>AND</u> special assistance allowances	
	User with lease or temporary right	Cash assistance at 30% of the replacement cost of the affected land; <u>AND</u> assistance from local authorities and RPMU to locate possible plots for relocation <u>AND</u> special assistance allowances	
	Non-legal user	Cash compensation for affected structure at full replacement cost <u>BUT</u> no compensation for land	Landless/Vulnerable AP will not be displaced until the District People's Committee and CARB has either (1) allocated replacement land/housing for them or (2) established some kind of mechanism, such as a long-term amortization plan, to ensure that AP are not left without an area of residence
	Tenant in private or government housing	Six months rent allowance <u>AND</u> assistance in finding new and affordable rental accommodation <u>AND</u> special assistance allowances	Notice to tenants by the owner has to be given at least two months in advance

TYPE & LEVEL OF IMPACT	ENTITLED PERSONS	COMPENSATION POLICY	IMPLEMENTATION ISSUES
C. HOUSES			
C.1. Completely Affected Houses			
	Owners of structures (regardless if land is owned or not)	Compensation at full replacement cost in material, labour, cash or a combination of all, with no deduction for depreciation or salvageable materials	
C.2. Partially Affected Houses			
	Owners of structures (regardless if land is owned or not)	Compensation at replacement cost in material, labour, cash or a combination of all, with no deduction for depreciation or salvageable materials <u>OR</u> cost of repair of property to original or better condition.	
	Tenant	AP has an option to stay with the owner's agreement <u>OR</u> If decides to move out with six months rent allowance <u>AND</u> assistance in finding new, affordable rental accommodation	Notice to tenants by the owner has to be done at least two months in advance
D. OTHER STRUCTURES (E.G. PIGSTY, TOILET, ETC.)			
	Owners of structures (regardless if land is owned or not)	Cash compensation for affected structure at replacement cost <u>OR</u> compensation to relocate the structure <u>OR</u> cost of repair of structure to original or better condition.	No deductions for depreciation or salvaged materials
E. TREES/STANDING CROPS			
	Owners (regardless if land is owned or not)	Cash compensation for loss of trees and standing crops at current market prices	Compensation for trees calculated on basis of type, age, and productive value Compensation for crops calculated on basis of highest yield in last three years
F. COMMUNITY ASSETS			
	Village, Ward, Government Unit	Restoration of affected community buildings and structures to original or better <u>OR</u> Replacement in areas identified in consultation with affected communities and relevant authorities	If income loss is expected (e.g. community irrigation, forest, pasture or fishing spot), the village is entitled to compensation for the total production loss (over 3 years), which should be used collectively for community benefits, such as income restoration measures or infrastructure

TYPE & LEVEL OF IMPACT	ENTITLED PERSONS	COMPENSATION POLICY	IMPLEMENTATION ISSUES
G. BUSINESSES AFFECTED (NON-LAND)			
<i>G.1. Temporary Loss of Business and Income Source Affected</i>			
	All regardless of status	Cash compensation for the duration of business/income generation disruption	
<i>G.2 Businesses that will rebuild business structures on remaining portion of land AND businesses that will lose entire land and need to relocate to other areas.</i>			
	Legally registered businesses with official financial documents	- Net income multiplied by six months	Project will give reasonable time for AP to continue their business operation while rebuilding their structures. In turn, AP will rebuild their structure as soon as payment is released and clear the area in the agreed timeframe.
	Non-registered businesses (e.g., small shops)	- Minimum wage per month at the respective province multiplied by six months	
H. LOSS OF INCOME OF EMPLOYEES OR HIRED LABORERS			
<i>H.1. Temporarily Affected (while business is reorganizing) within Remaining Land</i>			
	Employees and workers	Cash compensation for lost salary/wages for each month they cannot work <u>OR</u> assistance in securing new employment, such as skills training or start-up materials and equipment	Businesses will be encouraged to retain existing employees
H.2 Permanent Job Loss Due to Relocation of Business			
	Employees and workers	Cash compensation for 6 months salary/wages <u>OR</u> cash compensation for remaining contract period, whichever is higher	Project will encourage employers to provide Severance Pay for employees
I. SPECIAL ASSISTANCE ALLOWANCES			
<i>I.1. Transport Allowance</i>			
	Relocating AP	- Minimum 2,000,000 VND and Maximum 5,000,000 VND to transport household effects, salvaged and new building materials.	Exact amount will be determined by PPC according to distance
<i>I.2. Subsistence in Transition Allowance</i>			
	Relocating AP, Severely AP, Vulnerable Groups, AP rebuilding houses on remaining land	- Minimum of 30 kg of rice per person per month for six (6) months	
<i>I.3. Timely Removal Bonus</i>			
	Relocating AP	- Maximum of 5,000,000 VND per household for timely dismantling of structures and land clearance, payable immediately upon removal, where and as applicable by provincial legislation	Exact amount and timeframe will be determined by PPC according to type and grade of structures

TYPE & LEVEL OF IMPACT	ENTITLED PERSONS	COMPENSATION POLICY	IMPLEMENTATION ISSUES
<i>I.4. Social Assistance Allowance</i>			
	AP receiving special government assistance	- Maximum of 5,000,000 VND per AP household, where and as applicable by provincial legislation	Level of support will be defined by PPC, depending on type and level of social assistance received
<i>I.5 Income Rehabilitation Assistance</i>			
	Severely AP and Vulnerable Groups	<ul style="list-style-type: none"> - In-kind benefits, such as training skills, preferential credit or start-up materials, equivalent to 3,000,000 VND for one male and one female labourer in each affected household - <u>AND</u>, if applicable, subsistence allowance during training, valued at 30kg or rice/month (maximum 6 months) 	Type of support will be determined by PPC together with AP, based on AP's individual needs and preferences (see Chapter 8 on Rehabilitation Strategy for more details)
<i>I.6 Other Assistance</i>			
	Severely AP and Vulnerable Groups	- Priority hiring in project-related employment opportunities, as commensurate with skills and capacities of AP	The stipulations for priority hiring will be included in contracts for civil works

6 PUBLIC CONSULTATION AND DISCLOSURE OF RESETTLEMENT PLAN

The main objectives of public consultation and disclosure of the Resettlement Plan is to ensure that all Affected Persons (AP) and relevant stakeholders are fully informed about their rights, entitlements and options under the Project, as well as to provide them with details about the justification for, timeframe and processes of the Project. Effective public consultation helps to ensure that the resettlement process is designed according to the needs and interests of AP, as well as increase transparency and accountability, avoid or mitigate conflicts with affected populations, and reduce risks of delay in project implementation. The Project employed the following methods for public consultation and disclosure of the Resettlement Plan:

- Orientation Meetings with 100% of AP
- Orientation Workshops with local authorities, AP representatives and other relevant stakeholders
- Project Information Booklet
- Public Disclosure of Resettlement Plans

6.1 FIRST ORIENTATION MEETING

The primary purpose of the first Orientation Meeting was to familiarize AP with basic information on the Project, principles and policies for resettlement, and an outline of the process for developing the Resettlement Plan. Because the project's Area of Impact has many project sites with usually few AP households at each site, the first Orientation Meeting was carried out simultaneously with the IOL and SES at each site. The resettlement specialists trained the Survey Teams to facilitate the Orientation Meeting and provided a standard checklist (Annex 4) of main points to be covered at each meeting. The checklist was then signed onto by the Head of the Survey Team, commune official and at least one AP household, as the Meeting Minutes. The checklist also provided space to detail other topics covered at the Meeting and any comments or questions arising from the AP. AP participants were also asked to sign onto an attendance sheet, where further space was reserved for individual comments.

To help ensure equal access of information, the participation of women was monitored at each meeting. A total of 551 AP attended the meetings, of which 180 (32.7%) were women (see Table 6.1).

Table 6.1: Location and Schedule of first Orientation Meetings

No.	Location	Date	Participants	
			Total	Women
HANOI CITY				
	Dong Anh fly-over bridge	14/15/16/6/2006	45	12
VINH PHUC PROVINCE				
1	Thạch Lỗi station	17/3/2006	2	1
2	Hương Canh station	16/3/2006	2	0
PHU THO PROVINCE				
3	Việt Trì station	21/3/2006	4	1
4	Phủ Đức station	20/3/2006	1	1
5	Tiên Kiên station	22/3/2006	3	1
6	Chí Trữ station	19/3/2006	8	2
7	Vũ Ân station	21/3/2006	6	1
8	Mai Tùng station	30/3/2006	58	11
YEN BAI PROVINCE				
9	Cổ Phúc station	21/3/2006	8	7
10	Mậu A station	27/3/2006	8	7
11	Mậu Đông station	25/3/2006	7	3
12	Lâm Giang station	23/3/2006	6	3
13	Lạng Thập station	27/3/2006	21	3
14	Van Phu station	08/6/2006	19	8
15	Realignment km169 - 171	8-11/6/2006	52	6
LAO CAI PROVINCE				
16	Thái Văn station	24/3/2006	2	1
17	Thái Niên station	23/3/2006	2	1
18	Xu ân Giao station	30/3/2006	7	2
19	Lao Cai station	11-14/5/2006	85	35
20	Realignment km 283 -291	4-6/6/2006 & 8-9/6/2006	40	14
21	Pho Moi Resettlement Site	6-7/6/2006	45	20
22	Van Hoa Resettlement Site	8-9/6/2006	120	40
TOTAL			551	180

6.2 SECOND ORIENTATION WORKSHOP*****TO BE COMPLETED IN FINAL RESETTLEMENT PLAN*****

...Purpose and contents

...Persons and organizations attending

...Participation of women

...Minutes of meeting by PPC (in Annex 5)

Table 6.2 Location and Schedule of Second Orientation Workshops

No.	Location	Date	Participants		Summary of Main Comments/Questions (if any)
			TT	W	
	RPUC V. Phu				
	L. Cai Station				
		TOTAL			

TT = Total; W = Women

6.3 PROJECT INFORMATION BOOKLET AND INFORMATION GUIDE

A Project Information Booklet (PIB) and the *Information Guide on Public Consultation and the ADB's Accountability Mechanism* will be circulated presented at the second Orientation Workshop and later distributed to AP at each project site via the RPUC. The Project Information Booklet (PIB) (Annex 6) was prepared as an easy-to-understand

Question and Answer booklet about the Project. The eighteen (18) questions in the PIB address the following main topics:

1. Basic information about the Project, including identification of the responsible institutions
2. Project policies and principles on resettlement
3. Definition of Affected Persons
4. Legal and policy framework for determining compensation rates at replacement cost
5. Compensation policy for affected lands
6. Relevance of land title to compensation and entitlements
7. Compensation policy for houses and structures
8. Compensation policy for trees and crops
9. Compensation policy for businesses and income
10. Allowances for transport, transition and other rehabilitation assistance
11. Entitlement policy for renters
12. Entitlement policy for publicly owned or common land and assets
13. Eligibility cut-off date
14. Time limit for land clearance and dismantling structures
15. Proposed schedule for entire resettlement process
16. Mechanism for responding to grievances and complaints
17. Contact person for question, comments or complaints
18. Arrangements for monitoring and evaluation of the Project

The *Information Guide to Public Consultation and the ADB Accountability Mechanism* (Annex 7) is an ADB document that is also designed for local people in an easy-to-read format. The *Information Guide* provides practical information on how, where and under what conditions to file complaints directly to the ADB.

6.4 PUBLIC DISCLOSURE AND DISSEMINATION OF RESETTLEMENT PLANS

The draft Resettlement Plan was publicly disclosed to representatives of AP and relevant stakeholders at the Second Orientation Workshop. Upon final approval of the Resettlement Plan, the final Resettlement Plan will be distributed to the Provincial, District and Commune People's Committees and each RPUC with project components requiring land acquisition. Copies of the final Resettlement Plan made available for public consultation upon request.

The final Resettlement Plan will also be posted on the ADB's website.

7 GRIEVANCES AND COMPLAINTS

Should AP have any grievances about compensation payments or any other aspect of the resettlement process, they may lodge formal complaints, first, through different levels of local government and, if still unresolved, in the national court system; and/or through the ADB's Accountability Mechanism. **All AP will be exempt from any administrative and legal fees related to complaints, except for cases filed in the national court system.** The Independent Monitoring Organization will also have a responsibility to verify that AP have been able to raise their grievances, if any, through the appropriate channels and that their complaints have been responded to satisfactorily by the People's Committee and RPMU.

The successive stages for filing complaints through the national system are described in

Table 7.1: Stages of the Grievances and Complaints Mechanism

Stage	Unit	Unit's responsibilities	Time	Notes
1	Commune People's Committee	Date written complaints (or write-up and date verbal complaints) and respond in writing to the AP and RPMU	Within 15 days	
2	District People's Committee	Hear the complaint and respond in writing to the AP and RPMU	Within 15 days	AP must submit complaint to DPC within 30 days of original complaint
3	Provincial People's Committee	Hear the complaint and respond in writing to the AP and RPMU	Within 30 days	AP must submit complaint to PPC within 45 days of original complaint
4	National Court	Process the case	Variable	AP must cover own legal and administrative costs

ADB also has its own Accountability Mechanism (as defined in Section L1 of the ADB's *Operations Manual*) that allows AP to file their complaints directly with the ADB in Manila via the Office of the Special Project Facilitator (OSPF).

Key information about filing complaints to the OSPF is as follows:

- AP should first try to find local solutions to complaints and grievances, either by pursuing them through the Project's grievances and complaints mechanism or by approaching the relevant RPUC or RPMU.
- At least two persons in the community should file the complaint. The complaint can also be submitted by an organization, association or group of individuals. AP may also appoint a representative to duly represent them in their case.
- The complaint should be in a written letter, either in the Vietnamese or English language. The letter should state clearly the nature of the problem, how many people are affected and how they are affected. Factual details and verifiable descriptions should be provided to better substantiate the claim, such as adverse impacts on livelihoods, community or the environment. The name of the group of complainants, contact details, and the name and specific location of the ADB-assisted project that has caused the complainants harm should also be included.
- If a representative has been appointed, a letter of authority for that representative along with his/her name, organization, contact details and other relevant information should also be included.
- If AP wish to keep the case confidential, it should be indicated in the letter. ADB will ensure confidentiality on all matters indicated by AP.

- Finally, the letter should also indicate the complainants' expected resolution to the complaint.
- The complaint letter should be addressed to this address:
 Office of the Special Project Facilitator
 Asian Development Bank
 6 ADB Avenue Mandaluyong City 1550
 Metro Manila, Philippines
 Tel: (+632) 832-4825
 Fax: (+632) 636-2490
 E-mail: spf@adb.org
 Website: www.adb.org/spf

The ADB's process for following up on complaints is presented in Table 7.2.

Table 7.2: Timeframe and Process for Filing Complaints to the OSPF

Stage	Unit	Unit's responsibilities	Time
1	OSPF	Register the complaint and send an acknowledgement letter to the complainants	Within 7 days
2	OSPF	Determine the initial eligibility of the complaint and inform complainants about its eligibility	Within 21 days
3	OSPF	Review and assess the case by consulting involved parties, documents and possibly visiting the project site	Within Approx. 49 days of Step #1
4	OSPF	Send findings and recommendations to complainants and/or their representatives	
5	Complainants	If complainants wish to pursue with consultation, inform by writing to the OSPF of decision to continue	Within 14 days of Step #4
6	OSPF & Complainants	Agree on courses of action or resolution with all parties involved	
7	All parties	Terminate consultation process when all parties are agreed to termination	

8 RESETTLEMENT AND REHABILITATION STRATEGY

8.1 CASH COMPENSATION AT REPLACEMENT COST

Cash compensation at replacement cost is the main strategy for ensuring that Affected Persons (AP) are able to restore pre-project living standards and productive capacity. To establish compensation rates, an independent survey team assessed current prices in local markets of all items identified in the Inventory of Losses. Information was gained by posing as customers and asking prices from a sample of local persons, traders and businesses. The surveys were carried out in various locations along the line that represented the highest market value among a group of situated located project sites, as described in Table 8.1. The market rates were then compared with Provincial compensation rates and the highest value between the two rates was applied to the Project. See Annex 8 for the final report of the Replacement Cost Survey and its list of recommended prices.

Table 8.1: Sample Sites for Replacement Cost Survey and Justification

No	Sample Site	Representative of	Justification
I	Ha Noi City		
1	Dong Anh fly-over bridge		Dong Anh overpass is on National Road No. 3 in Ha Noi
II	Vinh Phuc Province		
1	Huong Canh Station	Thach Loi station	These two stations are close to each other and located in a rural area of Vinh Phuc province
2		Huong Canh station	
III	Phu Tho Province		
3	Viet Tri Station	Viet Tri station	These three stations are all located in or near urban areas of Phu Tho province, namely Viet Tri and Phu Duc stations near Viet Tri city and Tien Kien station near Hung Son town, Lam Thao district.
4		Phu Duc station	
5		Tien Kien station	
6	Mai Tung station	Chi Chu station	These stations are all located in rural areas of Phu Tho province. Chi Chu and Vu En stations are located in Thanh Ba district, while the new station at Mai Tung will be located in Ha Hoa district.
7		Vu En station	
8		Mai Tung station	
IV	Yen Bai Province		
9	Co Phuc Station	Co Phuc station	These two stations are located in Tran Yen district near Yen Bai City.
10		Van Phu station	
11		Realignment km169-171	
12	Lang Thip Station	Mau A station	All these stations are located in rural areas of Yen Bai province.
13		Mau Dong station	
14		Lam Giang station	
15		Lang Thip station	
V	Lao Cai Province		
16	Xuan Giao Station	Station Thai Van	All these stations are located in rural areas of Lao Cai province
17		Station Thai Nien	
18		Station Xuan Giao	
19	Lao Cai Station	Station Lao Cai	This station is located in Lao Cai city
20		Realignment km283-291	

*Note: Because sections of realignment passed through residential and agricultural areas, the urban sample sites were selected to represent market value prices for realignment sections in each province.

During implementation of the Resettlement Plan, the Independent Monitoring Organization will verify that the proposed compensation rates are still current and, if required, update them through a similar replacement cost survey. To ensure that compensation is paid in full and directly to the AP, the payment process will be supervised directly by the RPMU in coordination with the Provincial People's Committee. The provincial Compensation and Resettlement Boards (PCARB) making the payments will be responsible to:

- a. Inform AP regarding payment schedule at least two (2) weeks in advance;
- b. Prepare a list of AP households and each of their total compensation payments;
- c. Prepare three (3) copies of Agreement Compensation Forms with an itemized list of AP compensation and entitlements to be signed and kept by the AP and representatives of the PCARB and RPMU; and
- d. Report in writing to the Provincial People's Committee and RPMU within one (1) week after payments have been made.

The AP will:

- a. Bring all required documents (e.g., LURC, ID, civil registration certificates, etc.);
- b. Review carefully the Agreement Compensation Form and any other related documents;
- c. Sign a Receipt of Payment, if the AP agrees that the stated compensation amount is correct according to the principles and policies of the Resettlement Plan;
- d. Keep one (1) copy of the Agreement Compensation Form; and
- e. File a complaint with the Commune People's Committee if anything is amiss in the compensation payment process.

If the AP is unavailable to claim the compensation payment on the scheduled date, he/she will inform local authorities immediately with a written authorization for a representative to claim on his/her behalf, or the AP may request the PCARB to reschedule a later date for his/her payment.

The RPMU will:

- a. Witness directly the payment process;
- b. Ensure that the AP is aware of his/her rights and entitlements;
- c. Sign as witness to the Agreement Compensation Form; and
- d. Keep one (1) copy of the Agreement Compensation Form.

The Independent Monitoring Organization will:

- a. Verify a sample of AP to assess whether compensation was paid out in full and directly to the AP;
- b. Record any grievances and complaints of AP related to the payment of compensation; and
- c. Provide recommendations to MOT and ADB on how to resolve any problems that may have arisen during the compensation payment process.

8.2 SPECIAL ASSISTANCE ALLOWANCES

In addition to cash compensation, special assistance allowances will be provided for Severely Affected Persons (SAP) and vulnerable groups (as defined in Chapter 1). An Income Rehabilitation Allowance will be awarded in kind to both SAP and vulnerable groups at a value of 3,000,000 VND per one male and one female labourer in each AP'

household. The exact form of assistance will vary depending on local employment opportunities and the individual or group interests of the AP. Survey questions during the Inventory of Losses indicated that the large majority of AP in the Area of Impact preferred preferential credit (70%) or start-up equipment and materials (28%) (Table 8.2). Less than 1% of AP opted for training, suggesting a strong preference for concrete assistance with funds from Income Rehabilitation Assistance. Meanwhile, all AP in the resettlement sites expressed preference for start-up equipment and materials.

Table 8.2: Preferences for Income Rehabilitation Assistance in Area of Impact

Area of Impact	INCOME REHABILITATION OPTIONS				
	Sample Size	Training	Pref. Credit	Equip, Matrls	Other
THAI HA	49	0%	94%	6%	0%
Dong Anh	49	0%	94%	6%	0%
VINH PHUC	4	0%	75%	25%	0%
Thach Loi	2	0%	50%	50%	0%
Huong Canh	2	0%	100%	0%	0%
PHU THO	81	1%	93%	5%	1%
Viet Tri	3	0%	33%	67%	0%
Phu Duc	1	0%	100%	0%	0%
Tien Kien	3	0%	100%	0%	0%
Chi Chu	9	0%	89%	11%	0%
Vu En	7	0%	100%	0%	0%
Mai Tung	58	2%	95%	2%	2%
YEN BAI	122	1%	60%	37%	2%
Co Phuc	8	0%	13%	88%	0%
Mau A	6	0%	100%	0%	0%
Mau Dong	7	0%	71%	0%	29%
Lam Giang	6	0%	83%	0%	17%
Lang Thip	19	0%	11%	89%	0%
Van Phu	20	0%	0%	100%	0%
Realign km169-171	56	2%	96%	2%	0%
LAO CAI	146	0%	59%	40%	1%
Thai Van	2	0%	0%	100%	0%
Thai Nien	2	0%	0%	100%	0%
Xuan Giao	7	0%	0%	100%	0%
Lao Cai	92	0%	47%	52%	1%
Realign km283-291	43	0%	100%	0%	0%
TOTAL	402	0%	70%	28%	1%

Funds for Income Rehabilitation Assistance and their associated programs will be administered through the Compensation and Resettlement Boards at District or provincial levels. The specific application of the funds will be based on a signed agreement between the Compensation and Resettlement Board and the AP. Because there are less than 10 AP households entitled to Income Rehabilitation Assistance in nearly all project sites (see Chapter 1), options for Income Rehabilitation Assistance will be decided on a case-by-case basis at the time of implementation of the Resettlement Plan.

8.3 REHABILITATION STRATEGIES IN LAO CAI AND MAI TUNG

In Lao Cai and Mai Tung, where there are a large number of SAP and vulnerable group AP households, project and programs for Income Rehabilitation Assistance may be implemented as a collective fund, such as a micro-credit fund administered by the

Farmers' Union or Women's Union. Representatives of the Farmers' Union and Women's Union in Lao Cai already have experience managing credit funds through various government projects. In Mai Tung, these Unions would require support from the District level, or the RPMU could assist in bringing in outside expertise from government offices or NGOs operating in the province. The Lao Cai People's Committee also has several programs for livelihood support and job development that the Project will support AP households to benefit from, if they so wish. For example, Resolution No.81/2005/QD-TTg provides short-term work training for rural labour for households losing commercial or productive assets as a result of land acquisition for national purposes; Resolution No.457/2004/QD-UB provides loans, work training, initial capital investment support for businesses and assistance in registering for product licences and trademarks; and Resolution No. 07/2005/QD-UB supports 30% of interest on loans for poor households. There are also a number of Vocational Training Centres operating in Lao Cai that provide training on handicrafts, mechanics, construction, metal work, etc., as well as support in business networking and start-up loans. The RPMU will also work with the Yen-Lao RPUC to reserve a portion of the new jobs created by the increased capacity of the Lao Cai Rail Station for AP. For AP households currently operating small businesses (e.g., drink stands) inside the Lao Cai Rail Station, the Project will assist them in securing a new place of business on the station's grounds, if the AP so wishes.

In Mai Tung Commune, where over 90% of AP households depend on agricultural land for their main source of income (see Chapter 2), replacement land can be provided through the Village Land Fund. The Village Land Fund is managed by the village administration, which would be willing to use the land fund to provide replacement land for AP households, if they so wish. The Village Administration would sell plots of land to the Project and then use proceeds from the sales to invest in community services and infrastructure. AP households in Mai Tung should also be able to benefit from new economic opportunities created by the building of the new Rail Station. In particular, the RPMU will work with the Vinh Phu RPUC to reserve a portion of the jobs created by the new station for AP, as well as secure potential commercial spaces on the station's grounds for AP households to open up small shops and businesses.

8.4 RESETTLEMENT SITES FOR LAO CAI RAIL STATION

The Lao Cai City People's Committee is currently preparing two resettlement sites that will be used to accommodate the 90 AP households relocating from Lao Cai Rail Station. One site is in Pho Moi Ward, whose southern border is adjacent to the riverside of Road M12; and the other is in Van Hao Commune, whose western border runs along the Song Hong River. The current land use in each resettlement site will be completely reorganized to develop residential plots of 80-100sq.m plots and equip the site with adequate road access, residential electricity and watery supply, drainage and sewerage.

The resettlement site in Pho Moi will be able to accommodate 110 households, while the resettlement site in Van Hoa will be able to accommodate 220 households. This includes accommodating the households who are already living and using land in these areas designated for the resettlement sites, as described in Chapter 1. A summary of the Investment Plans for both resettlement sites is presented in Annex 9.

AP households will have to buy land plots in the resettlement sites from the Lao Cai City People's Committee with their own compensation money from the Project. For AP households that may not have sufficient money, the Lao Cai People's Committee has agreed to set up amortization arrangements, whereby the AP would be allowed to pay back the purchase price of the plot in a series of financial instalments over an period of time. Persons currently living in the areas designated for the resettlement sites will

have first priority to purchase and select a plot of residential land. If AP from Lao Cai Rail Station do not wish to relocate to the resettlement site, they will be assisted to find another location, as required. However, no AP will be required to relocate from Lao Cai Rail Station until another place of residence has been identified and secured. All households required to relocate as a result of the Project are considered as Severely Affected Persons and, therefore, they will be entitled to Income Rehabilitation Assistance, as described above. Relocating households will also be entitled to transport and subsistence allowances to buffer them against financial losses resulting from the period of transition.

The investment plans prepared for the resettlement sites have been assessed by the resettlement specialists to ensure concurrence with ADB policy, including compensation plans for AP in the resettlement sites. Persons currently living or using land in the areas designated as resettlement sites are considered as AP equally entitled to compensation and other project benefits defined in this Resettlement Plan. Hence, the Inventory of Losses and Socio-Economic Survey were also conducted with the AP population in the resettlement sites and their compensation and rehabilitation costs have been formulated as part of this Resettlement Plan. See Chapter 1 for more information on AP in the resettlement sites.

9 ETHNIC MINORITIES

9.1 DEFINITIONS

The Asian Development Bank defines Ethnic Minorities (or Indigenous Peoples) as having:

- Descent from population groups present in a given area before modern states or territories were created; and
- Maintenance of cultural and social identities separate from mainstream or dominant societies or cultures.

(OM Section F3/BP, Para. B3)

Characteristics that reinforce the above definition include:

- Self-identification and identification by others as being part of a distinct indigenous cultural group, and the display of the desire to preserve their cultural identity;
- A linguistic identity different from that of the mainstream or dominant society;
- Social, economic, and political traditions and institutions distinct from the mainstream society;
- Economic system oriented more toward a traditional system of production than toward the mainstream production system; and/or
- Unique tie with and attachment to traditional habitat and ancestral territory and its natural resources

(OM Section F3/BP, Para. B3)

The Government of Vietnam recognizes 63 different national ethnic minorities, whose definitional categorization is consistent with ADB policy. These ethnic minorities derive from three main linguistic families, namely Sino-Tibetan (32 groups), Mon-Khmer (24 groups) and Malayo-Polynesian (7 groups). Originally, the Mon-Khmer and Malayo-Polynesian groups lived in the Mekong Delta, Central Highlands and South-Central regions of Vietnam, while the Sino-Tibetan groups lived mainly in the northern mountainous areas and the North-Central region. This ethno-geographic distribution generally holds true today, although modern history has occasioned more dispersion and intermixing with the different ethnic groups, as well as with the dominant Kinh.

9.2 POLICIES

The Government recognizes the same social position, rights and obligations of all ethnic groups within the territory of the Vietnamese State, as declared by the National Assembly in the 1946, 1959, 1980 and 1992 Constitutions of Viet Nam. However, acknowledging a certain development lag among ethnic minorities, the Government has enacted several policies and programs that provide preferential support to ethnic minority social and economic development (notably, Program 135 on hunger eradication and poverty reduction and Program 143 for remote communes with special difficulties), as well as established the Committee for Ethnic Minorities and Mountainous Areas (CEMMA) to coordinate the implementation of these programs.

Asian Development Bank policy on Indigenous Peoples (or Ethnic Minorities) is described in Chapter 3.

9.3 SCOPE OF RESETTLEMENT IMPACTS ON ETHNIC MINORITIES

A total of 27 ethnic minority households are impacted by the Project, accounting for only 7% of the AP population (Table 9.1), and 5 ethnic minority households in the

resettlement sites, accounting for only 3% (Table 9.2). Hence, ethnic minorities are underrepresented among the AP population, given that they constitute approximately 14% of the national population. For project components in Lao Cai, ethnic minorities constitute 16% (23 households) of the AP population, but they are still underrepresented when compared to the provincial ethnic minority population. Furthermore, only in Lao Cai Rail Station are there as many as ten (10) ethnic minority AP households in one project site. For the other project sites, ethnic minority AP households are no more than five (5). At Lao Cai Rail Station, the ethnic minorities are from three different ethnic groups, namely the Tay-Nung (4 households), Hoa (1 hh) and Ray (5 hh), living dispersed among the Kinh AP households. In sum, ethnic minorities among the AP population were relatively few, dispersed, and no communities of any one ethnic group were identified in the project's Area of Impact or the resettlement sites. For these reasons, a full Ethnic Minority Development Plan was *not* required, although Ethnic Minority Specific Actions are discussed below.

Table 9.1: Ethnic Groups in Area of Impact (AP households and percent)

Area of Impact	Kinh		Tay-Nung		H'mong-Dzao		Muong		Hoa		Other		EM TOTAL	
	HH	%	HH	%	HH	%	HH	%	HH	%	HH	%	HH	%
HANOI	50	100	0	0	0	0	0	0	0	0	0	0	0	0
Dong Anh	50	100	0	0	0	0	0	0	0	0	0	0	0	0
VINH PHUC	4	100	0	0	0	0	0	0	0	0	0	0	0	0
Thach Loi	2	100	0	0	0	0	0	0	0	0	0	0	0	0
Huong Canh	2	100	0	0	0	0	0	0	0	0	0	0	0	0
PHU THO	82	100	0	0	0	0	0	0	0	0	0	0	0	0
Viet Tri	4	100	0	0	0	0	0	0	0	0	0	0	0	0
Phu Duc	1	100	0	0	0	0	0	0	0	0	0	0	0	0
Tien Kien	3	100	0	0	0	0	0	0	0	0	0	0	0	0
Chi Chu	9	100	0	0	0	0	0	0	0	0	0	0	0	0
Vu En	7	100	0	0	0	0	0	0	0	0	0	0	0	0
Mai Tung	58	100	0	0	0	0	0	0	0	0	0	0	0	0
YEN BAI	121	94	4	3	0	0	0	0	0	0	0	0	4	3
Co Phuc	7	88	1	13	0	0	0	0	0	0	0	0	1	13
Mau A	5	63	3	38	0	0	0	0	0	0	0	0	3	38
Mau Dong	7	100	0	0	0	0	0	0	0	0	0	0	0	0
Lam Giang	6	100	0	0	0	0	0	0	0	0	0	0	0	0
Lang Thip	21	100	0	0	0	0	0	0	0	0	0	0	0	0
Van Phu	20	87	0	0	0	0	0	0	0	0	0	0	0	0
RA km169-171	55	98	0	0	0	0	0	0	0	0	0	0	0	0
LAO CAI	123	84	9	6	1	1	0	0	1	1	12	8	23	16
Thai Van	2	100	0	0	0	0	0	0	0	0	0	0	0	0
Thai Nien	1	50	0	0	1	50	0	0	0	0	0	0	1	50
Xuan Giao	2	29	5	71	0	0	0	0	0	0	0	0	5	71
Lao Cai	82	89	4	4	0	0	0	0	1	1	5	5	10	11
RA km283-291	36	84	0	0	0	0	0	0	0	0	7	16	7	16
TOTAL	380	92	13	3	1	0	0	0	1	0	12	3	27	7

Table 9.2: Ethnic Groups in Resettlement Sites (AP households and percent)

Resettlement Sites	Kinh		Tay-Nung		H'mong-Dzao		Muong		Hoa		Other		EM TOTAL	
	HH	%	HH	%	HH	%	HH	%	HH	%	HH	%	HH	%
Pho Moi Ward	47	94	2	4	0	0	0	0	0	0	1	2	3	6
Van Hoa Comm.	128	98	2	2	0	0	0	0	0	0	0	0	2	2
TOTAL	175	97	4	2	0	0	0	0	0	0	1	1	5	3

Ethnic Minority Specific Actions are still necessary because the generally inferior political and economic position of ethnic minorities in the social order of Vietnam puts them at elevated risk of impoverishment and discrimination through resettlement. Socio-economic data collected for this Resettlement Plan showed some evidence of inferior social and economic achievements among ethnic minorities in the AP population, though not always. However, it must be noted that project data on ethnic minorities should be understood as rough approximations because the sample size (n=27) was very small and widely spread out over a range of settings¹⁵.

The proportion of ethnic minority AP households whose primary source of income was land-based was largely the same as Kinh AP households (Table 9.3). Only in certain sections of realignment from km 283-292 was the dependence on land-based income slightly more among ethnic minority households than Kinh households (86% and 74%, respectively).

Table 9.3: Comparison of Ethnic Minority Occupations among AP Population

Area of Impact	AP Occupation		EM Occupation	
	Land-based	Non Land-based	Land-based	Non Land-based
Co Phuc	100%	0%	100%	0%
Mau A	100%	0%	100%	0%
Thai Nien	100%	0%	100%	0%
Xuan Giao	100%	0%	100%	0%
Lao Cai	1%	99%	0%	100%
RA km283-292	74%	26%	86%	14%

Note: Land-based refers to agriculture and forestry

The average annual income of ethnic minority AP households was generally lower than their Kinh counterparts, being as low as 67% of the income level of Kinh AP households at Lao Cai Rail Station (Table 9.4). However, income levels for ethnic minority AP households were higher (105%) than their Kinh counterparts at Xuan Giao Rail Station and nearly the same (95%) at Thai Nien Rail Station.

Table 9.4: Comparison of Ethnic Minority Incomes among AP population

Area of Impact	AP avg. Income	EM avg. Income	% Dif. (EM/AP)
	VND (000)	VND (000)	%
Co Phuc	5,513	4,000	73
Mau A	14,500	9,667	67
Thai Nien	4,750	4,500	95
Xuan Giao	4,571	4,800	105
Lao Cai	14,983	10,000	67
RA km283-292	16,879	15,143	90

The household head of ethnic minority AP showed higher levels of educational attainment than their Kinh counterparts among the AP population at Thai Nien, Xuan Giao and Lao Cai Rail Stations, as well as along the sections of realignment km 283-292 (Table 9.5).

¹⁵ Similarly, the data collected from the Socio-Economic Survey was not very useful for comparing ethnic minorities to the general AP population because it was administered on only 20% of ethnic minority AP households (n=5)..

Table 9.5: Comparison of Education Levels of EM Household Head among AP Population

Area of Impact	AP Education				EM Education			
	PS	<HS	=HS	Univ.	PS.	<HS	=HS	Univ.
Co Phuc	0%	63%	25%	0%	0%	100%	0%	0%
Mau A	0%	88%	13%	0%	0%	100%	0%	0%
Thai Nien	0%	50%	50%	0%	0%	0%	0%	100%
Xuan Giao	0%	100%	0%	0%	0%	0%	100%	0%
Lao Cai	0%	55%	42%	0%	0%	0%	70%	30%
RA km283-292	7%	91%	2%	0%	7%	14%	86%	0%

Note: PS=Primary School; HS=High School; Univ=University or College

Apart from Lao Cai Rail Station, nearly all Ethnic Minority AP households had legal land tenure (i.e., Land Use Rights Certificate) for both their agricultural and residential lands (Table 9.6). At Lao Cai Rail Station, only 20% of ethnic minority AP households had legal land tenure for their lands, which was slightly more than the Kinh AP population (13%).

Table 9.6: Comparison of Land Tenure for Ethnic Minority AP

Area of Impact	AP Land Tenure				EM Land Tenure			
	Residential		Agricultural		Residential		Agricultural	
	LURC	None	LURC	None	LURC	None	LURC	None
Co Phuc	100%	0%	100%	0%			100%	0%
Mau A	100%	0%	100%	0%			100%	0%
Thai Nien	100%	0%	100%	0%	100%	0%		
Xuan Giao	100%	0%	100%	0%	100%	0%	100%	0%
Lao Cai	13%	87%			20%	80%		
RA km283-292	88%	82%	75%	0%	100%	0%		

In sum, the annual household income of ethnic minority AP was usually, though not always, lower than their Kinh counterparts. However, they exhibited similar levels of dependency on land-based income and they performed slightly better in educational achievement and land tenure.

9.4 ETHNIC MINORITY SPECIFIC ACTIONS

The following specific actions will be taken during implementation of the Resettlement Plan to guard against discrimination and impoverishment to ethnic minorities during the resettlement process:

- Require that the international and national specialists have expertise and background in ethnic minority issues in Vietnam;
- Provide funds for Income Rehabilitation Assistance for all Ethnic Minority AP households;
- Involve the local Committees for Ethnic Minorities and Mountainous Affairs (CEMMA) in programs and projects for Income Rehabilitation Assistance for groups of AP households, notably in Mai Tung and Lao Cai City;
- Ensure that at least one ethnic minority AP for each project site with an ethnic minority population is represented at Resettlement Training;
- Ensure that Resettlement Training for project authorities and AP representatives adequately addresses ethnic minority issues;

- Disaggregate social and economic indicators in monitoring data for AP according to ethnic minority households;
- Require that specialists of the Independent Monitoring Unit have expertise and background in ethnic minority issues in Vietnam; and
- Monitor the distribution of compensation payments to ensure that they are paid out fully and directly to ethnic minority households and that no discrimination is exercised against them.

10 GENDER ISSUES

10.1 POLICIES

The Government of Vietnam recognizes women as equal to men under the laws and constitution of Vietnam. GoV has no specific policies to promote gender issues in Vietnam, although Women's Unions generally exist at every level of government administration.

The Asian Development Bank's policy for gender and development is described in Chapter 3.

10.2 SCOPE OF RESETTLEMENT IMPACTS ON WOMEN

Women and girls comprise exactly 50% of the AP population (878) (Table 10.1), as expected. Within the three main age categories of girls (< 15 years), women (15-55 years) and elderly women (>55 years), females comprise between 48%-52% of their cohort population.

Table 10.1: AP Population of Women and Girls in Area of Impact

Province / City	Total		15-55		<15		>55	
	#	%	#	%	#	%	#	%
HANOI	106	0	70	0	26	0	12	1
VINH PHUC	11	55	9	64	0	0	2	33
PHU THO	212	50	107	38	58	65	22	45
YEN BAI	242	47	160	52	56	46	28	58
LAO CAI	307	53	188	50	78	52	26	52
TOTAL	878	50	534	48	218	51	90	52

Female-Headed Households comprise 33% (147 households) of the AP population, while single (i.e. no spouse) Female-Headed Households with dependents comprise 15% (58 households) (Table 10.2). The average annual income among Female-Headed Households was estimated at 18.4 million VND per household per year, or 86% of the average annual income of Male-Headed Households. The average annual income among single Female-Headed Households with dependents was 12.9 million VND per year, which was only 61% of the average annual income of a Male-Headed Household. In sum, Female-Headed Households, especially single Female-Headed Households with dependents, showed inferior economic performance when compared to Male-Headed Households among the AP population.

Table 10.2: Number and Income of Female-Headed Households compared to male-headed AP households.

PROVINCE/ CITY	Female-Headed Household (FHH)					Single FHH w/ dependents				
	Number		INCOME compared to MHH			Number		INCOME compared to MHH		
	#	%	Avg	Dif.	% Dif	#	%	Avg	Dif.	% Dif
HANOI	14	0	62,857	67,716	96	3	0	18,333	-46,847	28
VINH PHUC	1	25	12,000	-9,600	56	0	0			
PHU THO	25	30	18,200	291	102	2	2	11,000	-6,909	61
YEN BAI	38	31	13,134	-879	94	28	22	8,929	-5,084	64
LAO CAI	57	39	11,289	-3,469	76	25	17	8,440	-6,318	57
TOTAL	135	33	18,412	-2,942	86	58	14	12,948	-8,405	61

Women are also less likely to have their lands registered in their names. Land Use Rights Certificates were issued in the names of both man and women in only 5% of AP households for residential land and 3% of AP households for agricultural land (Table 10.3). These figures rise to 32% and 14% respectively, when counting total LURC issued in the name of a woman among the AP population. However, from 50% to 100% of these cases represent single female-headed households.

Table 10.3: Land Use Right Certificates Issued in Names of Males and Females (Percent)

Province/ City	Residential LURC				Agricultural LURC			
	M	F	Both	n	M	F	Both	n
HANOI	86	14	0	7				0
VINH PHUC	0	100	0	1				0
PHU THO	74	26	0	19	87	13	0	15
YEN BAI	65	26	9	23	43	13	0	13
LAO CAI	62	31	8	13	38	15	15	9
TOTAL	68	27	5	63	44	11	3	37

n=sample size

Data from the first Orientation Meeting also showed that only 33% of meeting participants were women (see Chapter 6). These data show that women have specific risks to suffering negative impacts from resettlement because of inferior household economy, lack of control over land and productive assets and less access to information. Other data has been collected on health, education, household workload and labour migration that showed no revealing differences between men and women, but they will be used to monitor during project implementation the resettlement impacts on women and girls.

10.3 GENDER ACTIONS

The following specific actions will be taken during implementation of the Resettlement Plan to guard against discrimination and impoverishment to women and girls during the resettlement process:

- Engage an international specialist in Gender and Social Development to help ensure gender sensitivity in the implementation of the Resettlement Plan;
- Allocate replacement lands in the names of both man and woman in married or partnered AP households;
- Provide funds for Income Rehabilitation Assistance for one male and one female labourer in each of the eligible AP households;
- Provide funds for Income Rehabilitation Assistance for all single female-headed AP households with dependents;
- Involve the local Women's Union in programs and projects with Income Rehabilitation Assistance;
- Ensure that women have equal access to project information by ensuring that at least 30% of participants in Resettlement Training are women;
- Ensure that Resettlement Training for project authorities and AP representatives adequately addresses gender issues;
- Disaggregate social and economic monitoring data according to gender; and
- Require that a gender specialist is part of the Independent Monitoring Unit.

11 INSTITUTIONAL ARRANGEMENTS

11.1 CENTRAL LEVEL

11.1.1 Railway Project Management Unit (RPMU)

The Railway Project Management Unit (RPMU) under Vietnam Railways will be responsible for all components of Project implementation, which includes updating the Resettlement Plan, as well as its implementation, monitoring and evaluation.

The main responsibilities of the RPMU will be to:

- a. Organize the updating of the Resettlement Plan in close collaboration with provincial People's Committees;
- b. Review and allocate necessary budget for resettlement activities;
- c. Supervise and monitor implementation and progress;
- d. Supervise compensation payments to Affected Persons (AP);
- e. Supervise and monitor land acquisition and relocation;
- f. Assist in resolving grievances and complaints arising from AP;
- g. Coordinate with relevant government agencies and other organizations to assist planning, implementation, monitoring and evaluation of the Resettlement Plan; and
- h. Submit the updated Resettlement Plan to the Ministry of Transport and the ADB.

11.1.2 VNR Land Clearance Office

Within RPMU, the Land Clearing Office (*Phong Giai Phong Mat Bang*) will be responsible for supervising resettlement activities at all stages. The LCO is headed by one senior resettlement specialist and three junior staff. They have extensive experience with land clearance and resettlement from previous Vietnam Railways projects. They will be supported by the resettlement specialists on the specific applications of ADB resettlement policy, as well as one gender and social development specialist (see below). The main responsibilities of the LCO will be to:

- a. Coordinate with the Provincial People's Committee (PPC) to establish Compensation and Resettlement Boards (CARB) at provincial and district levels;
- b. Guide and assist the CARB with dissemination of project information and public consultation with AP and other relevant stakeholders;
- c. Supervise and assist the development of Compensation Plans and compile them into the updated Resettlement Plan;
- d. Supervise and monitor compensation payments to AP;
- e. Supervise and monitor land acquisition and relocation;
- f. Coordinate with the Provincial/District Land Administration Offices to allocate replacement land that has been awarded to AP;
- g. Coordinate with relevant government offices at Provincial and District levels to organize, implement and monitor the income rehabilitation assistance projects and programs in accordance with the Resettlement Plan;
- h. Regularly liaise with the CARB to update the list of AP, compensation payments and grievance resolutions;
- i. Submit quarterly progress reports to the RPMU on resettlement activities; and
- j. Prepare and submit the updated Resettlement Plan to the RPMU.

11.2 PROVINCIAL LEVEL

11.2.1 Provincial People's Committee (PPC)

PPCs will be responsible for all resettlement activities related to the Project within their administrative jurisdiction. The main responsibilities of the PPC will be to:

- a. Supervise implementation of resettlement activities in accordance with the Resettlement Plan;
- b. Establish the Provincial Compensation and Resettlement Board (PCARB) and issue instructions to establish District Compensation and Resettlement Boards (DCARB);
- c. Review and approve Project compensation rates for each type of loss submitted by the Independent Monitoring Organization; and
- d. Review and approve Compensation Plans and other information provided by PCARB.

11.2.2 Provincial Compensation and Resettlement Board (PCARB)

The PCARB will be established in each province where people are affected by land acquisition or resettlement as a result of the Project. The main responsibilities of the PCARB will be to:

- a. Coordinate, supervise and manage resettlement activities with District and Commune People's Committees and the DCARB;
- b. Prepare Compensation Plans and provide other information relevant to the Resettlement Plan to the PPC for approval;
- c. Assist in the identification and allocation of land to poor and vulnerable AP who have no other land;
- d. Assist in compensation payments and delivery of entitlements; and
- e. PCARBs will include representatives from the provincial Farmers' Association, Women's Union and Committee for Ethnic Minorities and Mountainous Areas, if ethnic minority households are among the AP in that province.

11.3 DISTRICT AND COMMUNE LEVELS

11.3.1 District People's Committee (DPC)

The DPCs will be primarily responsible to assist the PCARB. The main tasks of the DPC will be to:

- a. Delegate District and Commune Officials and/or establish District Resettlement Committee (DCARB) to assist the PCARB in implementation of resettlement activities;
- b. Assist the PCARB to coordinate with relevant Commune People's Committees;
- c. Certify the list of AP prepared by District Officials or the DCARB; and
- d. Review Compensation Plans and other information produced by District Officials or the DCARB for inclusion in the Resettlement Plan.

11.3.2 District Compensation and Resettlement Board (DCARB)

The District People's Committee will establish a DCARB if there are a substantial number of AP 20 households in that District. But because most project components minimal impacts on few households, it will suffice in most cases for the District to assign

selected District Officials to work directly with the PCARB. The main responsibilities of District Officials and/or the DCARB will be to:

- a. Organize, plan and carry out resettlement activities in the district on behalf of the DPC and under guidance from the PCARB;
- b. Verify and update Compensation Plans and other information required for the Resettlement Plan;
- c. Assist in the identification and allocation of land to poor and vulnerable AP without other land for relocation;
- d. DCARBs will include representatives from the District Farmers' Association and Women's Union

11.3.3 Commune People's Committee (CPC)

The CPC will be responsible to assist the PCARB and/or DCARB. The main responsibilities of the CPC will be to:

- a. Delegate Commune officials to assist the DCARB and/or PCARB in implementation of resettlement activities
- b. Sign Agreement Compensation Forms with AP;
- c. Assist AP to resolve grievances and/or file complaints at appropriate levels (see Chapter 8); and
- d. Actively participate on all land acquisition and resettlement, rehabilitation measures and income rehabilitation assistance projects and programs.

11.4 CONSULTANTS FOR RESETTLEMENT, ETHNIC MINORITIES AND GENDER

To help ensure that resettlement activities will be implemented in accordance with ADB policy, RPMU will engage one international Resettlement Specialist for a period of six (6) months and one national Resettlement Specialist for a period of twelve (12) months. Both specialists will also have expertise and background on ethnic minority issues. The main responsibilities of the Resettlement Specialists will be to:

- a. Oversee preparation of the updated Resettlement Plan and its implementation to ensure that it conforms with ADB resettlement policy;
- b. Identify training needs and organize training courses on ADB resettlement policy for RPMU and implementing partners;
- c. Support and advise RPMU on all aspects of ADB policy that are relevant to resettlement and land acquisition;
- d. Develop effective mechanisms for ensuring adequate dissemination of project information and public consultation with AP;
- e. Establish and maintain a database of all AP;
- f. Assist in the coordination and design of rehabilitation assistance programs;
- g. Assist RPMU in monitoring the preparation and implementation of the Resettlement Plan;
- h. Prepare Terms of Reference for an Independent Monitoring Organization and support RPMU in identifying suitable candidates

The RPMU will also engage one international Gender and Social Development Specialist for a period of four (4) months to help ensure that gender issues are integrated during the updating, implementing, monitoring and evaluation of the Resettlement Plan. The main responsibilities of the Gender and Social Development Specialist will be to:

- a. Identify training needs and organize training courses on gender issues for RPMU and implementing partners;
- b. Support and advise RPMU on all aspects of ADB policy that are relevant to gender and development;
- c. Develop effective mechanisms for ensuring adequate dissemination of project information and public consultation with female AP;
- d. Ensure that socio-economic data on AP is disaggregated by gender;
- e. Advise on the development of gender-sensitive income rehabilitation programs;
- f. Assist RPMU in monitoring gender issues in the preparation and implementation of the Resettlement Plan;

12 MONITORING AND EVALUATION

Monitoring and evaluation will have two purposes for this Project:

- To verify that resettlement activities have been completed effectively with respect to quantity, quality and timeliness in accordance with the Resettlement Plan; and
- To assess that these activities have succeeded in maintaining or improving the pre-project living standards and productive capacity of AP.

Regular supervision and internal monitoring of resettlement activities will be carried out by RPMU and counterparts, while external monitoring and evaluation will be carried out by an Independent Monitoring Organization (IMO).

12.1 SUPERVISION AND INTERNAL MONITORING

12.1.1 Objectives and Timeframe

The primary objectives of supervision and internal monitoring are to ensure that resettlement activities are implemented according to the Resettlement Plan and to address any arising problems with appropriate measures. As such, it is carried out on an ongoing basis.

12.1.2 Institutional Arrangements and Procedures

Supervision and internal monitoring will be primarily the responsibility of RPMU, in close cooperation with the Provincial People's Committees (PPC). The PPC will report in writing to the RPMU on a quarterly basis, based on information collected from CARB and other relevant organizations. The RPMU will compile all PPC reports into quarterly and bi-annual Progress Reports, which will be submitted to the Ministry of Transport and the Asian Development Bank. Progress Reports will provide information on at least the following:

- Consultation and disclosure activities;
- The number of AP by category of impact per component, and the status of compensation payments, relocation, and income restoration for each category
- The amount of funds allocated for operations or for compensation and the amount of funds disbursed for each;
- The eventual outcome of complaints and grievances and any outstanding issues requiring management or ADB's assistance;
- Implementation issues; and
- Any revisions in implementation schedule.

Internal monitoring will be conducted continuously throughout the implementation of the Project, including implementation of Income Rehabilitation Assistance programs (see Chapter 7).

12.2 EXTERNAL MONITORING AND EVALUATION

12.2.1 Objectives and Timeframe

The primary objective of external monitoring and evaluation is to verify that resettlement activities are achieving the Project's main policy objective, namely to maintain or improve the pre-project living standards and productive capacity of AP. External

monitoring and evaluation will also assess that resettlement activities are implemented in quantity, quality and timeliness according to the Resettlement Plan.

External monitoring and evaluation will initially be conducted at four stages in the project, first, after payment of compensation before civil contracts are awarded and then again at 3, 6, 12 and 24 months after the date of relocation. **External monitoring and evaluation will continue until the Project's policy objective has been achieved.**

12.2.2 Arrangements and Procedures

External monitoring and evaluation will be carried out by an Independent Monitoring Organization (IMO) contracted to RPMU. The IMO will be an NGO, university or research institute that is qualified in socio-economic assessments, resettlement, and ethnic minority issues. The IMO will prepare Project Evaluation Reports that will be submitted directly to the Ministry of Transport and the Asian Development Bank. The Project Evaluation Reports will document the level of social and economic impacts of the Project on AP according to the baseline data collected for this Resettlement Plan, and they will provide recommendations on what measures the RPMU needs to take to ensure that the Project's policy objective is achieved.

12.2.3 Evaluation Indicators

The IMO will include the following indicators in its monitoring and evaluation assessments:

Public Participation and Consultation

- Verify that AP received and understood the Public Information Booklet distributed by RPMU
- Verify that AP were adequately notified of public meetings and other consultation activities carried out by RPMU
- Assess that AP received adequate and timely information on the Project and the resettlement process

Compensation and Entitlements

- Verify that the Compensation Plan adheres to the principles and policies of the Resettlement Plan
- Verify that AP received full compensation amounts and other entitlements as specified in the Agreement Compensation Form (ACF)
- Verify that the pricing in the Compensation Plan adequately reflects replacement value in local markets
- Verify that replacement land provided by the Project has been of equal value and productive capacity as lands acquired by the Project and that the AP has received a Land User Rights Certificate for the replacement land
- Verify that compensation payments were made in due time to allow AP to relocate and make necessary preparations before award of civil works contracts

Post-project Living Standards

- Evaluate baseline data that was collected under the Socio-Economic Survey to assess changes in:
 - Household income and expenditures
 - Expenditure composition patterns
 - Primary and secondary occupations
 - Borrowing amounts and debt patterns

- Material conditions and possession of consumer items
 - Land area and tenure arrangements
 - School attendance of children
 - Child malnutrition and general health
 - Distances to public services and infrastructure
-
- Collect qualitative indicators on AP's own assessment of changes in living standards before and after the project at household and community levels, which may be collected through open ended questions, semi-structured interviews, case studies, or group discussions employing a range of PRA tools and methods
 - Verify with AP that community services and resources damaged during road construction works have been fully restored to their previous conditions and operational capacity

Grievances and Complaints

- Assess that AP were aware of and understand the Project's mechanism for addressing grievances and complaints
- Verify that any complaints filed were resolved satisfactorily and in line with the principles and policies of the Resettlement Plan
- Verify that AP paid no fees for filing complaints at the commune, district or provincial level

13 IMPLEMENTATION SCHEDULE**Table 13.1: Implementation Schedule**

#	ACTIVITY	IMPL. UNIT	MONTH										
			First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth	Tenth	...until end
1	Establishment of CARB	CARB	■										
2	Resettlement training for implementing units and relevant institutions (e.g., Women's Union, Farmers' Union, CEMMA)	RPMU, PPC	■										
3	Resettlement training for Affected Persons and local authorities (e.g., Commune officials) and related organizations (e.g., NGO)	RPMU, PPC	■										
4	Public consultation and information dissemination with AP on implementation of Resettlement Plan	CARB	■										
5	Revised list of AP & updated Detailed Measurement Survey for Resettlement Plan	CARB		■	■								
6	Establishment of compensation rates and prices	CARB			■	■							
7	Disclosure of Compensation Plan to AP & Review of Special Rehabilitation Assistance Programs	RPMU & CARB				■	■						
8	Submit updated Resettlement Plan to GoV and ADB for review and approval	GOV & ADB					■	■					
9	Compensation payments and establishment of timeframe for land clearing and relocation	RPMU						■	■				
10	Independent monitoring of Resettlement Plan and Compensation Payments	IMO						■	■				
11	Land clearing and relocation from Project Area	AP & RPMU							■	■	■		
12	Award construction contracts and execute civil works	RPMU										■	
13	Plan and implement Special Rehabilitation Assistance Programs	PPC										■	■
14	Supervision and internal monitoring	RPMU	■	■	■	■	■	■	■	■	■	■	■
15	External monitoring and evaluation	IMO						■	■				■

14 COST ESTIMATES

14.1 COMPENSATION COSTS

The total cost for compensation of Affected Persons is estimated at 37.2 billion VND (approx. 2.3 million USD) in the project's Area of Impact (Table 14.1) and 9.4 billion VND (approx. 0.6 million USD) in the resettlement sites (Table 14.2).

14.2 TOTAL COSTS

The total cost for resettlement is estimated at 82.6 billion VND (approx. 5.1 million USD) (Table 14.3). **All costs for resettlement will be financed by the Government of Vietnam.**

Table 14.1: Compensation Costs in Area of Impact

Area of Impact	Land	Houses	Structures	Crops	Trees	Bus&Emp	Allowances	TOTAL (VND 000)	TOTAL (USD)
HANOI	22,706,946	1,093,574	56,750	0	27,289	550,200	44,100	24,478,859	1,529,929
Dong Anh	22,706,946	1,093,574	56,750	0	27,289	550,200	44,100	24,478,859	1,529,929
VINH PHUC	0	0	125	962	1,962	0	34,800	37,849	2,366
Thach Loi	0	0	0	212	423	0	17,400	18,035	1,127
Huong Canh	0	0	125	750	1,539	0	17,400	19,814	1,238
PHU THO	481,665	590,845	133,130	40,209	300,592	70,200	462,000	2,078,640	129,915
Viet Tri	1,886	0	0	911	2,481	0	32,100	37,377	2,336
Phu Duc	2,944	0	0	0	0	0	0	2,944	184
Tien Kien	15,870	1,989	822	0	887	70,200	0	89,768	5,611
Chi Chu	9,716	0	0	3,141	7,796	0	43,500	64,153	4,010
Vu En	12,203	0	3,075	1,400	9,456	0	34,800	60,934	3,808
Mai Tung	439,047	588,856	129,233	34,757	279,973	0	351,600	1,823,465	113,967
YEN BAI	1,688,657	1,853,319	198,018	10,670	600,014	29,700	757,600	5,137,977	321,124
Co Phuc	12,735	0	0	650	1,301	0	18,000	32,686	2,043
Mau A	12,641	0	0	863	1,725	0	66,500	81,729	5,108
Mau Dong	14,515	0	0	281	67,507	2,100	12,000	96,403	6,025
Lam Giang	7,455	0	0	398	18,842	0	52,200	78,895	4,931
Lang Thip	40,719	258,747	54,053	10	48,553	27,600	93,400	523,081	32,693
Van Phu	733,632	751,852	88,164	816	24,074	0	230,200	1,828,738	114,296
Realign. km169-171	866,960	842,720	55,801	7,652	438,012	0	285,300	2,496,445	156,028
LAO CAI	1,502,567	2,058,942	77,500	31,032	364,245	2,100	1,463,400	5,499,786	343,737
Thai Van	1,300	105,222	65	420	3,130	0	14,700	124,837	7,802
Thai Nien	0	5,440	23	1	1,413	0	12,000	18,878	1,180
Xuan Giao	18,110	0	0	1,811	3,622	0	44,100	67,643	4,228
Lao Cai	861,757	1,845,080	74,302	2,190	38,675	2,100	1,233,000	4,057,103	253,569
Realign. km283-291	621,400	103,200	3,110	26,610	317,405	0	159,600	1,231,325	76,958
TOTAL	26,379,834	5,596,680	465,522	82,873	1,294,102	652,200	2,744,500	37,233,111	2,327,069

Note: 1 USD = 16,000 VND

Table 14.2: Compensation Costs in Resettlement Sites

Resettlement Sites	Land	Houses	Structures	Crops	Trees	Bus&Emp	Allowances	TOTAL (VND 000)	TOTAL (USD)
Pho Moi	375,224	1,124,660	24,945	5,200	28,949	8,400	685,000	2,252,378	140,774
Van Hoa	1,853,548	3,152,200	137,705	18,788	211,334	30,600	1,781,000	7,185,175	449,073
TOTAL	2,228,772	4,276,860	162,650	23,988	240,283	39,000	2,466,000	9,437,553	589,847

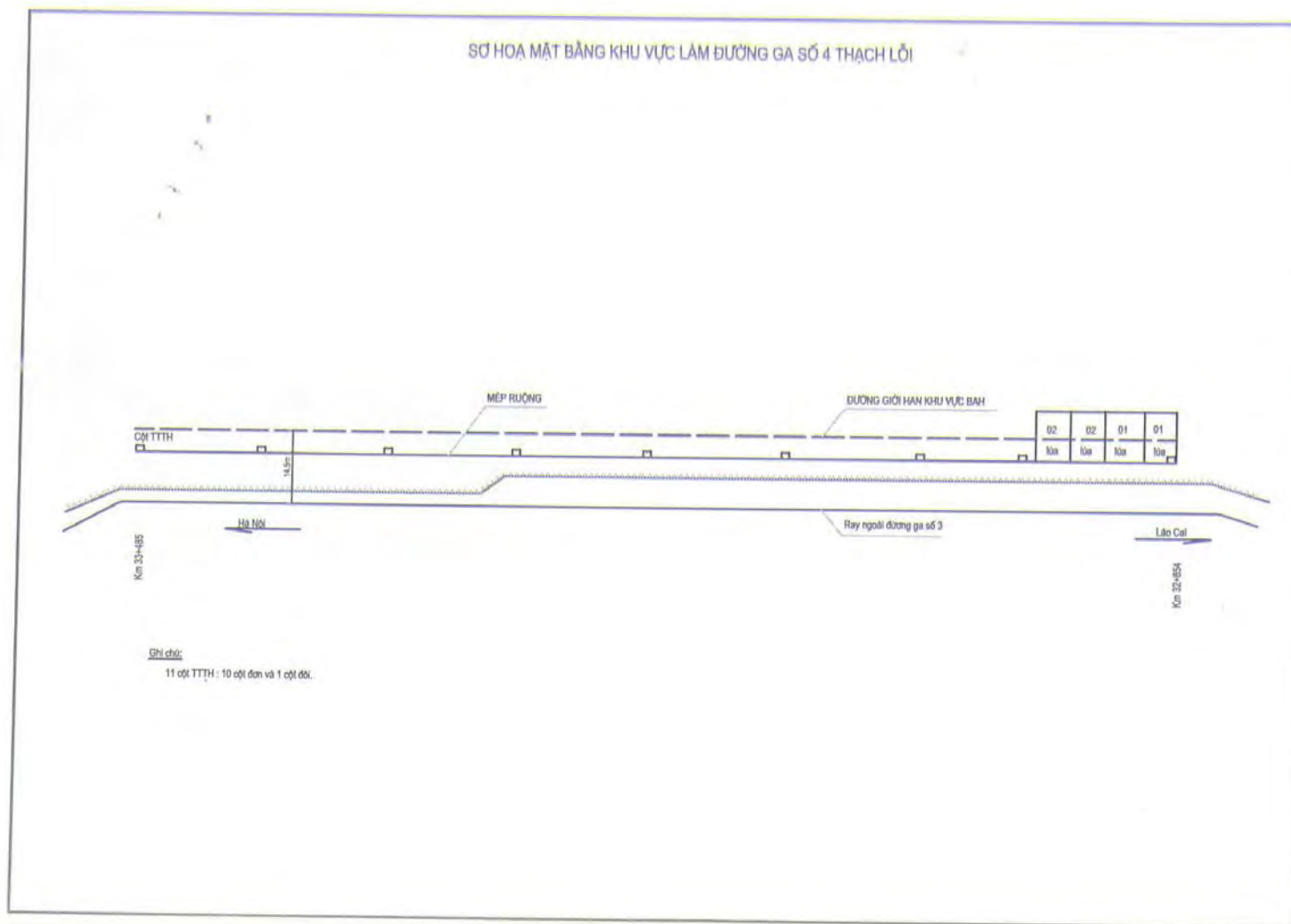
Note 1 USD = 16,000 VND

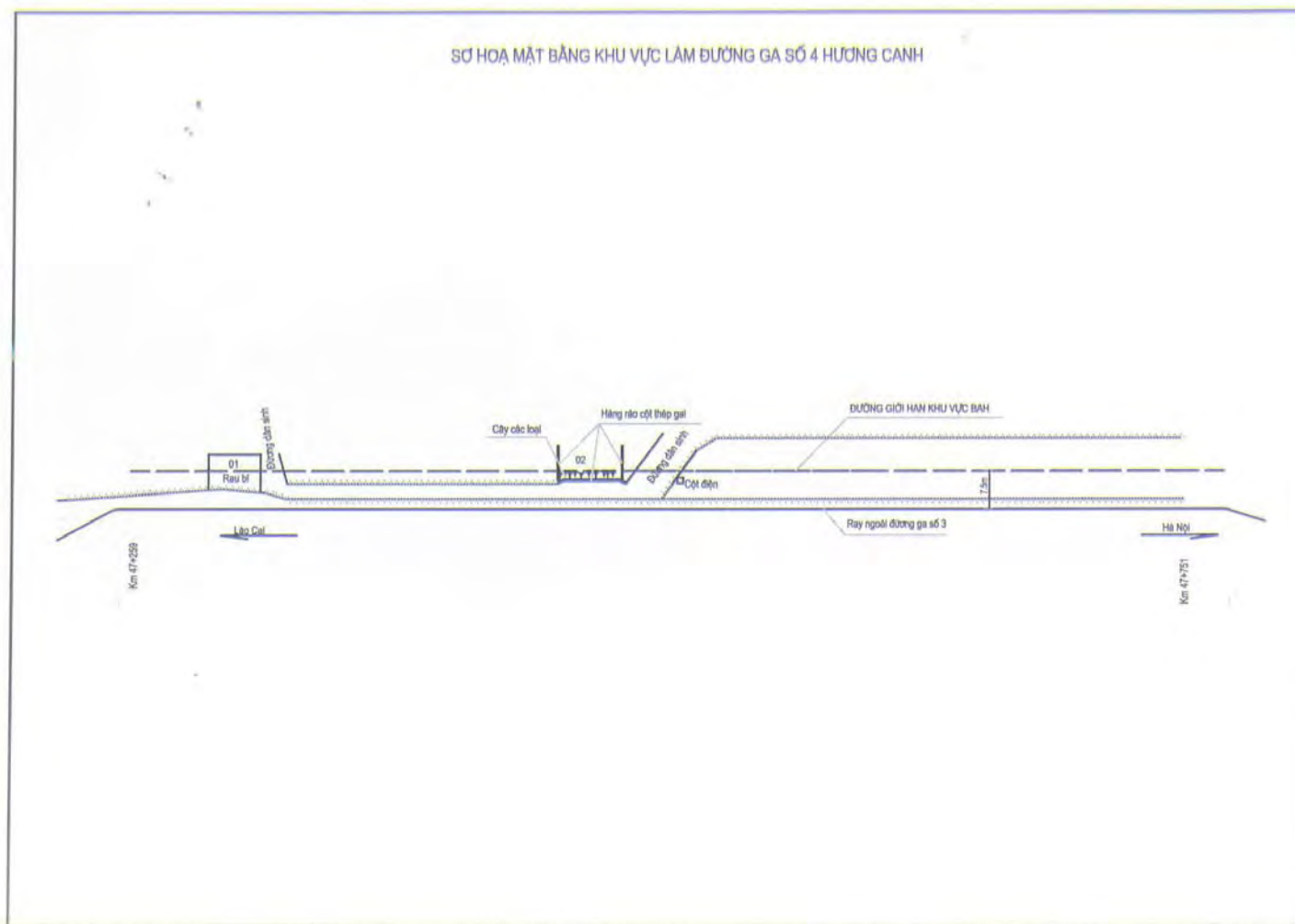
Table 14.3: Total Estimated Cost for Project

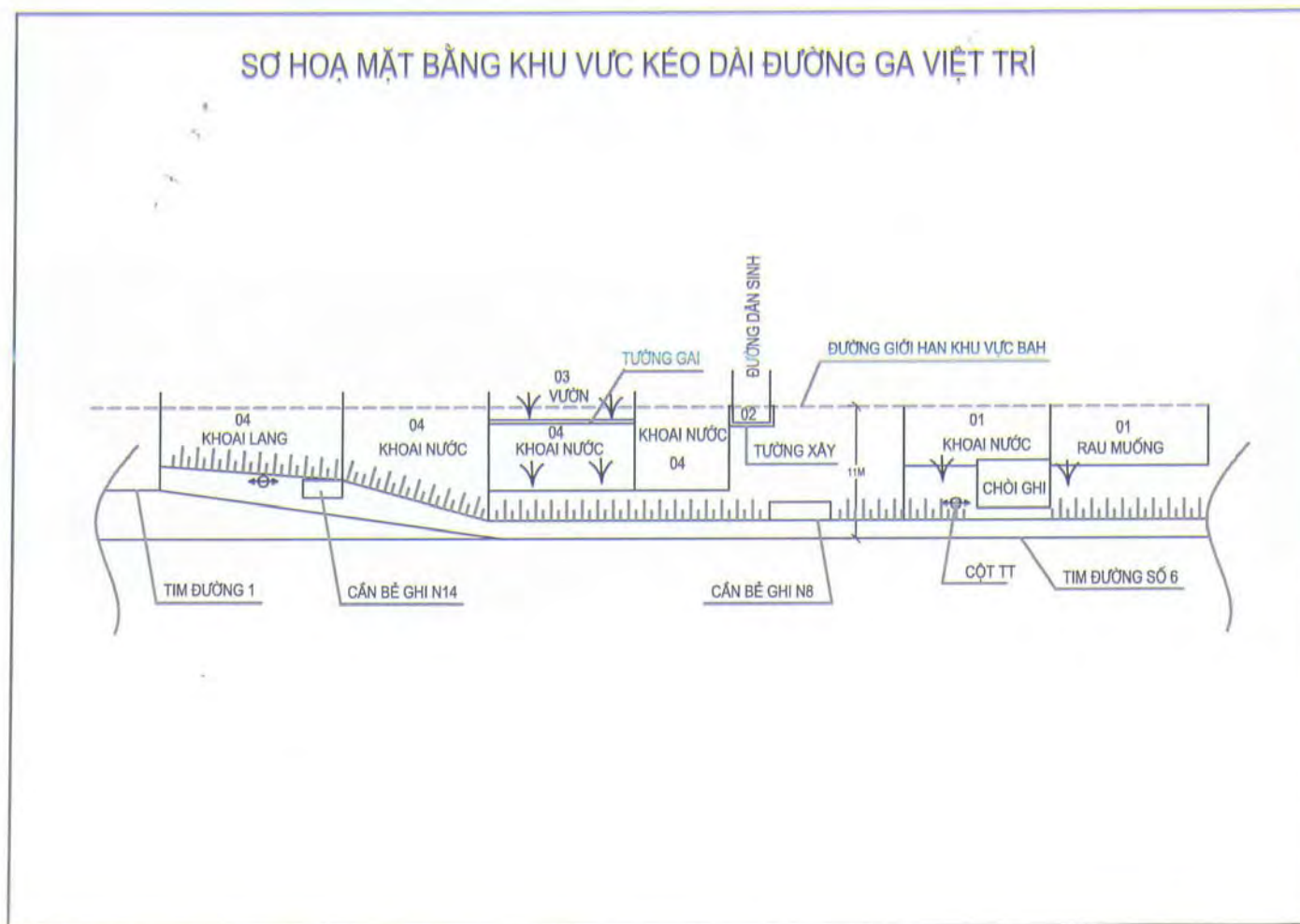
#	COST CATEGORY	TOTAL (VND 000)	TOTAL (USD)
1	Compensation and Allowances in Project Area of Impact	37,233,111	2,327,069
1.1	- Land	26,379,834	1,648,740
1.2	- Houses	5,596,680	349,792
1.3	- Structures	465,522	29,095
1.4	- Crops and Trees	1,376,975	86,061
1.5	- Businesses and Employment	652,200	40,763
1.6	- Allowances	2,761,900	172,619
2	Resettlement Sites	21,403,252	1,337,703
2.1	- Compensation and Allowances	9,437,553	589,847
2.2	- Investment Costs	11,965,699	747,856
3	Surveying and Consultants	5,439,000	339,938
3.1	- Surveying and Coordination Costs	591,000	36,938
3.2	- Resettlement Training Workshops	80,000	5,000
3.3	- Resettlement and Ethnic Minority International Specialist (6 mo.)	2,400,000	150,000
3.4	- Resettlement and Ethnic Minority National Specialist (12 mo.)	768,000	48,000
3.5	- Gender and Social Development Specialist (4 mo.)	1,600,000	100,000
4	Sub-Total (1+2+3)	64,075,363	4,004,710
5	Management Costs	18,581,855	1,161,366
5.1	- Management (7%)	4,485,275	280,330
5.2	- Monitoring and Evaluation (7%)	4,485,275	280,330
5.3	- Contingency (15%)	9,611,304	600,707
6	TOTAL (4+5)	82,657,218	5,166,076

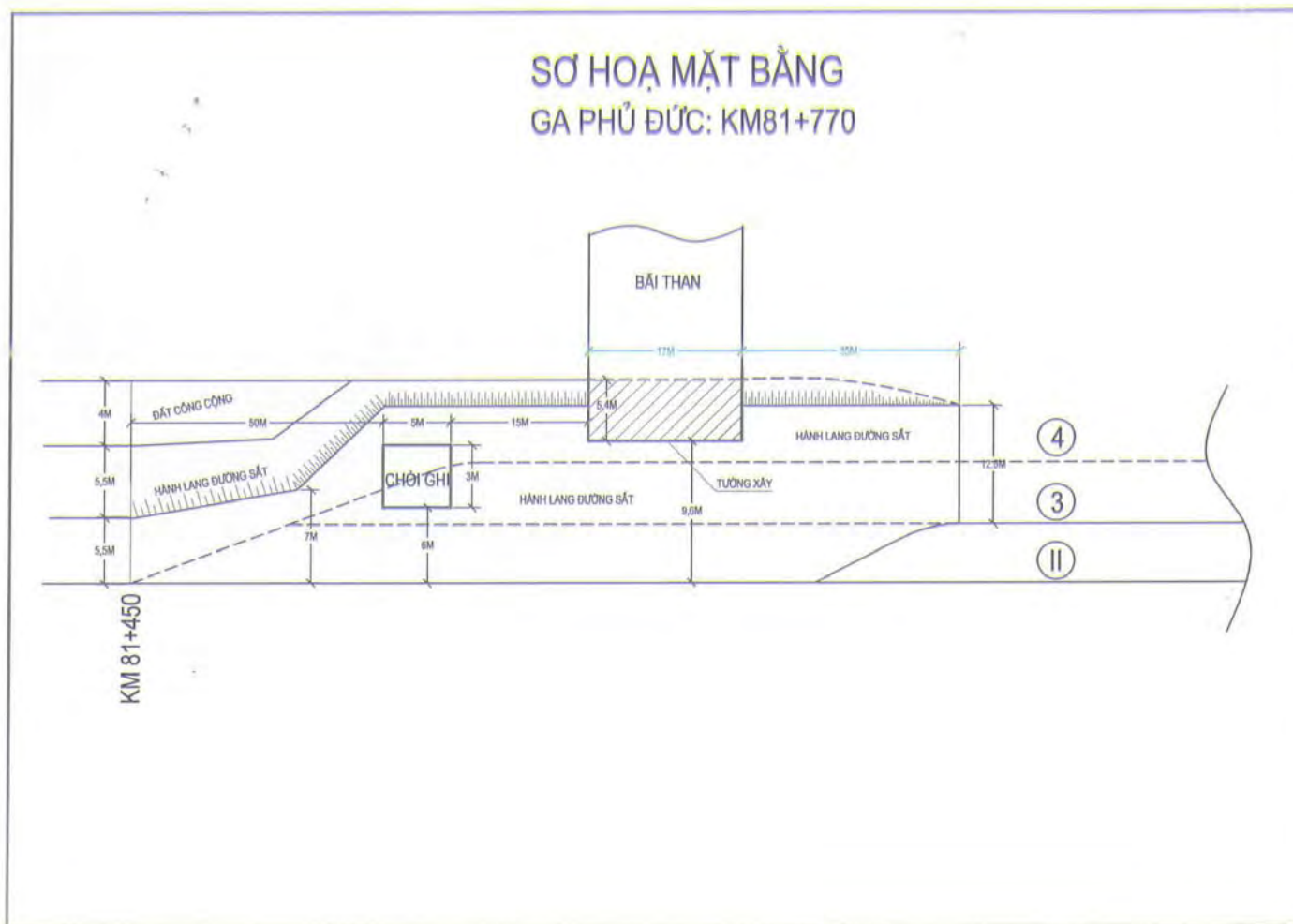
ANNEX 1

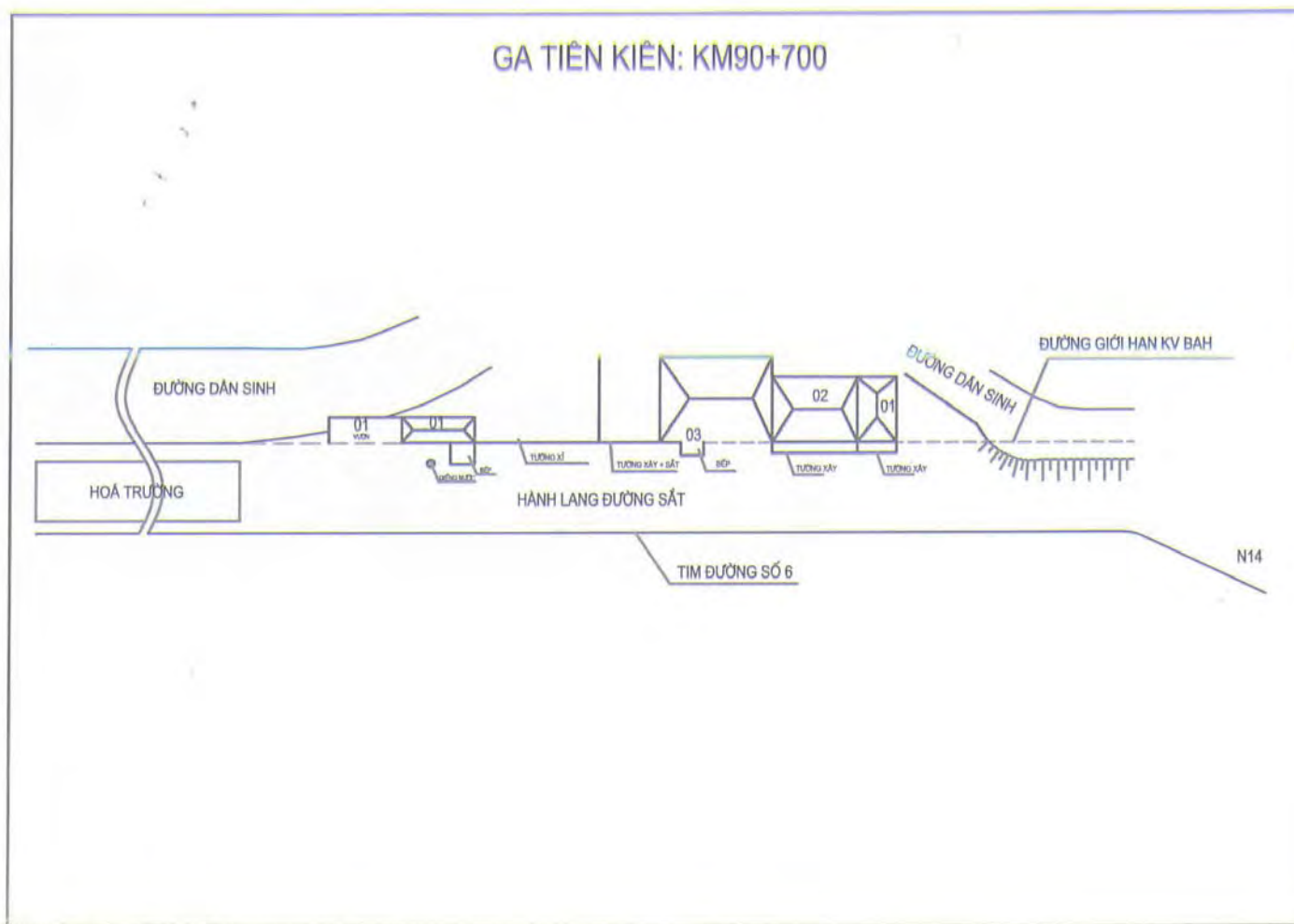
Sketches of Project Area of Impact

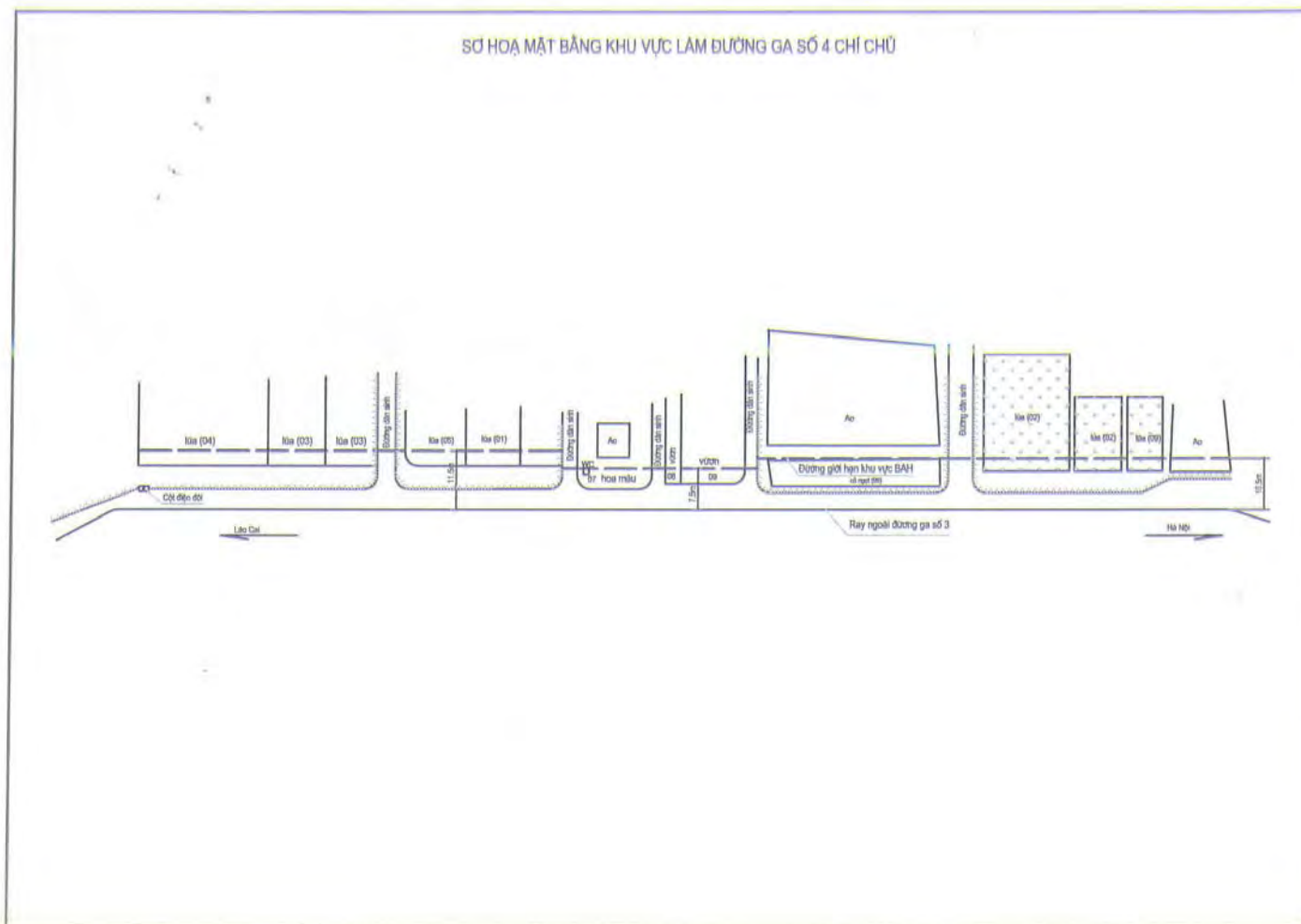
Thach Loi Station

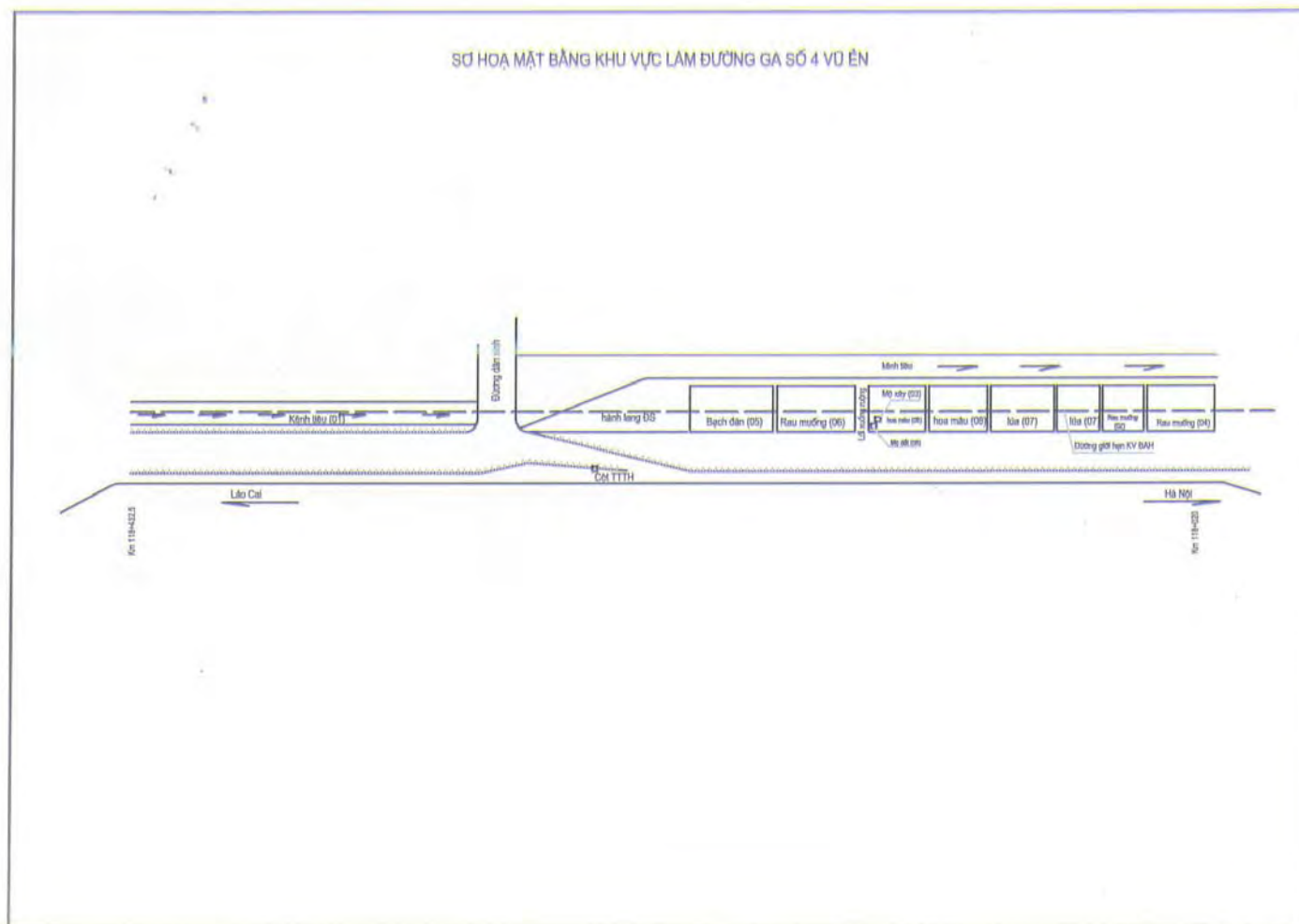
Huong Canh Station

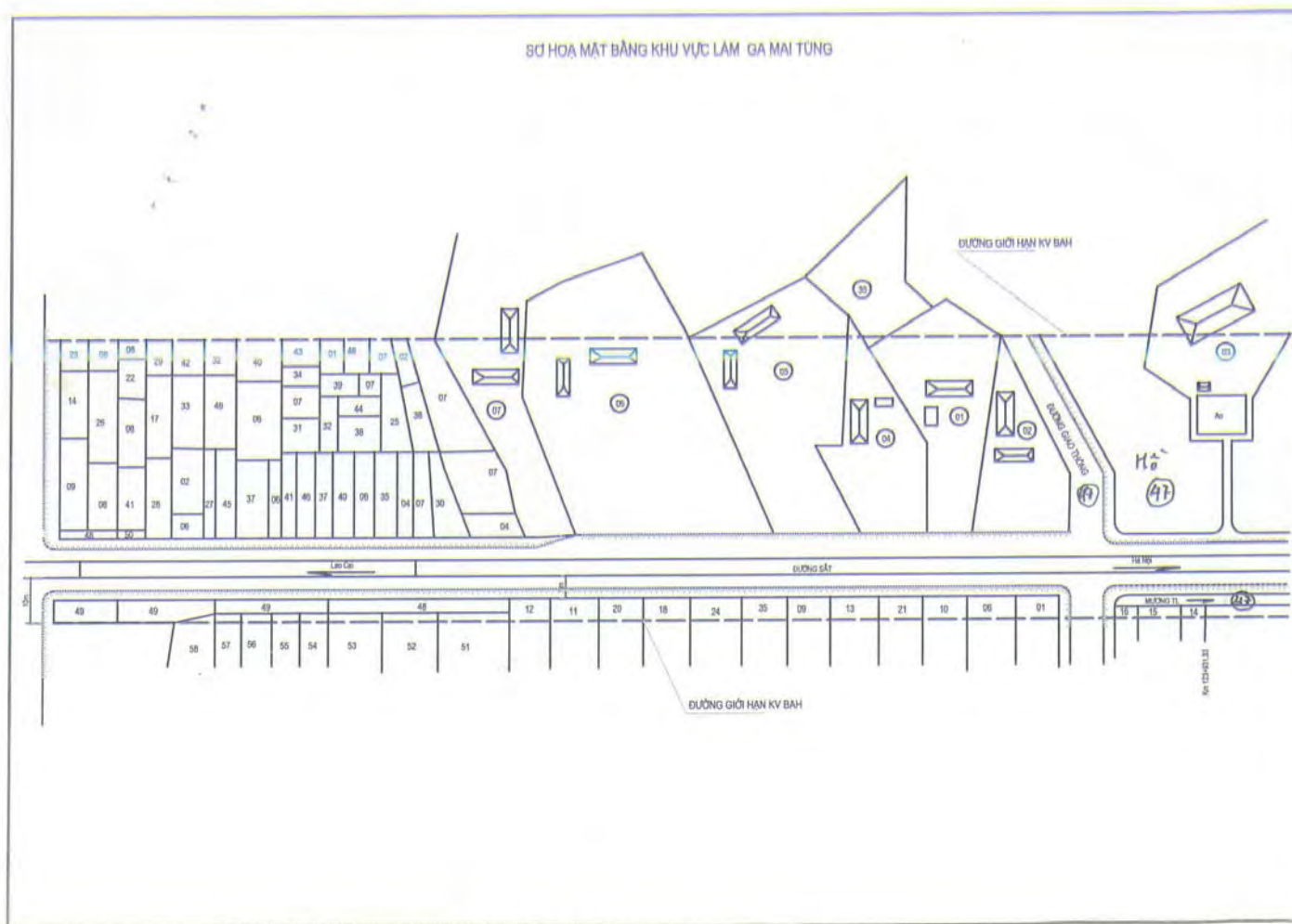
Viet Tri Station

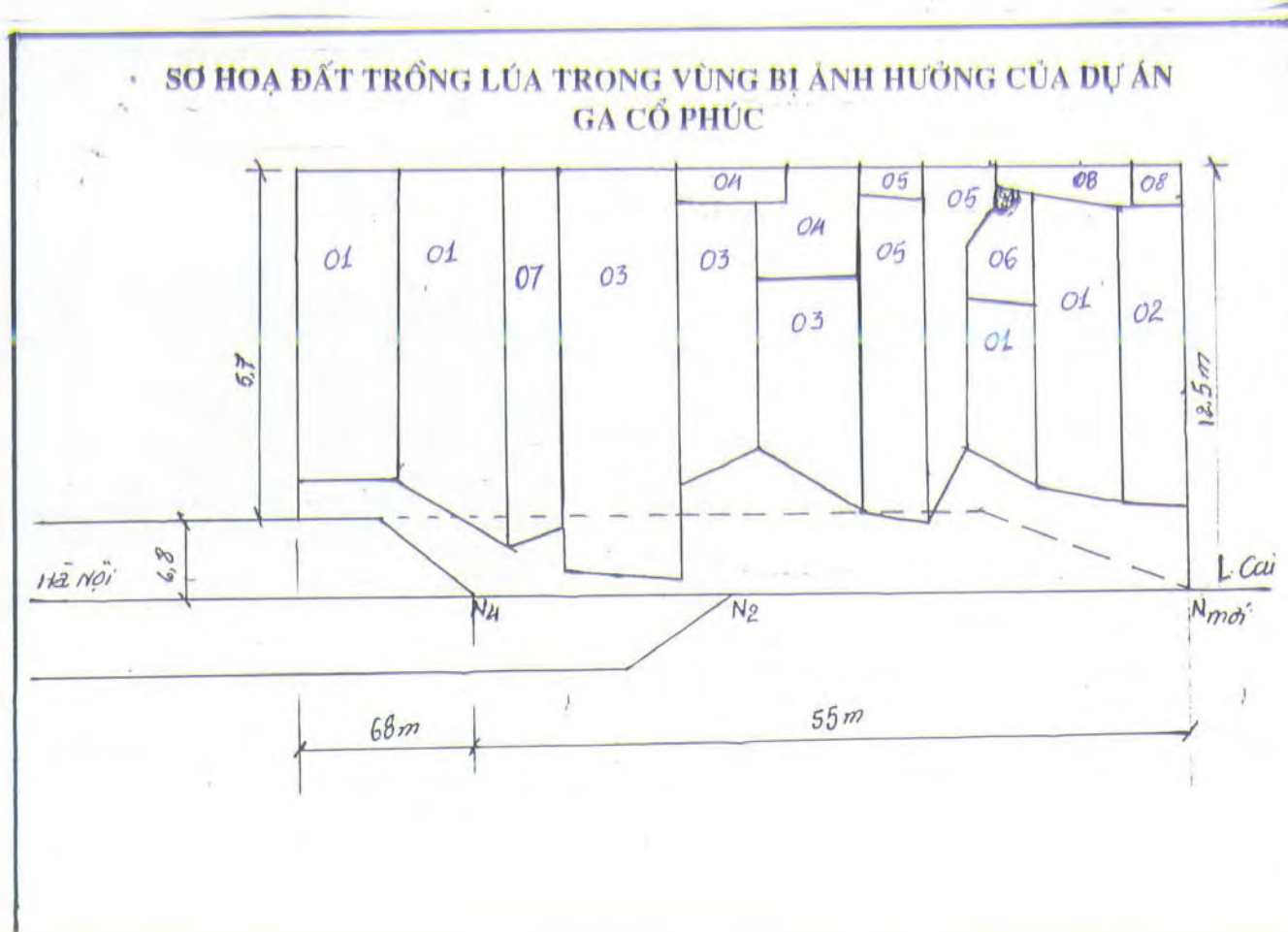
Phu Duc Station

Tien Kien Station

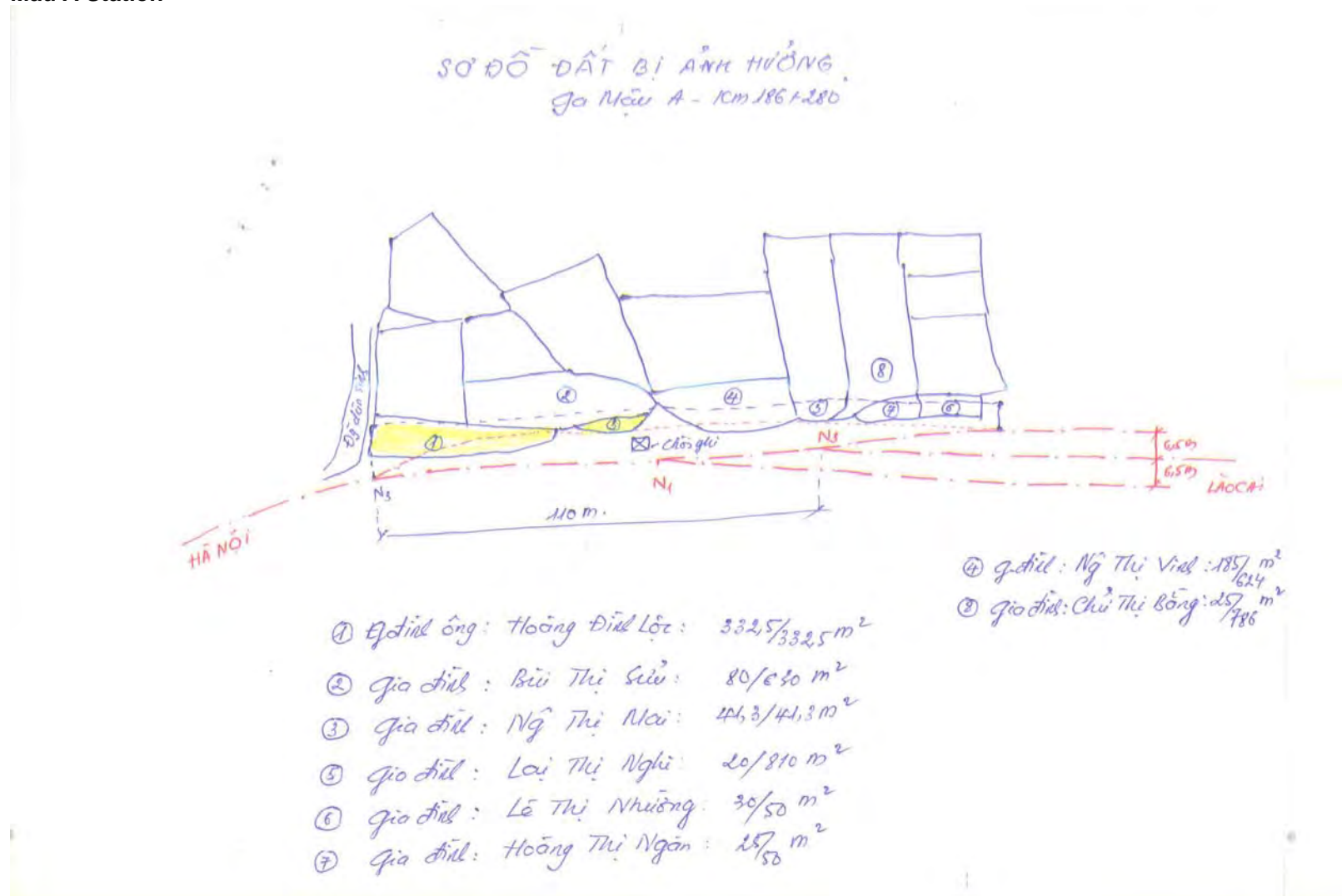
Chi Chu Station

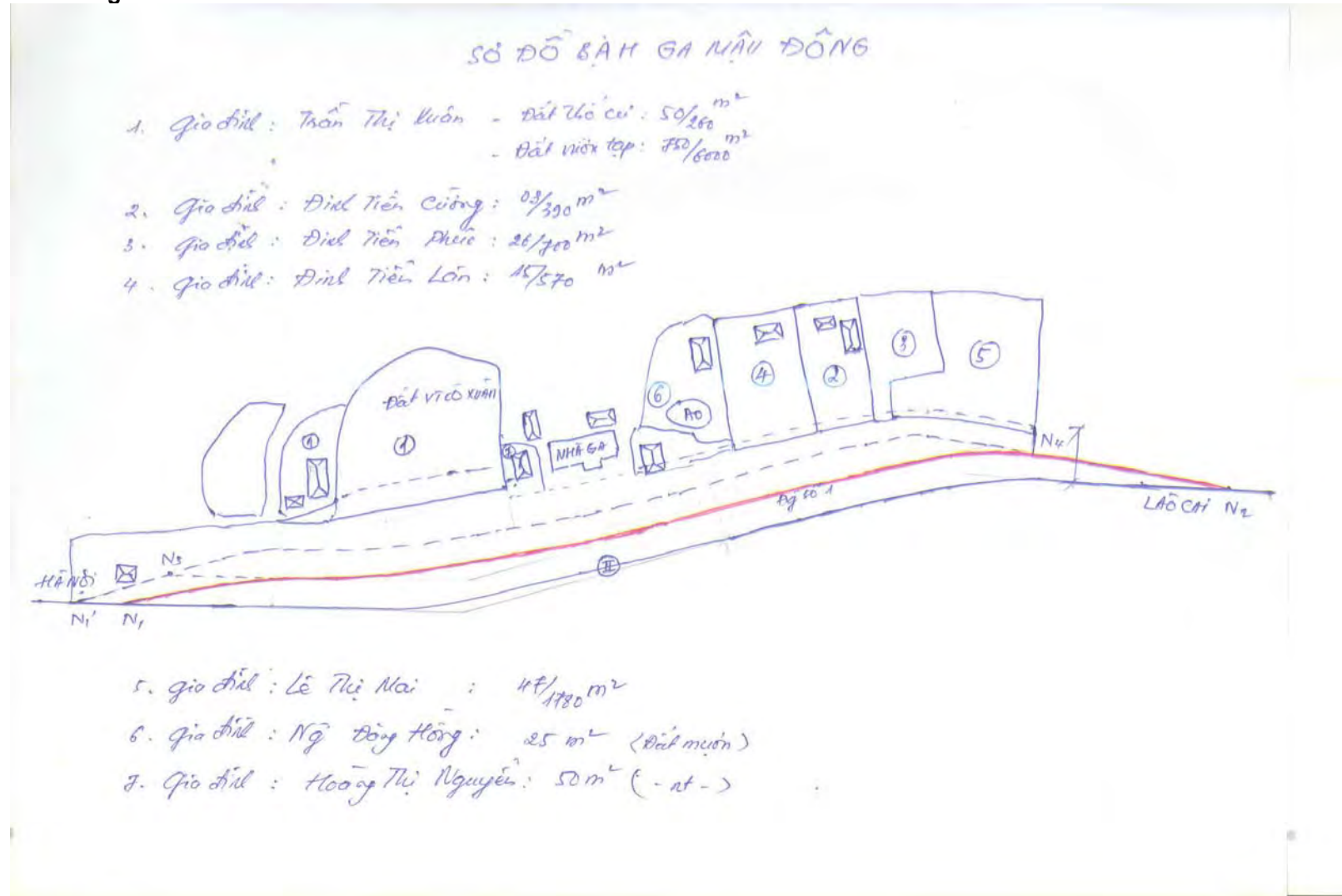


Mai Tung Commune

Co Phuc Station

Mau A Station

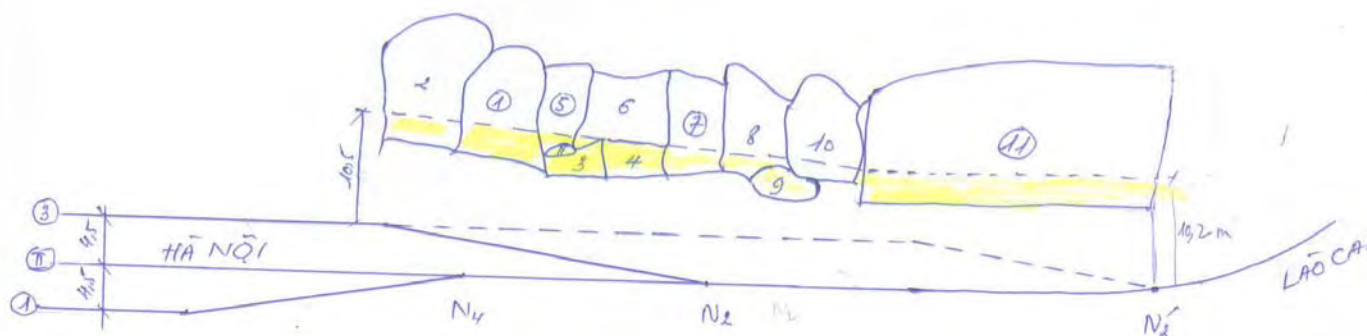


Mau Dong Station

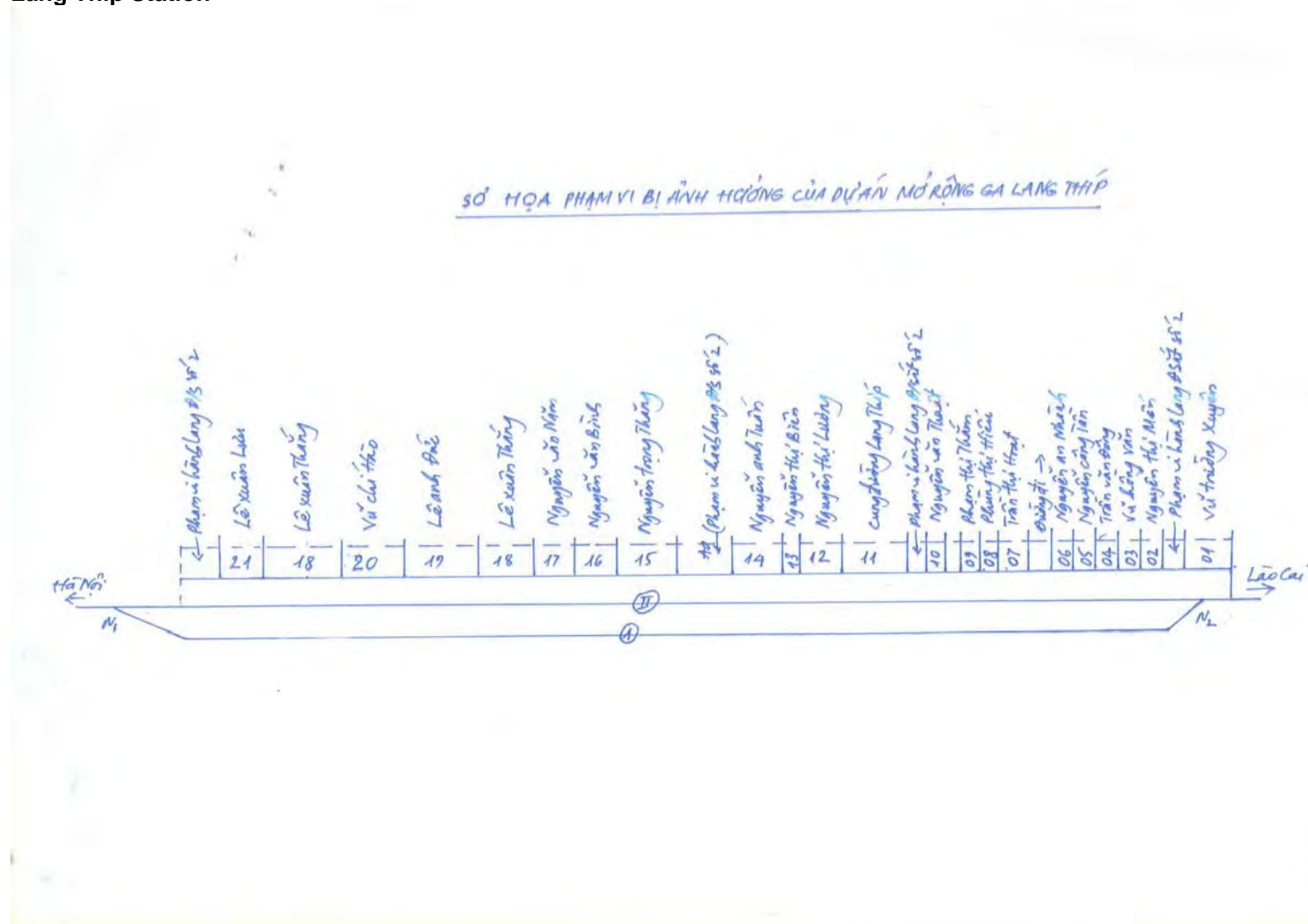
Lam Giang Station

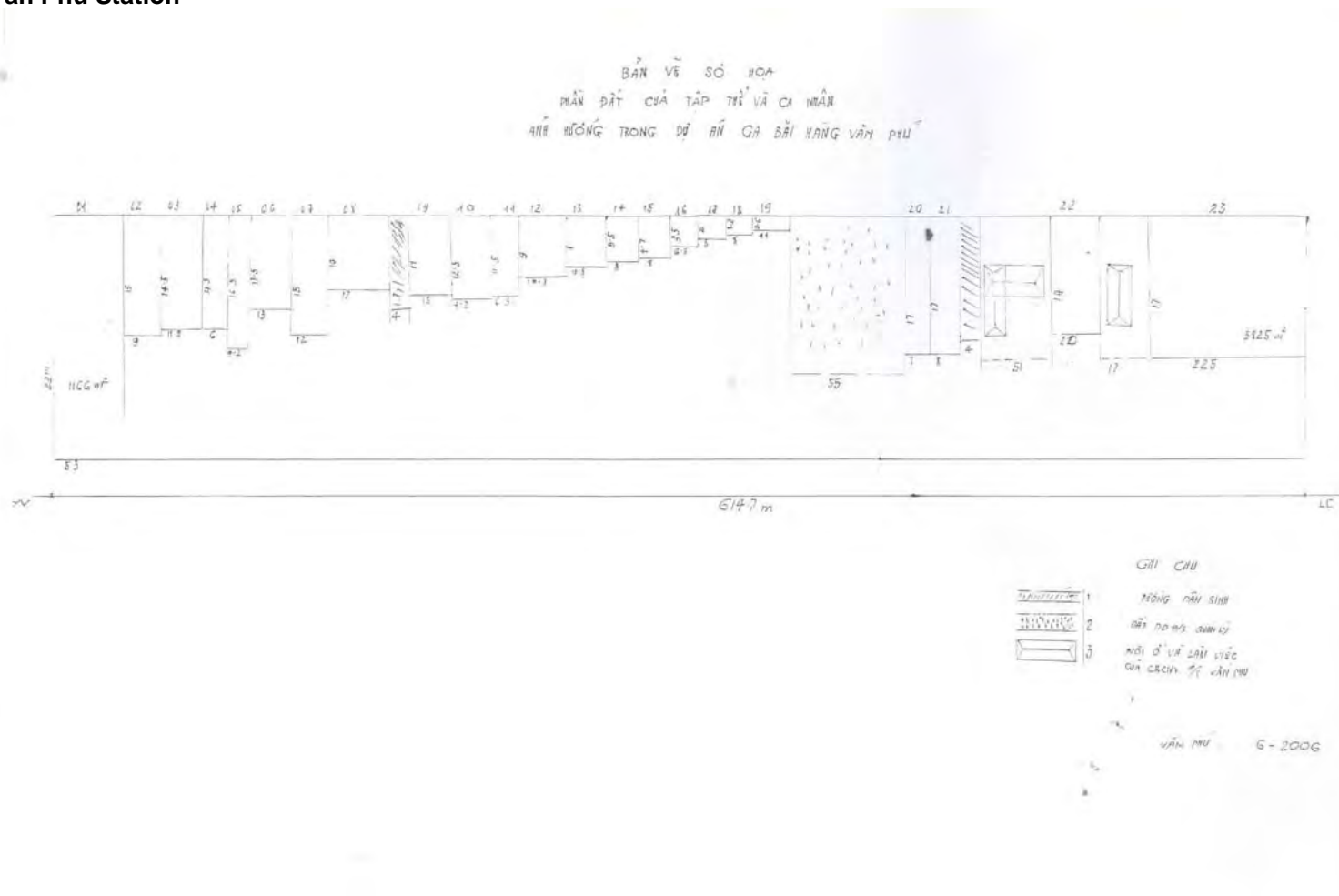
SƠ ĐỒ ĐẤT BỊ ẢNH HƯỞNG
ga: Lam Giang

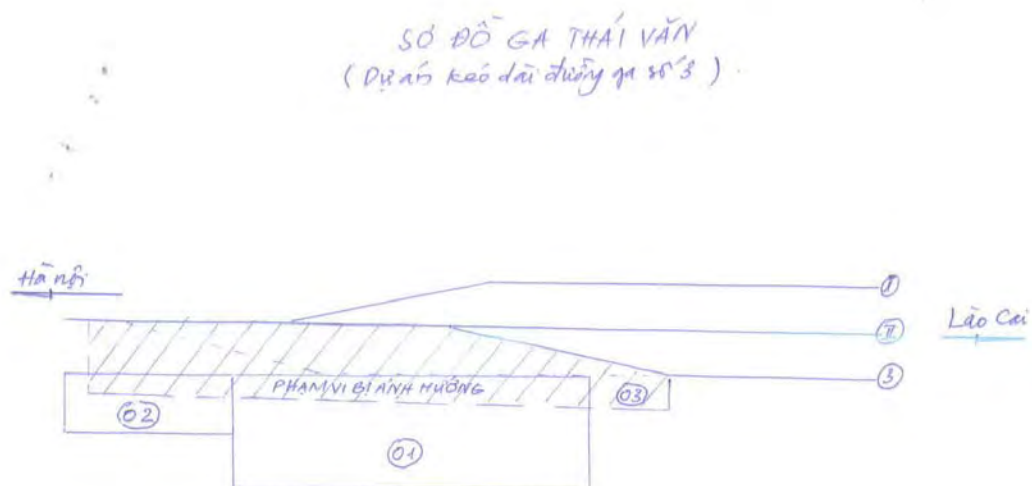
1. Gia đình: Phạm Thị Quý (1)(3)(4) = 174/150 m²
2. Gia đình: Lưu Hồng Kỳ (7)(9)(10) = 64/150 m²
3. Gia đình: Nguyễn Thị Thuyết (11)(12) = 25/150 m²
4. Gia đình: Phạm Đoàn Tèo : 75/11 : 207/150 m²
5. Ng. Thị Oanh (13) : 54/54 m²
6. Ng. Văn Bình (18) : 18/150 m²



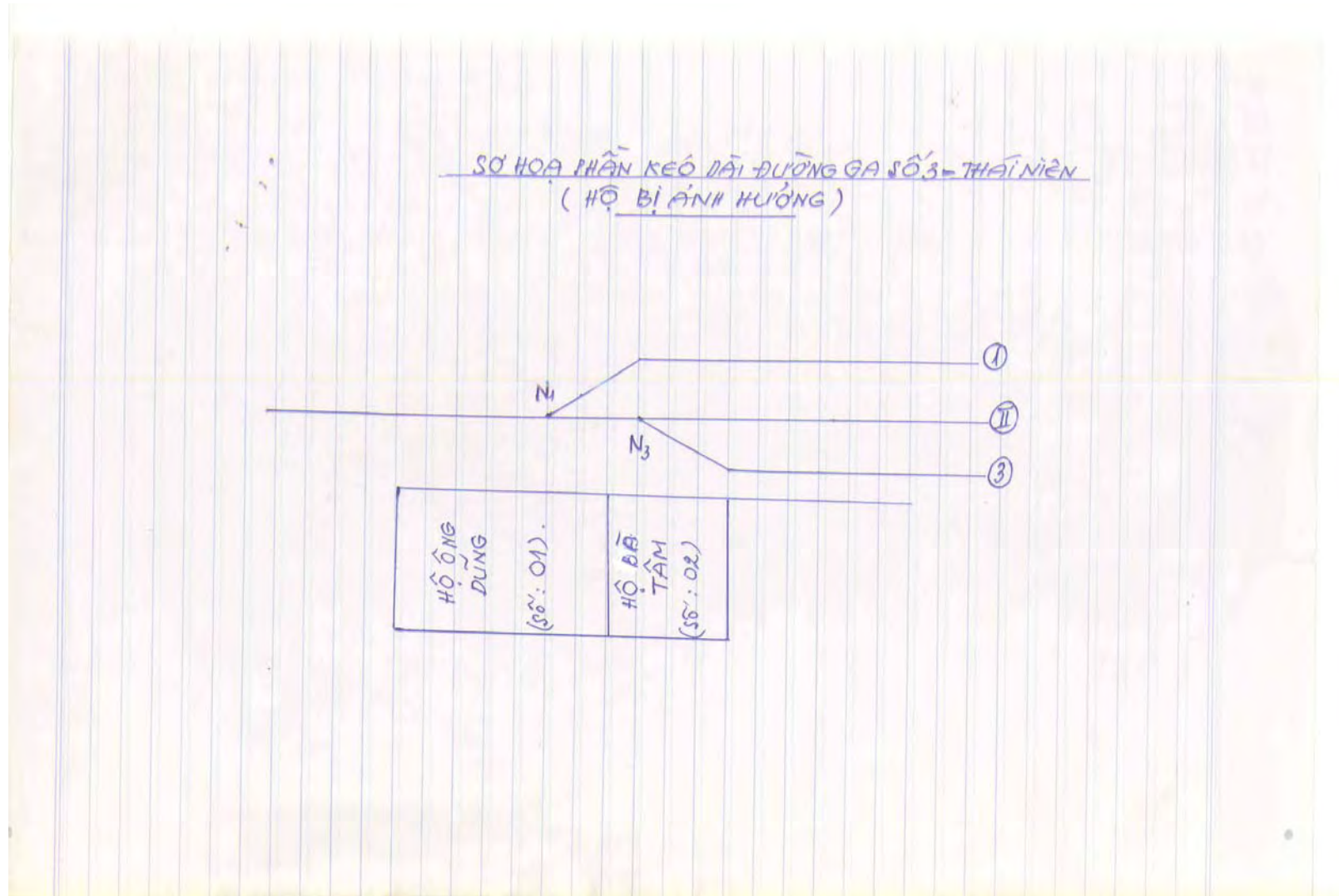
Lang Thip Station



Van Phu Station

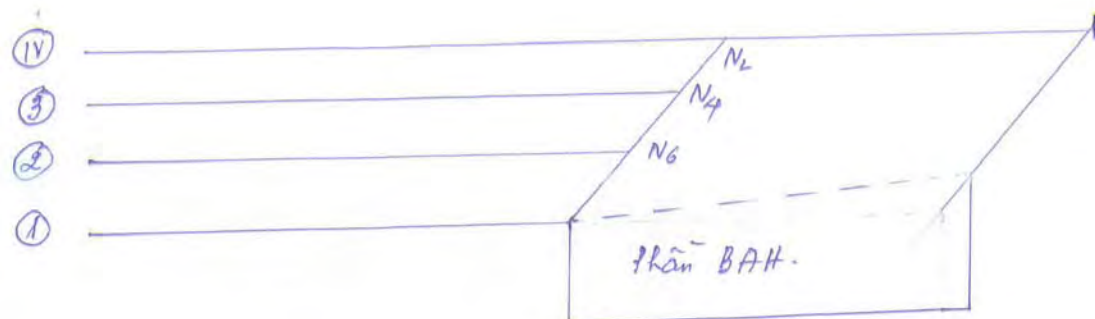
Thai Van Station

Ghi chú: 01: Hộ gia đình ông Tạ Quang Đông.
02: Hộ gia đình bà Hoàng Thị Hòa.
03: Đất thực hành xây dựng sắt đã có.

Thai Nien Station

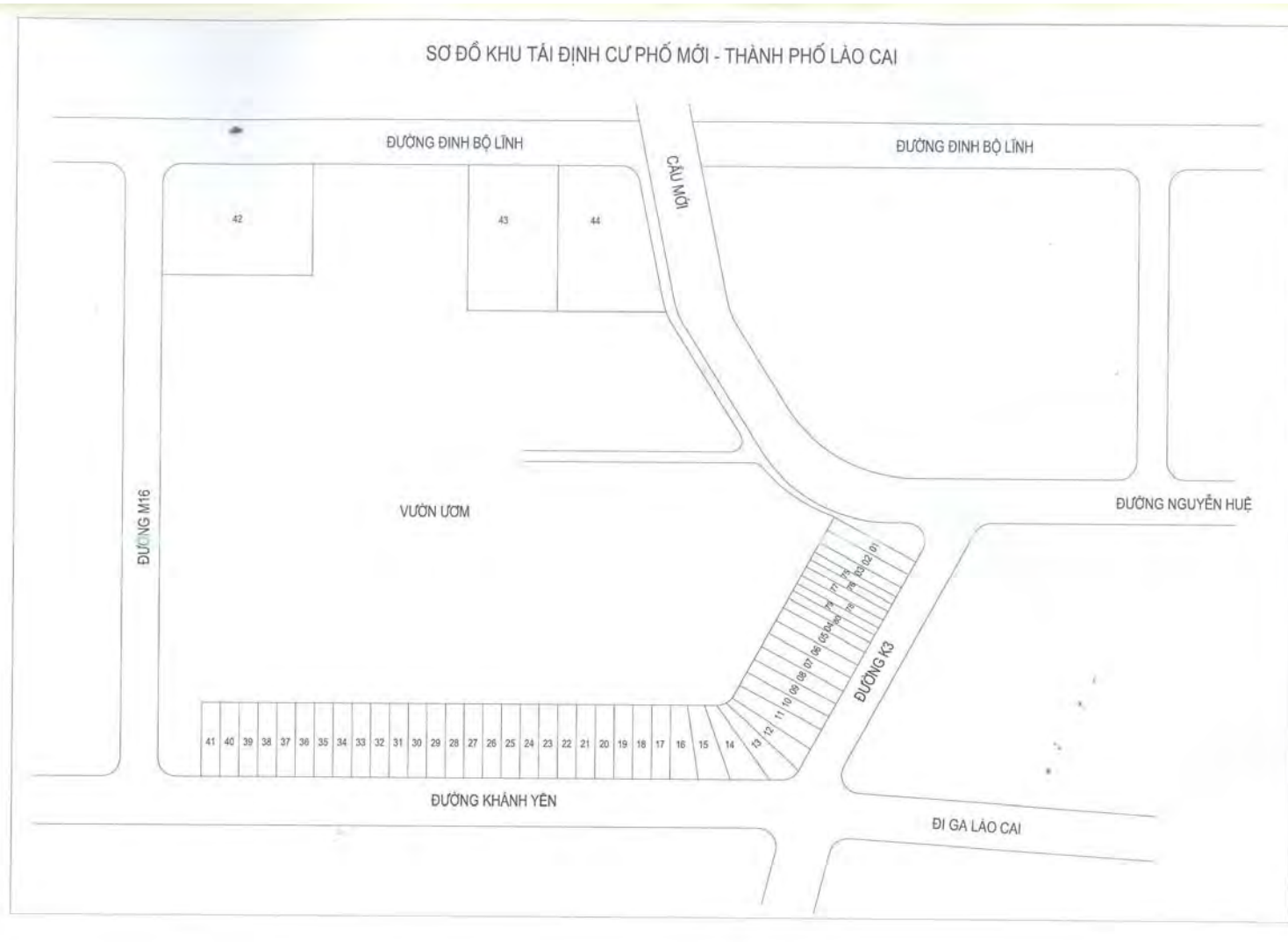
Xuan Giao Station

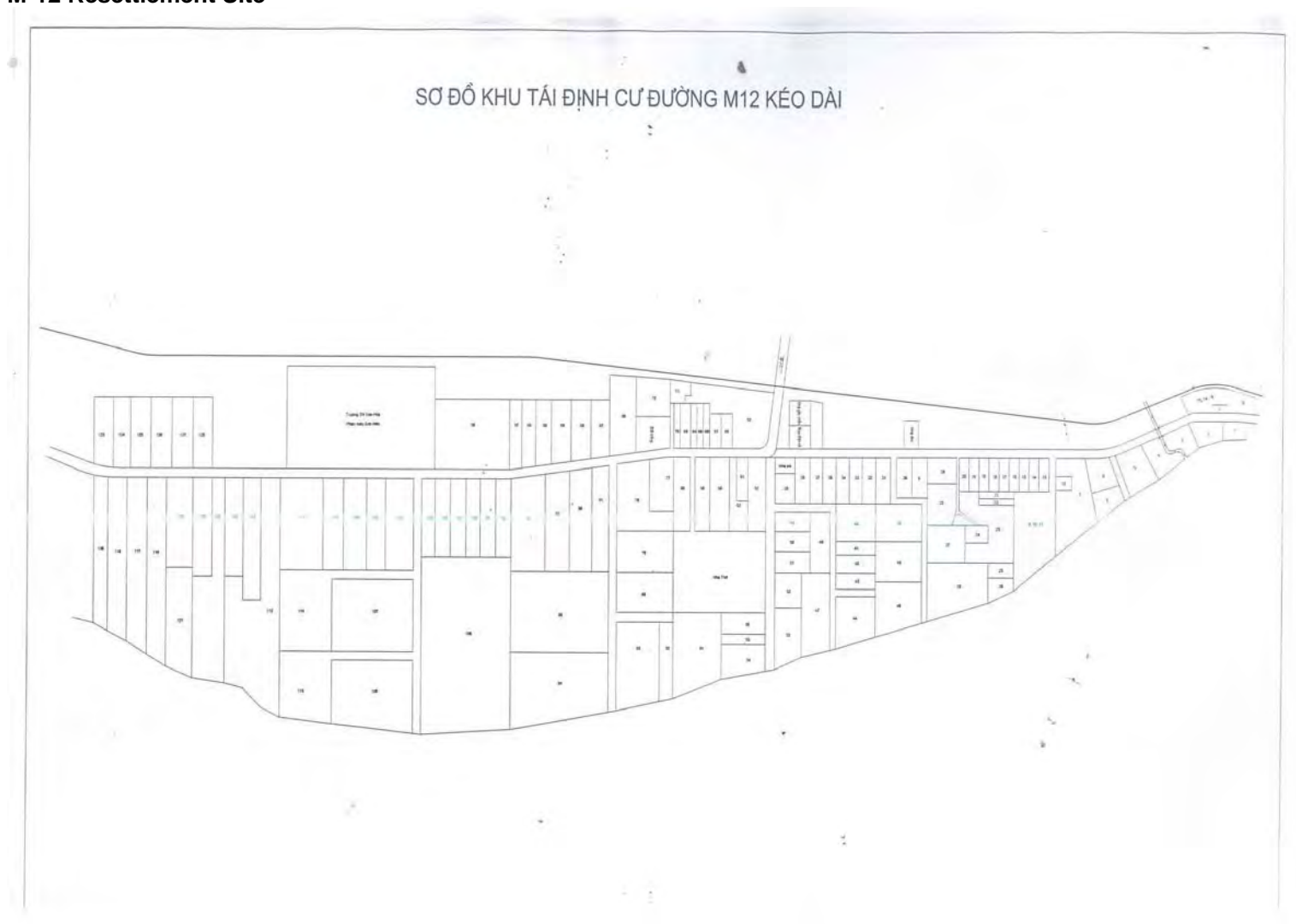
SỐ HỘ BỊ ẢNH HƯỞNG DO KÉO DÀI ĐƯỜNG 1, 2, 3 – GA XUÂN GIAO A.



Số hộ 06	Số hộ 05	Số hộ 04	Số hộ 03	Số hộ 02 Số hộ 07	Số hộ 01
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Lao Cai Station

Pho Moi Resettlement Site

M-12 Resettlement Site

ANNEX 2

Inventory of Losses Questionnaire

BẢNG HỎI ĐIỀU TRA THIẾT HẠI

INVENTORY OF LOSSES QUESTIONNAIRE

Railway Code: AP No.:

Railway Codes:

TL	Thạch Lỗi
HC	Hương Canh
VT	Việt Trì
PD	Phủ Đức
TK	Tiên Kiên
CC	Chí Chủ
VE	Vũ ến

CP	Cổ Phúc
MA	Mậu A
MD	Mậu Đông
LG	Lâm Giang
LT	Lạng Thíp
TV	Thái Văn
TN	Thái Niên

VP	Văn Phú ga hàng mới
LC	Lao Cáy ga hàng mới
CN	Cầu Nhò ga quy hoạch mới
MT	Mai Tùng ga quy hoạch mới
DA	Dòng Anh đường đón gửi
KH	Công trình khác

Please draw a sketch of the household's land and structures in area of project impact.

A. Basic Information on Household Head or Land Use Organization

A1. Name: _____

A2. Birth Year: _____

A3. Gender: [a] Male [b] Female

A4. Education Level: [a] Illiterate [b] Incomplete School [c] High School Diploma [d] University

A5. Address:

Village _____ Commune _____ District _____ Province _____

A6. Household Members:

Household Members	Total	Female
Labourers 15-55 yrs		
Children <15 yrs		
Elderly >55yrs		

A7. Ethnicity:

[a] Kinh [b] Tay/Nung [c] H'mong/Dao [d] Muong [e]

Hoa [f] Other

A8. Occupation:

	Prim.	Secd.
[a] Agriculture/Forestry		
[b] Industry/Handicraft		
[c] Business/Services		
[d] Factory Worker		
[e] Civil Servant		
[f] Retired		
[g] Other: _____		

A9. Please estimate your household's annual income: _____ VND

A10. Please estimate your household's annual expenses: _____ VND

A11. Are you a single female-headed household with dependents?

[a] Yes [b] No

A12. Does the household head have an illness or permanent disability that significantly limits his/her productive capacity?

[a] Yes [b] No

A13. Does the household depend on elderly/retired persons without sufficient social assistance?

[a] Yes [b] No

A14. Is the household included on the Commune's list of poor households?

[a] Yes [b] No

A15. Is the household landless or without secure land tenure?

[a] Yes [b] No

B. Impacts on Land**B1. Residential or Commercial Land**

1.1. Total Area of Plot: _____ sq.m

1.2. Total Affected Area: _____ sq.m

1.3. Legal Status of Land:

[a] Land User Rights Certificate (LURC) obtained in _____ (year)

[b] In process of applying for LURC since _____ (year)

[c] Lease or Rent at rate of _____ (VND/month)

[d] Non-Titled but occupied since _____ (year)

1.3 (a). If you selected “b” for the question 1.3 above, please state:

Full name of land owner/ land leaser	Type	Contract Termination Date	Amount (VND/month)
	[a] Short term [b] Long term		

1.3 (b) If you selected “c” for the question 1.3 above, can you tell me which way did you get your land.

Which way did you receive your land?	From what person/ organization	Years of using land	Type of Contract
[a] Buying [b] Inheriting [c] Custom and tradition [d] With the permission of Authority [e] Without the permission of Authority			[a] Written [b] Verbal

1.4. You prefer compensation by: [a] Cash [b] Replacement Land of Equal Value

1.5. After land acquisition, you prefer: [a] Rearrange on the remaining area of land
[b] Compensate for the whole land plot and relocate**B2. Agricultural Land**

1.1. Total Affected Area: _____ sq.m

1.2. Total Area of Plot: _____ sq.m

1.3. Land class: [a] I [b] II [c] III [d] IV [e] V

1.4. Legal Status of Land:

[a] Land User Rights Certificate (LURC) obtained in _____ (year)

[b] Lease or Rent at rate of _____ (VND/month)

[c] Non-Titled but occupied since _____ (year)

1.4 (a). If you selected “b” for the question 1.4 above, please state:

Full name of land owner/ land leaser	Type	Contract Termination Date	Amount (VND/month)
	[a] Short term [b] Long term		

1.4 (b) If you selected “c” for the question 1.4 above, can you tell me which way did you get your land.

Which way did you receive your land?	From what person/ organization	Years of using land	Type of Contract
[a] Buying [b] Inheriting [c] Custom and tradition [d] With the permission of Authority [e] Without the permission of Authority			[a] Written [b] Verbal

1.5. You prefer compensation by: [a] Cash [b] Replacement Land of Equal Value

1.6. If you have other agricultural land plots, please provide the following information:

Agriculture land plot	Total area (sq.m)	[a] commune; [b] district; [c] province [d] other	Distance (Km)
		[a] [b] [c] [d]	
		[a] [b] [c] [d]	
		[a] [b] [c] [d]	
		[a] [b] [c] [d]	

B3. Garden, Fish Pond on resident Land Plot

1.1. Total Affected Area: _____ sq.m

1.2. Total Area of Plot: _____ sq.m

1.3. Legal Status of Land:

[a] Land User Rights Certificate (LURC) obtained in _____ (year)

[b] Lease or Rent at rate of _____ (VND/month)

[c] Non-Titled but occupied since _____ (year)

1.3 (a). If you selected “b” for the question 1.3 above, please state:

Full name of land owner/ land leaser	Type	Contract Termination Date	Amount (VND/month)
	[a] Short term [b] Long term		

1.3 (b) If you selected “c” for the question 1.3 above, can you tell me which way did you get your land.

Which way did you receive your land?	From what person/ organization	Years of using land	Type of Contract
[a] Buying [b] Inheriting [c] Custom and tradition [d] With the permission of Authority [e] Without the permission of Authority			[a] Written [b] Verbal

1.4. You prefer compensation by: [a] Cash [b] Replacement Land of Equal Value

B4. Forestry Land

1.1. Total Area of Plot: _____ sq.m

1.2. Total Affected Area: _____ sq.m

1.3. Legal Status of Land:

[a] Land User Rights Certificate (LURC) obtained in _____ (year)

[b] Lease or Rent at rate of _____ (VND/month)

[c] Non-Titled but occupied since _____ (year)

1.3 (a). If you selected “b” for the question 1.3 above, please state:

Full name of land owner/ land leaser	Type	Contract Termination Date	Amount (VND/month)
	[a] Short term [b] Long term		

1.3 (b) If you selected “c” for the question 1.3 above, can you tell me which way did you get your land.

Which way did you receive your land?	From what person/ organization	Years of using land	Type of Contract
[a] Buying [b] Inheriting [c] Custom and tradition [d] With the permission of Authority [e] Without the permission of Authority			[a] Written [b] Verbal

1.4. You prefer compensation by: [a] Cash [b] Replacement Land of Equal Value

B5. Public and Other Land. Please Specify: _____

1.1. Total Area of Plot: _____ sq.m

1.2. Total Affected Area: _____ sq.m

1.3. Legal Status of Land:

[a] Land User Rights Certificate (LURC) obtained in _____ (year)

[b] Lease or Rent at rate of _____ (VND/month)

[c] Non-Titled but occupied since _____ (year)

1.3 (a). If you selected “b” for the question 1.3 above, please state:

Full name of land owner/ land leaser	Type	Contract Termination Date	Amount (VND/month)
	[a] Short term [b] Long term		

1.3 (b) If you select “c” for the question 1.3 above, can you tell me which way did you get your land.

Which way did you receive your land?	From what person/ organization	Years of using land	Type of Contract
[a] Buying [b] Inheriting [c] Custom and tradition [d] With the permission of Authority [e] Without the permission of Authority			[a] Written [b] Verbal

1.4. You prefer compensation by: [a] Cash [b] Replacement Land of Equal Value

B6. Sharecroppers and Wage Labourers

Please provide information on anybody sharecropping, labouring or otherwise working on your land.

Name	Type of work	Contract Expiry Date	Amount Type of payment	Rate	Unit

C. Impacts on Structures

C1. Primary Structures (e.g., Buildings, Houses, Shops, etc.)

No.	Type	Category	Total Area (sq.m)	Affected Area (sq.m)	Remaining Area Is Viable
					[a] Yes [b] No
					[a] Yes [b] No
					[a] Yes [b] No
					[a] Yes [b] No
					[a] Yes [b] No
					[a] Yes [b] No
					[a] Yes [b] No
					[a] Yes [b] No

C2. Secondary Structures (including graves)

No.	Type	Material	Unit	Quantity

D. Impacts on Crops and Trees

D1. Annual Crops

No.	Type	Unit	Quantity	Highest output in last	Notes

				three years (unit/area)	

D2. Perennial Crops and Trees

No.	Type	Unit	Qty	Cat./Yr.	Notes

E. Impacts on Businesses and Employment

E1. Type of business:

- [a] Corner Store/ Street Shop [b] Hair Salon/ Barber Shop [c] Car/Motor Repair
- [d] Restaurant/ Eatery [e] Hotel/ Guest House [f] Café/ Entertainment
- [g] Pharmacy/ Clinic [h] Fruit/Vegetable Stand [i] Phones/ Electronics
- [j] Other: _____

E2. Do you have a business license?

- [a] Yes. Id No.: _____ [b] No

E2. (a) How much do you pay tax per year _____ VND

E3. What is average monthly income of business? _____ VND

E3 (a). What is monthly income during peak months? _____ VND

F3 (b). What is monthly income during low months? _____ VND

E4. Please provide the following information on all employees.

Name	Type of work	Contract Expiry Date	Amount		
			Rate	Rate	Unit

F. Additional Information on Resettlement and options for Severely AP and Vulnerable Groups

F1. If you are required to move, do you know where you intend to move?

- [a] Yes. Please specify: _____ [b] No.

F1 (a) Which of following options would you prefer:

- [a] Arrange relocation yourself [b] Move to a resettlement site prepared by the local authority

F2. In what way can the Project best help you to restore your income and production levels?

- [a] Training [b] Preferential Credit
- [c] Start up funds or materials [d] Other: _____

F3. If you are eligible for training assistance, in what field of training would you prefer?

F4. What problems related to land acquisition or resettlement, do you think could obstruct restoration of your pre-project living standards and productive capacity (if any)?

F5. Do you have any specific comments or requests for the Project? Please elaborate.

H. Final Comments

H1. Participants of Inventory:

Name: _____ Position: _____

Name: _____ Position: _____

Name: _____ Position: _____

Name: _____ Position: _____

Name: _____ Position: _____

H2. Conclusion of Household.

- 1.1. Do you agree entirely with results of Inventory? [a] Yes [b] No
1.2. Please state grievances or complaints about the inventory, if any:

_____ H3. The household agrees to review the AP's Compensation Form. If the household agrees with the details on the Agreement Compensation Form and the compensation package, then the household will return the form within 7 days to a representative of the Project Management Unity in the nearest Railway Public Utilities Company. Upon receiving full compensation, the household will clear the area in accordance with the set schedule.

Signature of Head of Household
of RPUC

Signature of Representative

Date: _____

ANNEX 3

Socio-Economic Survey Questionnaire

SOCIO-ECONOMIC SURVEY OF AP

AP No. - **A. Basic Information on Survey Respondent**A1. Name: _____
HH:

A2. Relationship to Head of

A3. Birth Year: _____

A4. Gender:

[a] Male

[b] Female

B. Information on land

B1. What is the approximate area of your total land holdings:

[a] Agricultural land: _____ sq.m

[c] Forestry land: _____ sq.m

[b] Residential land: _____ sq.m

[d] Other: _____ sq.m

B2. What is the legal status of your residential lands?

[a] Have LURC

[b] Applied for or awaiting issuance of LURC

[c] Have WRITTEN contract of purchase or inheritance
of purchase or inheritance

[d] Have VERBAL contract

[e] Have WRITTEN permission from government
from government

[f] Have VERBAL permission

[g] Renting
permission

[h] Occupying without

B2(a) If registered, in whose name is the LURC registered?

[a] Man

[b] Woman

[c] Both

[d]

Not

registered

B3. What is the legal status of your agricultural lands, if any?

[a] Have LURC

[b] Applied for or awaiting issuance of LURC

[c] Have WRITTEN contract of purchase or inheritance

[d] Have VERBAL contract of purchase or inheritance

[e] Have WRITTEN permission from government

[f] Have VERBAL permission from government

[g] Renting

[h] Occupying

without

permission

B3(a) If registered, in whose name is the LURC registered?

[a] Man

[b] Woman

[c] Both

[d] Not registered

C. Material & Living Conditions

C1. What are the main materials of your house?

[a] Brick & concrete

[b] Wood

[c] Bamboo & mud

[d] Scrap metals

C2. Do you own any of the following items?

Yes	No
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

[a] Mosquito Nets

[b] Fan

[c] Gas or Electric Stove

[d] Refrigerator

Yes	No
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

[e] Radio

[f] Television

[g] Motorcycle

[h] Car

C3. What is your main source of power supply?

[a] Connected to National Grid

[b] Private electric generator

[c] Not yet have electricity

C4. What is your main source of drinking water?

- [a] Connected to water system (or bottled water) [b] Ground well
 [c] River, lake or canal [d] Rain Water [e] Fetch water at public well
 C4(a) If water is fetched, who usually fetches it for the household?
 [a] Husband [b] Wife [c] Son(s)
 [d] Daughter(s) [d] Wife & Daughter(s) [e] Son(s) &
 Daughter(s)
 [f] Elderly [g] Shared by all [h] Other(s)
 C5. What is your main source of residential water?
 [a] Connected to water system [b] Ground well [c] River, lake or canal
 [d] Rain Water [e] Fetch water at public well
 C5(a) Who usually washes the clothes and dishes for the household?
 [a] Husband [b] Wife [c] Son(s)
 [d] Daughter(s) [d] Wife & Daughter(s) [e] Son(s) &
 Daughter(s)
 [f] Elderly [g] Shared by all [h] Other(s)
 C6. Do you collect fuelwood for household consumption? [a] Yes. Please state how
 far away: _____ km [b] No
 C6(a) Who usually collects fuelwood for the household:
 [a] Husband [b] Wife [c] Son(s)
 [d] Daughter(s) [d] Wife & Daughter(s) [e] Son(s) &
 Daughter(s)
 [f] Elderly [g] Shared by all [h] Other(s)

D. Expenditures & Savings

- D1. Please estimate your annual household expenditure:
 [a] Less than 5 million VND [b] Between 5 and 10 million VND
 [c] Between 10 and 20 million VND [d] More than 20 million VND
 D2. Please rank each category according to which one you spend most income on
 (note: 1 = most, 6 = least)
 _____ Production
 _____ Foods & Medicines
 _____ Clothing & Basic Supplies (e.g., kitchen utensils, school supplies)
 _____ Leisure & Small Luxury Items (e.g., cigarettes, cosmetics)
 _____ Furniture & Electronics
 _____ Savings
 D3. How many months per year do you lack rice, if any:
 [a] 1-3 months [b] 4-6 months [c] 7-9 months [d] 10-12 months
 [e] NEVER lack rice
 D4. How much debt do you hold per year to meet basic living needs (e.g., food, shelter,
 medical costs, school fees), if any:
 [a] Less than 2 million VND [b] 3-5 million VND [c] 6-10 million VND
 [d] More than 10 million VND [e] NONE
 D5. If you need to borrow money or goods, who do you usually go to?
 [a] Family relatives [b] Friends or Neighbours [c] Private lenders
 [d] Companies or Businesses [e] Banks or Financial
 Institutions [f] Village Groups [g] NEVER borrow

E. Health & Education

- E1. Are any of your children suffering from malnourishment?
 [a] No. of boys: _____ [b] No. of girls: _____ [c] None
 E2. Are any household members affected with a chronic illness?
 [a] Yes. Please specify: _____ [b] No

E3. Does any household member suffer a disability that prevents her/him from labouring or attending school?

[a] Yes. Please specify: _____

[b] No

E4. Please indicate any of the following ailments suffered by a household member on a REGULAR BASIS (please check if “M” for Male or “F” for Female):

M	F

[a] Cough or Lung Infection

[b] Eye or Ear Infection

[c] Vomiting or Stomach Ache

M	F

[d] Headache

[e] Serious Chest Pain

[f] Skin Rash or Itchiness

E5. Number of times you or family member needed to consult a medical clinic or hospital in past 6 months:

[a] 0-5 times

[b] 5-10 times

[c] 10-20 times

[d] More than 20 times

E6. Who in the household is most likely to suffer from illness or require medical attention?

[a] Husband

[b] Wife

[c] Son(s)

[d] Daughter(s)

[d] Grandmother(s)

[e]

Grandfather(s)

[h] Other(s): _____

E7. Number of school-aged children NOT attending school, if any:

[a] 1 [b] 2 [c] 3 [d] More than 3

E7 (a) They are:

[a] Boys

[b] Girls

[c]

Both

E8. Number of children attending school below age-appropriate level, if any:

[a] 1 [b] 2 [c] 3 [d] More than 3

E8(a) They are:

[a] Boys

[b] Girls

[c] Both

F. Access to Public Services & Infrastructure:

F1. Please indicate distance to the nearest:

Primary school	_____ km	Commune UBND	_____ km
Junior Secondary School	_____ km	District UBND	_____ km
Senior Secondary School	_____ km	Paved Road	_____ km
Medical Clinic	_____ km	Provincial Road	_____ km
Public Hospital	_____ km	Local Market	_____ km
Post Office	_____ km	Major Market	_____ km

F2. Do any household members leave the house for extended periods to find work?

HH Member	Frequency: [a] All Year [b] Seasonal [c] On Occasion [d] Never	Type of Work [a] Labourer [b] Trade/Business [c] Company/Service [d] Other	Approximate Distance from Household (km)
Husband	[a] [b] [c] [d]	[a] [b] [c] [d]	
Wife	[a] [b] [c] [d]	[a] [b] [c] [d]	
Son(s)	[a] [b] [c] [d]	[a] [b] [c] [d]	
Daughter(s)	[a] [b] [c] [d]	[a] [b] [c] [d]	
Elderly	[a] [b] [c] [d]	[a] [b] [c] [d]	
Other: _____	[a] [b] [c] [d]	[a] [b] [c] [d]	

G. Awareness of and Opinions on the Kunming-Haiphong Transport Corridor Project

G1. Prior to this survey, were you aware of the government's plans for the Kunming-Haiphong Transport Corridor Project?

[a] Very Aware [b] Somewhat Aware [c] Not Very Aware [d] Not at all Aware

G2. What is your general opinion about the Project?

[a] Very Supportive [b] Somewhat Supportive [c] Not Very Supportive

[d] Not at all Supportive

G3. Do you feel that the proposed upgrading on the Rail Line will improve your living standards and/or income potential?

[a] Very Much [b] Somewhat [c] Not Much [d] Not at all

G4. Please identify what you perceive as FAVOURABLE impacts of the Rail Line improvements on your Household:

[a] Improved Train Service [b] Local Investment [c] Potential Construction Jobs

[d] Compensation for Resettlement [e] Social Impacts [f] Environmental Impacts

G5. Please identify what you perceive as UNFAVOURABLE impacts of the Rail Line improvements on your Household:

[a] Improved Train Service [b] Local Investment [c] Potential Construction Jobs

[d] Compensation for Resettlement [e] Social Impacts [f] Environmental Impacts

G6. Please state any other COMMENTS or QUESTIONS you have about the Project:

.....

 Signature of Respondent

 Signature of Interviewer

 Full Name of Respondent

 Full name of Interviewer

 Date

ANNEX 4

Format for Minutes of First Orientation Meeting

KUNMING – HAI PHONG TRANSPORT CORRIDOR PROJECT ADB TA 4050-VIE
Upgrading Railway Line Between Yen Vien And Lao Cair

Minutes of First Orientation Meeting

Location:

Date:

Chairperson(s):

No. of participants: Total Female

1. THE FOLLOWING CONTENTS WERE CLEARLY AND FULLY PRESENTED AT THE MEETING:

Introduced the **Kunming-Haiphong Transport Corridor Project** and its sub-component for improving the rail line from Yen Vien to Lao Cai Rail Stations

- Objective is to meet traffic demand on rail line for 2020
- Proposed upgrading construction works along the rail line include extension and addition of passing loops, reparation of bridges and realignment
- Decision 344/QD-BGTVT dated on 1 December 2005 on agree to make Feasibility Study

Introduced Feasibility Study for Project

- Main objective is to provide cost estimates (including resettlement costs) to assess financial feasibility of Project
- Feasibility Study will be submitted to GoV and ADB for approval and, if approved, it will be followed by Project Implementation, which will include establishment of Compensation and Resettlement Committees at District or Provincial level to conduct detailed measurements and finalize the Resettlement Plan

Introduced **Basic Principles** about resettlement compensation and rehabilitation:

- Compensation and rehabilitation policy is guided mainly by Decision 197/2004 of GoV and ADB Policy OM/F2 on “Involuntary Resettlement”
- Project will compensate for all affected land and assets at full replacement value
- Assistance will be provided for relocation and rehabilitation costs, as required
- Temporary assistance will be provided for renters and employees affected by Project
- Special assistance will also be provided for poor and vulnerable groups, as well as households that are considered as severely affected by Project

- Lack of legal land title will NOT bar AP from certain project entitlements, as they will be entitled to compensation for structures, trees and crops

Clarified process for **Public Disclosure** of Resettlement Plan:

- first Orientation Meeting will be convened with every affected household (today!)
- Second Orientation Workshop will be convened at provincial level with representatives of AP (approx. end of April)
- Project Information Booklet will be distributed to all AP (approx. end of April)
- Copies of Draft and Final Resettlement Plans will be available to public for consultation at relevant Train Stations or Commune People's Committee offices (Draft at end of April and Final at end of June)
- Draft and Final Resettlement Plans will also be posted on ADB website

Identified and described mechanisms for **Grievances and Complaints**

- Commune People's Committee will have responsibility to assist AP to address grievances and complaints
- Any legal or administrative fees will be waived

Described process for conducting **Inventory of Losses**

- RPUC staff will complete one questionnaire together with each affected household
- Each household will sign questionnaire
- Results from Inventory of Losses will be presented together with the Draft Resettlement Plan at Second Orientation Workshop

Established and clarified **Eligibility Cut-Off Date**

- Eligibility Cut-Off Date will be established upon completion of the Inventory of Losses (i.e., today!)
- After the Cut-Off Date, new persons or assets encroaching on the Project Area of Influence will NOT be entitled to compensation or rehabilitation assistance

2. OTHER CONTENTS AND COMMENTS RAISED BY AP WERE AS FOLLOWS:

.....
 ..

 ..

 ..

LIST OF PARTICIPANTS (AP)

TT	Full Name	Sex	Ethnicity	Specific Comments	Signature

ANNEX 5

Provincial People's Committee Minutes of Second Orientation Workshop

MINUTES OF SECOND ORIENTATION WORKSHOPS TO BE INSERTED HERE
(AFTER WORKSHOP HAS BEEN HELD)

ANNEX 6

Project Information Booklet

KUNMING – HAIPHONG TRANSPORT CORRIDOR PROJECT
Upgrading Railway Line from Yen Vien to Lao Cai
Hanoi – Phu Tho – Vinh Phuc – Yen Bai – Lao Cai

PUBLIC INFORMATION BOOKLET

Prepared by:

MINISTRY OF TRANSPORTATION
VIETNAM RAILWAYS
RAILWAY PROJECT MANAGEMENT UNIT

WILBUR SMITH ASSOCIATES, INC.

April 2006

If you have further queries and suggestions, or would like to receive a full copy of the entitlement framework for the project (which describes all expected losses and the compensation required for each), please call or see us at:

RAILWAY PUBLIC UTILITIES COMPANY

Address:

Phone Number: _____

Contact person:

OR

DISTRICT/PROVINCIAL COMPENSATION AND RESETTLEMENT BOARD:

Address:

**1. QUESTION: WHAT IS THE KUNMING-HAIPHONG
TRANSPORT CORRIDOR PROJECT AND WHO IS
RESPONSIBLE FOR IT?**

ANSWER: The Government of Viet Nam, with assistance from the Asian Development Bank (ADB), is preparing a project to increase capacity on the Transport Corridor from Haiphong in Vietnam to Kunming in China. The Project will include **upgrading on the Railway Line** to meet passenger and transport demands for 2020. The railway section to be upgraded traverses about 285 km in a northwestern direction from Yen Vien Station near Hanoi to Lao Cai Station on the border with China, passing through the provinces of Lao Cai, Yen Bai, Phu Tho, Vinh Phuc and Hanoi City. The improvements will consist mainly of:

- Selective improvement of the horizontal and vertical alignment and track

Phone Number: _____
Contact person: _____

- layout;
- Stabilization of embankments and sliding slopes;
- Improvements of track-work including turnouts;
- Upgrading of bridges;
- Improvements of safety of selected at-grade level crossings;
- Upgrading of stations and passing loops for train loads up to 1,200 tons and train length of up to 400m; and
- Modernization of auxiliary facilities and provision of maintenance equipment and facilities, as well as rolling stock.

The Railway Project Management Unity (RPMU) of Vietnam Railways maintains overall responsibility for the Project, working in close collaboration with the Railway Public Utility Companies (RPUC) for Ha Hai, Ha Thai, Vinh Phuc and Yen Lao. The Project is currently in the process of **preparing a Feasibility Study** that will include engineering surveys, railway operations analyses, social and environmental impact assessments, resettlement plans, preliminary design and costing, economic and financial appraisal, prioritization and selection of engineering alternatives, and recommendations. If the Project is considered feasible, detailed designs are expected to begin at the end of 2006 and project implementation in 2007.

2. QUESTION: WILL THE PROJECT REQUIRE RESETTLEMENT AND, IF SO, WHAT ARE THE PROJECT'S RESETTLEMENT POLICIES?

ANSWER: Improvements on the Railway Line have been designed to avoid and minimize resettlement as much as possible. However, land acquisition and resettlement are unavoidable in some situations, particularly for the new stations, addition or extension of passing loops, and track realignment. Where resettlement is unavoidable, the Project's Policy Objective is to assist AP (AP) to maintain or improve their pre-project living standards and productive capacity.

The Basic Principles are as follows:

AP are entitled to compensation for lost or damaged land and assets, income and businesses, as well as transition allowances and rehabilitation assistance;

- Lack of legal rights to land will not prevent AP from Project entitlements, unless the AP has encroached on the Project Area after the eligibility cut-off date (see Question 10);
- Compensation for land and assets will be provided according to current replacement cost in local markets or government pricing lists, whichever is higher;
- Preparation, implementation and monitoring of resettlement will be carried out with the meaningful consultation and participation of AP and relevant authorities; and
- Compensation will be paid in full and directly to AP **before the award of civil works contracts.**

17. QUESTION: AS A RESIDENT OF PROVINCE, WHAT CAN I DO TO HELP?

ANSWER: We would like you to participate fully in all consultation meetings and other project-related activities to ensure that you are fully informed about the Project and your views are taken into account.

Your active participation during the survey, detailed designs, and implementation allows us to determine measures to mitigate negative impacts and identify solutions to potential problems.

18. QUESTION: HOW WILL I KNOW IF THE PROJECT MEETS ITS POLICY OBJECTIVE FOR RESETTLEMENT?

ANSWER: The Railway Project Management Unit and the project supervision consultant's resettlement specialists will monitor all project activities. RPMU will also hire an Independent Monitoring Organization to verify and report on resettlement implementation and recommend solutions to any problems or concerns that AP may have.

Reports will be prepared and submitted to ADB. A post-resettlement evaluation will also be undertaken to assess whether pre-project living standards and productive capacity have truly been restored.

The ADB will also monitor these activities during its regular supervision missions during the period of project implementation.

15. QUESTION: WHAT IS THE PROCESS FOR IMPLEMENTING THE RESETTLEMENT PLAN?

ANSWER: The Resettlement Plan will be submitted to the Government of Vietnam and the Asian Development Bank (ADB) for approval as a part of the Project's Feasibility Study. If the Feasibility Study is approved, then detailed designs and updating of the Resettlement Plan will likely begin in late 2006. Compensation and Resettlement Board (CARB) will be established by the relevant Provincial People's Committees to verify the Inventory of Losses with detailed measurements and other aspects of the Resettlement Plan.

Once the final Resettlement Plan is approved by the Provincial People's Committee, Government of Vietnam and the Asian Development Bank, the AP and will sign an Agreement Compensation Form that details the compensation items, rates and units for each individual household. Then the CARB will pay out compensation in full and directly to the AP **before the civil works contracts are awarded**. An Independent Monitoring Organization will also be responsible for verifying that the Resettlement Plan is being implemented according to plan. Upon successful verification, the Project will begin construction works. Programs related to rehabilitation assistance will be carried out within 6 months of relocation and clearance of the Project Area.

16. QUESTION: IF I HAVE ANY DISAGREEMENTS OR DISPUTES DURING PROJECT IMPLEMENTATION, HOW CAN I VOICE MY COMPLAINT?

ANSWER: AP should present their complaints to the Commune People's Committee or the relevant Railway Public Utilities Company. All verbal complaints will be recorded along with written complaints. The Commune People's Committee will have 15 days to respond in writing to the complaint. If the AP are dissatisfied with the resolution of the Commune, they may bring their complaint to District or Provincial People's Committee. The District or Provincial People's Committee will then have 30 days to respond in writing to the complaint. If the AP are still dissatisfied, they may

3. QUESTION: WHO ARE AP AND HOW WILL I KNOW IF I AM AN AP?

ANSWER: An **AP (AP)** is any person or organization whose land or assets, income or businesses are lost or damaged as a result of the Project. All AP were notified of their status at the first Orientation Meeting during the Project's Inventory of Losses in March and April 2006. A full list of AP and their entitlements is also included in the Project's *Resettlement Plan*, which was presented at the Second Orientation Workshops in Viet Tri and Lao Cai in April 2006 and is available for public viewing at the Commune People's Committee.

If you are still unsure if you are an AP, please ask your local Rail Station to help you to contact the Railway Public Utilities Company for more information. You may also contact the Railway Public Utilities Company by yourself at the address provided at the end of this booklet.

4. QUESTION: HOW AND BY WHOM ARE COMPENSATION RATES AND ENTITLEMENT POLICIES DETERMINED?

ANSWER: *The main legislation and policies for determining the Project's compensation rates and entitlements are **Decree 197/2004/ND-CP**, **Circular 116/2004/TT-BTC**, and **related provincial legislation**; and the **Asian Development Bank's Policy on Resettlement (1995)**. If there are any conflicts between these two policies, Decree 197 states clearly that "[w]here the international agreements which Vietnam has signed or acceded to contain provisions different from those of this Decree, the provisions of such international agreements shall apply" (Article 2).*

Compensation rates will be determined according to Replacement Cost in local markets, while allowances and special assistance will also be provided to ensure that all AP are able to maintain or

pursue their grievances through the National Court System.

AP will be **exempt from all taxes, administrative and legal fees** related to filing complaints and grievances, except for cases pursued through the National Court System.

Affected persons may also file a written complaint directly with the Asian Development Bank (ADB) through the Office of the Special Project Facilitator. For more information, please see the “Information Guide to the Consultation Phase of the ADB Accountability Mechanism” provided together with this Project Information Booklet.

improve their pre-project living standards and productive capacity. Final decisions about compensation rates and Project entitlements will be made by the Provincial People’s Committee in accordance with Decree 197 and ADB resettlement policy.

5. QUESTION: WHAT IF MY LAND IS REQUIRED BY THE PROJECT?

ANSWER: Marginally affected agricultural lands will be compensated by cash, while severely affected agricultural lands (i.e., more than 10% of landholding) will be compensated by cash or replacement land of equal value. If replacement land is unavailable in the locality, the Project will support farmers with special assistance to help them change occupations and re-establish productive capacity. Compensation prices for land will be according to replacement cost in local markets or provincial pricing lists, whichever is higher.

The same principles apply for residential and other types of land. However, for severely affected residential lands, the AP will have the option to re-organize on the remaining landholding or relocate. Special assistance for transition and rehabilitation will be provided to relocating households (see Question #10).

Formal land title (i.e., Land Use Rights Certificate) will be issued to the husband and wife for all replacement land provided by the Project.

6. QUESTION: DO WE NEED FORMAL LAND TITLE TO CLAIM COMPENSATION AND OTHER PROJECT ENTITLEMENTS?

ANSWER: No! Lack of formal land title (i.e., legal rights) or Land Use Right Certificate (LURC) is NOT a bar to Project entitlements. The Project recognizes three types of land users:

Legal land users: AP who have formal land title or LURC

Legalizeable land users: AP who are in the process of applying for formal land title, or in other ways can prove that they have occupied the land by legal means or traditional claim

Non-legal land users: AP who do not have or cannot show that they have occupied the land by legal means or traditional claim

Legal and legalizable land users are entitled to compensation for land, assets and Project allowances. Non-legal land users will NOT be compensated for land, but they will be compensated for fixed assets and any improvements made on land, as well as entitled to Projects allowances.

However, people occupying or using the affected land after the **eligibility cut-off date** will NOT be entitled to Project entitlements (see Section 13).

11. QUESTION: WHAT ABOUT RENTERS AND LAND LEASERS?

ANSWER: Renters of houses will receive 6 months rent allowance or, if they prefer, the option to stay with the owner's agreement. The Project will give renters at least 2 months leave notice and assist them to identify appropriate replacement housing. Persons leasing land will be compensated in cash for 30% of replacement cost of affected land or for loss of net income from remaining period on lease, whichever is higher.

12. QUESTION: WHAT ABOUT COMMON PROPERTY RESOURCES?

ANSWER: Common land resources will be replaced in areas identified in consultation with affected communities and relevant authorities. Affected buildings and structures will be restored to original or better condition. If community income loss is anticipated (e.g. irrigation, community forests, village fishponds), the affected village will be entitled to compensation for the total production loss. This compensation should be used collectively for community needs, such as income restoration measures or infrastructure.

13. QUESTION: DOES THIS MEAN THAT ANYBODY IN OUR COMMUNITY CAN CLAIM COMPENSATION?

ANSWER: No! Project entitlements are reserved for those persons who were surveyed during the Inventory of Losses. The **eligibility cut-off-date** for Project entitlements will be the date of the Detailed Measurement Survey. Persons who encroach into the Project Area after the cut-off-date will NOT receive compensation or other entitlements.

14. QUESTION: WHEN DO WE NEED TO CLEAR THE PROJECT AREA?

ANSWER: Clearing the Project Area will take place only **after** compensation has been received by AP. After the AP has acknowledged receipt of payment, the Project shall provide a reasonable timeframe to clear the Project Area, approximately 60 days to dismantle concrete houses and 30 days for simple houses and other structures.

10. QUESTION: WHAT TYPES OF ALLOWANCES AND SPECIAL ASSISTANCE IS AVAILABLE FOR AP?

ANSWER: To help ensure that all AP will be able to restore pre-project living standards and productive capacity, the Project will provide allowances and special assistance to severely affected households and vulnerable groups. **Severely Affected Households** are households losing more than 10% of productive assets or households required to relocate. **Vulnerable Groups** are defined as poor households, single female-headed households with dependents, landless households without non-land income sources, elderly households without labourers, or households where the household head or spouse suffers a physical disability or illness that prevents them from earning income. Other allowances, such as the Timely Removal Allowances, are available to all AP.

- **Transport Allowance:** Cash assistance to transport household effects, salvaged and new building materials up between 2-5 million VND, depending on the stipulations of relevant provincial legislation;
- **Transition Subsistence Allowance:** Cash assistance for the transition period equivalent to a minimum of 30 kg of rice per person per month in each household;
- **Rehabilitation Assistance:** In-kind assistance (e.g., skills training, preferential credit, production materials) aimed at restoring pre-project productive capacity equivalent to a maximum value of 3,000,000 VND per one male and one female labourer in each household;
- **Timely Removal Allowance:** Cash allowance for timely removal of structures and land clearance in the Project Area equivalent to a maximum of 5 million VND per household, depending on the stipulations of relevant provincial legislation

Priority Employment: AP will receive priority in the contractors' hiring policy for the Project's civil works, as commensurate with their skills and abilities.

7. QUESTION: WILL I BE COMPENSATED FOR LOST OR DAMAGED HOUSES AND STRUCTURES?

ANSWER: Yes! Houses and any other structures (e.g., shops, stables, fences, etc.) destroyed or damaged by the Project will be compensated at replacement cost so that owners can build another structure of the same size and standard. The Project will also compensate for any costs related to moving, dismantling and rebuilding.

Compensation for houses and structures is available for all types of AP, regardless of formal land title (see Question # 6)

8. QUESTION: WHAT ABOUT MY TREES AND CROPS?

ANSWER: Affected trees and crops (including fish crops) and trees will also be compensated at replacement cost in current markets.

Compensation for trees and crops is available for all types of AP, regardless of formal land title (see Question # 6)

9. QUESTION: WHAT ABOUT BUSINESSES AND INCOME LOSSES RESULTING FROM LOSS OF EMPLOYMENT?

ANSWER: *Businesses that are required to close or relocate will receive cash compensation for the duration of the disruption. Businesses that are legally registered will be compensated for net income for the entire period of disruption or relocation. Businesses that are NOT legally registered will receive cash compensation equivalent to the monthly minimum wage in the province for a minimum period of 6 months.*

Persons who lose their jobs because of disruption to businesses or other land (such as for sharecroppers or agricultural labourers) will also receive cash assistance. Persons whose jobs are temporarily affected will receive cash compensation equivalent to lost wages during the disruption or assistance in securing new employment, such as skills training or start-up capital. Persons who lose their jobs will receive cash compensation equivalent to 6 months wages or the remaining period of their contract, whichever is higher, and assistance in securing new employment.

ANNEX 7

Information Guide on Public Consultation and ADB's Accountability Mechanism

An Information Guide to the Consultation Phase of the ADB Accountability Mechanism



**'We listen to people and communities affected
by ADB-assisted projects'**



Asian Development Bank

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"We have been affected by an ADB-assisted project, we didn't know this will ruin our farms, the source of our livelihood, our culture, our environment, what should we do?"



Discuss your problem first with the project staff.
If you are unsatisfied with their responses you should address your concerns to:

The Office of the Special Project Facilitator (OSPF)

Asian Development Bank
6 ADB Avenue Mandaluyong City 1550
Metro Manila, Philippines
Tel: (+632) 632-4825 or
Fax (+632) 636-2490
E-mail: spf@adb.org
Website: www.adb.org/spf



At least two persons from your community can write a letter of complaint.

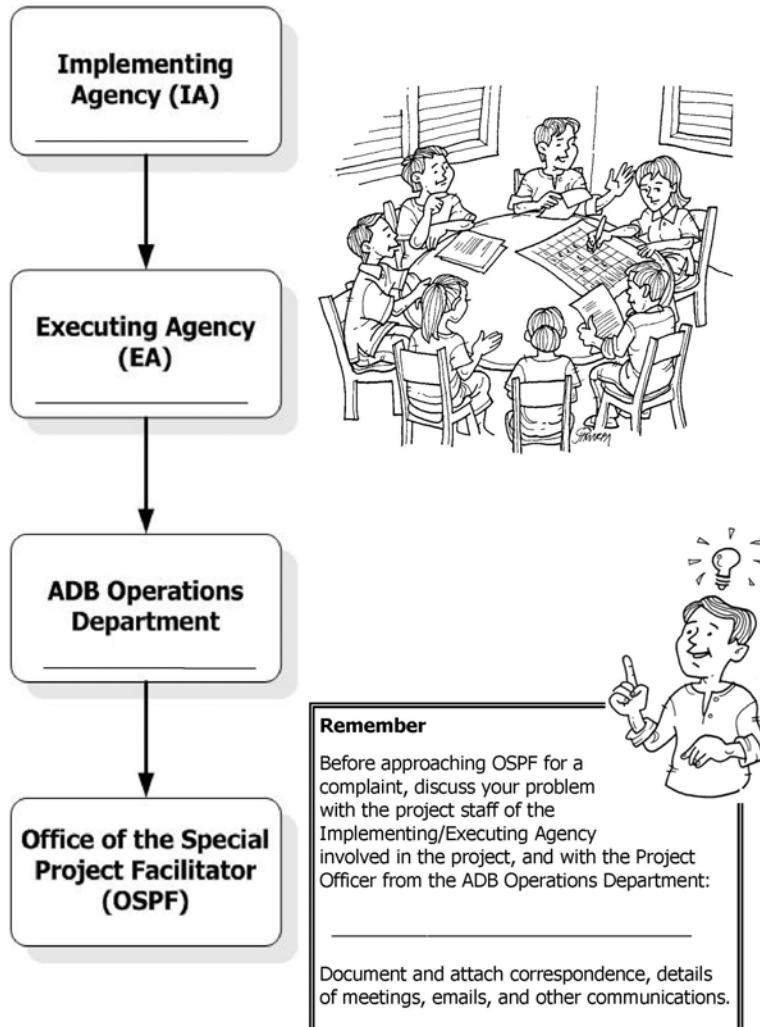
The complaint may also come from a local organization, association, or other groups of individuals from your community.

Some people find it easy to appoint a representative who can duly represent them.

- We, at the Office of the Special Project Facilitator, are ready to listen to your complaints with the aim to find satisfactory solutions to problems.
- We provide an independent forum for people and communities who have been adversely affected by an ADB-assisted project.
- We handle the Consultation Phase, which involves a series of activities and dialogue with all concerned parties to reach a good resolution.



In situations where there is an Implementing Agency at the local level, your complaints should first be addressed to the



“What do we have to prepare and consider before deciding to write a complaint to the Office of the Special Project Facilitator (OSPF)?”

We want to act on your complaint as efficiently as possible. So make sure you have done the following:

- ☒ Before approaching OSPF for a complaint, discuss your problem with the project staff of the Executing/Implementing Agency involved in the project, and with the Project Officer from the ADB Operations Department.
- ☒ Talk to other members of your group, neighbors, or community. Thoroughly assess the situation and determine if the problem you are experiencing is caused by an ADB-assisted project.
- ☒ It is important to note how many of you are affected and in what way have you experienced such harm.
- ☒ Write down detailed factual and verifiable descriptions of the harm you have experienced to support your complaint. This may include specific adverse effects to your livelihood, environment, or community.
- ☒ Identify the name of your group or the complainant.
- ☒ If you choose to have somebody represent you, e.g. an NGO, a local leader, etc., make sure you provide your representative with a letter of authority.
- ☒ Indicate the complainant's and authorized representative's name, contact address, and other relevant information.
- ☒ Indicate the name and location of the ADB-assisted project that has caused you harm.
- ☒ If you decide to keep your name confidential, indicate it in your letter. We assure that all matters will be kept in confidentiality.
- ☒ Agree with your group/community what action or outcome you expect from ADB.
- ☒ Write your letter-complaint in either English or your national language.



SAMPLE LETTER OF COMPLAINT

Date:

Office of the Special Project Facilitator
Asian Development Bank
6 ADB Avenue 1550 Mandaluyong City
Metro Manila, Philippines

Tel: (632) 632-632-4825

Fax: (632) 636-2490

Email: spf@adb.org

Dear Special Project Facilitator,

We, [(name of your group) or name of representative authorized by your group], whose names and addresses are attached, live in [location and country].

We hereby present this complaint to the Special Project Facilitator. [If the complaint is filed through a representative, please provide the names of the project-affected people with their addresses and evidence of authority to represent them].

1. We are currently experiencing problems due to an ADB-assisted project [specify name and description of project, and specify the site and country where project is located].
2. The direct harm we experience is/are the following: [describe the problem]
3. We seek the following outcomes and remedies through the help of the Special Project Facilitator: [describe what you would like to happen, how the harm or problem can be resolved].
4. We have previously made efforts to address our problem with the EA/IA and ADB operations department concerned in the following manner: [list and attach correspondence, details of meetings, emails, and other communications].
5. We do not request that our identities be kept confidential
[or]
We request that our identities be kept confidential for the following reason: [state reason]
6. You can contact us at: [Specify directions how to set a meeting with you and/or your authorized representative].

Signatures: _____

Names:

Addresses:

Other contact information:

Tel:

Fax:

Email:

Attachments: (complete list of complainants and addresses, representative's letter of authorization, if any)

Some matters not eligible for complaints/requests

- ☒ Allegations of fraud and corruption
- ☒ Procurement of goods, services, and consulting services
- ☒ Projects with a project completion report
- ☒ ADB personnel matters



“What happens when our letter of complaint is filed at OSPF?”

1. Within seven (7) days from receipt of your letter, we will register the complaint and we will send you an acknowledgment letter.
2. Within 21 days, we will determine the eligibility of your complaint.
 - We will verify, in good faith, your first efforts to address the problems with the concerned ADB Operations Department and Executing Agency/Implementing Agency.
 - We will study pertinent document and analyses regarding the issues mentioned in the complaint.
 - We may visit and discuss the complaint with you and other concerned parties.
3. Once we determine that the complaint is eligible, we will come again and conduct a review and assessment. This will help us determine the nature of the problem, the parties involved, the remedies you are seeking, and most important of all, the proposed action to resolve the problem.
 - From the time we receive your complaint, it will take about 49 calendar days to complete the review and assessment. If the matter is complicated, it might also take longer. But we will discuss this with you.
4. Upon completion of the review and assessment, we will send you or your representative our findings and recommendations.
5. When you receive the findings and recommendations, discuss these with your group.
 - Write down your comments and suggestions.
 - Collectively, you have to decide whether to continue (or not) with the consultation process.
 - Inform us of your decision. We must receive your decision within 14 days after you received the report.

If you decide to continue,
6. We will agree on possible courses of action or resolution together with all parties involved.
7. Thereafter, all parties will follow the agreed course of action until the problem is resolved.

**“When does the consultation process stop?”**

As much as possible, we will continue the consultation process until such time that all parties agree to terminate the consultation process.

If you have serious concerns on compliance, you may file your complaint with the Compliance Review Panel. Address your letter to

The Secretary
Compliance Review Panel
Asian Development Bank
Tel: (+632) 632-4149 or
Fax: (+632) 636-2088
Email: crp@adb.org



About the ADB and its Accountability Mechanism

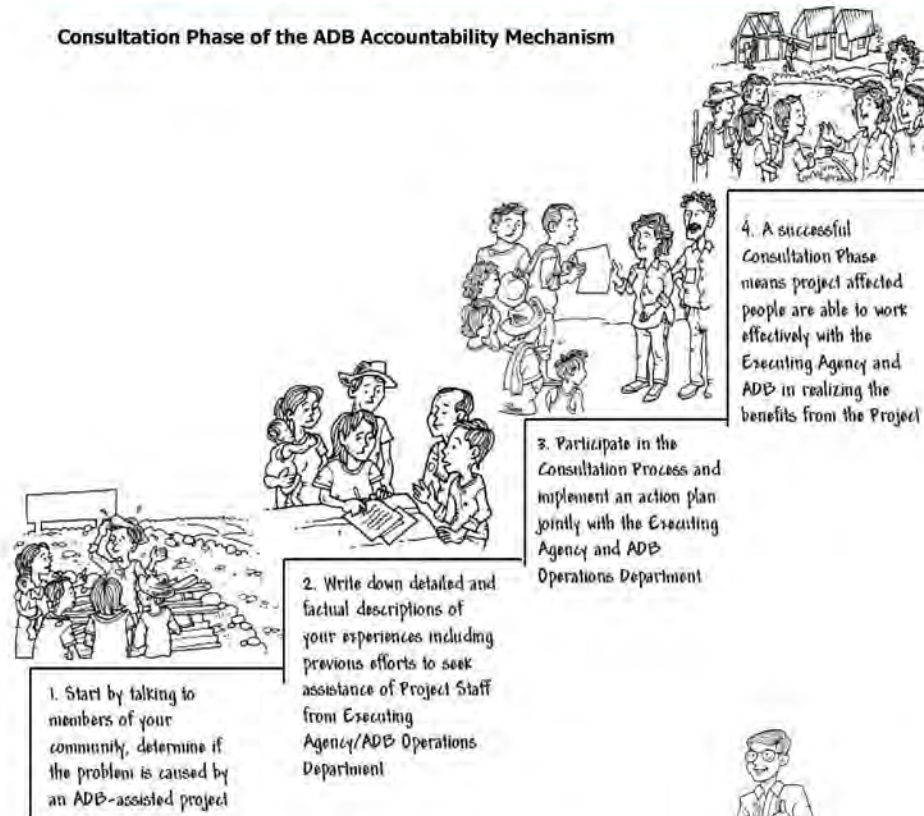
ADB is a development finance institution whose mission is to help its member countries reduce poverty and improve their living conditions. ADB also provides policy dialogue, loans, and technical assistance.

To help assure the smooth flow of ADB support to its member/partner country, and address complaints that are raised by people who may be adversely affected by a Project, ADB has established an Accountability Mechanism.

The Accountability Mechanism has two offices:

- The Office of the Special Project Facilitator (OSPF) has a problem-solving role and handles the Consultation Phase.
- The Compliance Review Panel investigates requests of policy violations. It handles the Compliance Review Phase.

Consultation Phase of the ADB Accountability Mechanism



An action-oriented dialogue toward achieving appropriate solutions to complaints from project-affected people.

ANNEX 8

Replacement Cost Survey

REPORT ON COST REPLACEMENT INVESTIGATION

Survey Objectives:

Purpose of the survey is to determine replacement price for land, assets, crops and tree, etc effected by project. Establishment for replacement price shall be equivalent or higher than market price to ensure that no PAP will be in worse condition, and PAP shall be at least as good as before, or improved living standard higher than before.

Method:

Replacement price is determined on the basic of study, and site survey. Information about price are collected from interviews with PAPs, households not effected by the project, especially households in land business and under construction of works. In addition, information are also collected from relevant agents as Department of Construction, Department of Finance – Assessment, Contractors, Businessmen and local authorities of committees, districts and provinces.

Survey Time:

Based on the result of PAP's assets inventory, we choose the representative stations for survey, namely Huong Canh, Viet Tri, Mai Tung, Co Phuc, Lang Thip, Xuan Giao and Lao Cai station. These stations are chosen for surveys due to:

- Representative of both urban and rural regions
- Large scope of site-clearing land

No	Location of survey	Upgraded station	Description
I	Ha Noi city		
1	Dong Anh overpass		Dong Anh overpass is on nation road number 3, nearly Ha Noi city
II	Vinh Phuc province		
1	Huong Canh station	Thach Loi station	Two these stations are close to eachother and locate in rural area of Vinh Phuc province
2		Huong Canh station	
III	Phu Tho province		
3	Viet Tri station	Viet Tri station	Three these stations all locate in urban of Phu Tho. Viet Tri station and Phu Duc station locates in Viet Tri city, Tien Kien station locates in Hung Son town, Lam Thao district
4		Phu Duc station	
5		Tien Kien station	
6	Mai Tung station	Chi Chu station	Chi Chu and Vu En stations locate in Thanh Ba dist, Mai Tung station in Ha Hoa dist. These stations all locate in rural area of Phu Tho province
7		Vu En station	
8		Mai Tung station	
IV	Yen Bai province		
9	Co Phuc station	Co Phuc station	Borth station in Tran Yen dist, Yen Bai province
10		Van Phu station	
11	Lang Thip station	Mau A station	All these locate in Van Yen dist., Yen Bai
12		Mau Dong station	
13		Lam Giang station	
14		Lang Thip station	
V	Lao Cai province		
15	Station Xuan Giao	Station Thai Van	These stations locate in rural area of Lao Cai province
16		Station Thai Nien	
17		Station Xuan Giao	
18	Station Lao Cai	Station Lao Cai	In Lao Cai city

Survey Samples:

Through represented PAPs, we can be aware of expectation for replacement price. However, for objective collection, non-PAPs who are in common of geological locations, types of assets, etc... are also selected for survey. For households not purchasing land, it is surveyed for price at which these expect to sell and purchase. During survey, households who have just bought and purchased land, crops and trees, and households under construction of works, take special priority because they are significant evidences in market. Sellers of trees at market, owners of construction materials, construction contractors, etc are being interviewed.

Information processing

Information collected from interviews are recorded fully in each station area, then generated, analyzed and provided a reasonable price for each type of assets in every region as market price.

Investigation result:***Land***

In rural and mountainous region, economic and market has not yet developed especially land market, and a few evidence of purchasing and transferring land market. Thus, survey mainly collects expected purchasing and selling price of households. Based on the survey result, surveyed land price is in compliance with latest replaced price issued by Provincial People's Committee.

In urban regions, there are more evidences on trading and transferring land. Difference on land price in different locations in the same region is very big. There is no general price for whole region. Whereas, unit price of province is normally applied for whole region, thus market price is higher than price of province in some locations and vice verse. Land price in urban is higher than in rural areas.

Land using purposes are different as regulated by law, then consequently prices are different. Based on survey result, there is a significant difference between prices of land types. Normally, highest price for residential land, lower price for Garden land and cultivated land, and lowest price for forest land.

Structures:

Generally, replacement for construction materials of provinces is higher than market price. This difference is because that works listed in unit price of provinces is "standardization", whereas households' works are not built in compliance with any standard. We would suggest applying price issued by provincial People's Committee for PAPs.

Crops and trees:

Surveyed price for short-day crops such as rice, maize is lower than price issued by provincial People's Committee. On the contrary, price for some kinds of long-year fruit trees is higher than price issued by provincial People's Committee. However, there is no this kind of tree. Thus, applying price of provincial People's Committee is profitable for PAPs.

Survey Result: Hanoi**Table A.1: Result of land price survey in Dong Anh overpass**

(VND per sq.m)

No.	Type of land	Price issued by People Committee of Ha Noi city	Surveyed price	Comparison (%)	Suggested price
I	Cultivated land				
1	Cultivated land, classification I	108,000	120,000	111.1	120,000
2	Cultivated land, classification II	90,000	105,000	116.6	105,000
3	Cultivated land, classification III	72,000	85,000	118.1	85,000
4	Cultivated land, classification IV	54,000	65,000	120.4	65,000
II	Resident land				
1	Resident land, category road I	11,000,000	10,000,000	90.9	11,000,000
2	Resident land, category road 1I	9,100,000	9,000,000	98.9	9,100,000

Table A.2: Survey result on price of works and architectural works

(VND)

No	Type of works & architecture	Unit	Price issued by People Committee of Ha Noi city	Surveyed price	Comparison (%)	Suggested price
1	House category III	sq.m	1,645,000	1,500,000	91.2	1,645,000
2	House category IV	sq.m	715,000	700,000	97.9	715,000
3	Cottage house	sq.m	297,000	250,000	84.2	297,000
4	Brick court	sq.m	49,000	50,000	102.0	50,000
5	Cement court	sq.m	72,000	70,000	97.2	72,000

Table A.3: Result of price survey on crops and trees.

(VND)

No	Type of crops & trees	Unit	Price issued by People Committee of Ha Noi city	Surveyed price	Comparison (%)	Suggested price
1	Mango diameter ≥ 40cm	Tree	1,540,000	1,460,000	95	1,540,000
	Mango diameter 31cm – 39cm	Tree	1,120,000	1,030,000	92	1,120,000
	Mango diameter 15 -30cm	Tree	840,000	630,000	75	840,000
	Mango diameter 9cm – 14cm	Tree	150,000	120,000	80	150,000
	Mango diameter < 8cm	Tree	100,000	78,000	78	100,000
2	China-tree diameter ≥ 40cm	Tree	15,000	16,000	107	16,000
	China-tree diameter 31cm – 39cm	Tree	10,000	11,000	110	11,000
	China-tree dia. 15 - 30cm	Tree	5,000	5,500	110	5,500

No	Type of crops & trees	Unit	Price issued by People Committee of Ha Noi city	Surveyed price	Comparison (%)	Suggested price
	China-tree dia. 9cm – 14cm	Tree	3,000	3,000	100	3,000
	China-tree diameter < 8cm	Tree	1,500	1,800	120	1,800
3	Dracontomelum diameter >= 40cm	Tree	450,000	430,000	96	450,000
	Dracontomelum diameter 31cm – 39cm	Tree	360,000	350,000	97	360,000
	Dracontomelum diameter 15 -30cm	Tree	270,000	270,000	100	270,000
	Dracontomelum diameter 9cm – 14cm	Tree	150,000	150,000	100	150,000
	Dracontomelum diameter K < 8cm	Tree	100,000	100,000	100	100,000
4	Fig diameter >= 40cm	Tree	450,000	315,000	70	450,000
	Fig diameter 31cm – 39cm	Tree	360,000	260,000	72	360,000
	Fig diameter 15 - 30cm	Tree	270,000	200,000	74	270,000
	Fig diameter 9cm – 14cm	Tree	150,000	83,000	55	150,000
	Fig diameter < 8cm	Tree	100,000	55,000	55	100,000
5	Tamarind diameter >= 40cm	Tree	200,000	180,000	90	200,000
	Tamarind diameter 31cm – 39cm	Tree	120,000	106,000	88	120,000
	Tamarind diameter 15 -30cm	Tree	60,000	51,000	85	60,000
	Tamarind diameter <14cm	Tree	30,000	27,000	90	30,000
6	Longan diameter >= 40cm	Tree	450,000	414,000	92	450,000
	Longan diameter 31cm – 39cm	Tree	360,000	306,000	85	360,000
	Longan diameter 15 -30cm	Tree	270,000	220,000	81	270,000
	Longan diameter 9cm – 14cm	Tree	150,000	120,000	80	150,000
	Longan diameter K < 8cm	Tree	100,000	80,000	80	100,000
7	Longan diameter >= 40cm	Tree	2,500,000	2,370,000	95	2,500,000
	Longan diameter 31cm – 39cm	Tree	1,700,000	1,660,000	98	1,700,000
	Longan diameter 15 -30cm	Tree	450,000	380,000	84	450,000
	Longan diameter K 9cm – 14cm	Tree	210,000	168,000	80	210,000
	Longan diameter < 8cm	Tree	50,000	48,000	96	50,000
8	Eucalypter diameter >= 40cm	Tree	15,000	15,000	100	15,000

No	Type of crops & trees	Unit	Price issued by People Committee of Ha Noi city	Surveyed price	Comparison (%)	Suggested price
	Eucalypter diameter 31cm – 39cm	Tree	10,000	10,000	100	10,000
	Eucalypter diameter 15 -30cm	Tree	5,000	5,500	110	5,500
	Eucalypter diameter 9cm – 14cm	Tree	3,000	2,400	80	3,000
	Eucalypter diameter < 8cm	Tree	1,500	1,100	73	1,500
9	Keo la tram diameter >= 40cm	Tree	15,000	14,000	93	15,000
	Keo la tram diameter 31cm – 39cm	Tree	10,000	9,500	95	10,000
	Keo la tram diameter 15 -30cm	Tree	5,000	4,500	90	5,000
	Keo la tram diameter 9cm – 14cm	Tree	3,000	2,700	90	3,000
	Keo la tram diameter < 8cm	Tree	1,500	1,200	80	1,500
10	Flamboyant diameter >= 40cm	Tree	15,000	15,000	100	15,000
	Flamboyant diameter 31cm – 39cm	Tree	10,000	10,000	100	10,000
	Flamboyant diameter 15 -30cm	Tree	5,000	4,400	88	5,000
	Flamboyant diameter 9cm – 14cm	Tree	3,000	2,500	83	3,000
	Flamboyant diameter < 8cm	Tree	1,500	1,100	73	1,500
11	Sapodilla diameter >= 40cm	Tree	300,000	324,000	108	324,000
	Sapodilla diameter 31cm – 39cm	Tree	150,000	155,000	103	155,000
	Sapodilla diameter 15 -30cm	Tree	100,000	105,000	105	105,000
	Sapodilla diameter < 14cm	Tree	30,000	33,000	110	33,000
12	Shaddock diameter >= 40cm	Tree	300,000	315,000	105	315,000
	Shaddock diameter 31cm – 39cm	Tree	150,000	150,000	100	150,000
	Shaddock diameter 15 -30cm	Tree	100,000	95,000	95	100,000
	Shaddock diameter < 14cm	Tree	30,000	32,000	107	32,000
13	Guava diameter >= 40cm	Tree	200,000	184,000	92	200,000
	Guava diameter 31cm – 39cm	Tree	120,000	108,000	90	120,000

No	Type of crops & trees	Unit	Price issued by People Committee of Ha Noi city	Surveyed price	Comparison (%)	Suggested price
	Guava diameter 15 -30cm	Tree	60,000	52,000	87	60,000
	Guava diameter K <14cm	Tree	30,000	25,000	83	30,000
14	Paper flower	Tree	30,000	28,000	93	30,000
15	Milk flower	Tree	60,000	65,000	108	65,000
16	Bamboo	Tree	10,000	11,000	110	11,000

Survey Result: Vinh Phuc**Table B.1: Result of land price survey**

(VND)

No.	Type of land	Unit	Price issued by Peoples Committee of province	Surveyed price	Comparison (%)	Suggested price
I	Huong Canh station					
1	Cultivated land, classification I	sq.m	25,000	26,000	104.0	26,000
2	Cultivated land, classification II	sq.m	24,000	25,000	104.2	25,000
3	Cultivated land, classification III	sq.m	23,000	24,000	104.3	24,000
4	Cultivated land, classification IV	sq.m	21,000	22,000	104.8	22,000
5	Cultivated land, classification V	sq.m	18,000	18,000	100.0	18,000
6	Cultivated land, classification VI	sq.m	16,000	16,000	100.0	16,000

Table B.2: Survey result on price of works and architectural works

(VND)

No	Type of works & architecture	Unit	Price of People's Committee of provinces	Surveyed price	Comparison (%)	Suggested price
1	Barbed wire fence	sq.m	-	5,000	-	5,000

Table B.3: Result of price survey on crops and trees.

(VND)

No	Type of crops & trees	Unit	Price of People's Committee of provinces	Surveyed price	Comparison (%)	Suggested price
1	Banana tree with bananas	Tree	20,000	17,000.0	85.0	20,000
2	Banana tree without banana h>1.6m	Tree	15,000	11,000.0	73.3	15,000
3	Banana tree without banana h<1.6m	Tree	7,500	5,000.0	66.7	7,500
4	Vetable	sq.m	15,000	14,000.0	93.3	15,000
5	Rice	sq.m	-	1,000.0	-	1,000
6	Jackfruit					

Survey Result: Phu Tho**Table C.1: Result of survey on land price**

(VND)						
No	Classification of land	Unit	Price of People's Committee of provinces	Surveyed price	Comparison (%)	Suggested price
Viet Tri station						
I	Cultivated land					
1	Cultivated land, classification I	sq.m	31,200	32,000	102.6	32,000
2	Cultivated land, classification II	sq.m	26,100	27,000	103.4	27,000
3	Cultivated land, classification III	sq.m	21,100	22,000	104.3	22,000
4	Cultivated land, classification IV	sq.m	15,900	16,000	100.6	16,000
5	Cultivated land, classification V	sq.m	10,400	11,000	105.8	11,000
6	Cultivated land, classification VI	sq.m	5,600	6,000	107.1	6,000
II	Resident land	sq.m	150,000	200,000	133.3	200,000
III	Garden land					
1	Garden land, classification I	sq.m	383,000	390,000	101.8	390,000
2	Garden land, classification II	sq.m	32,100	35,000	109.0	35,000
3	Garden land, classification III	sq.m	25,900	26,000	100.4	26,000
4	Garden land, classification IV	sq.m	19,500	20,000	102.6	20,000
5	Garden land, classification V	sq.m	12,800	13,000	101.6	13,000
IV	Pond land					
1	Pond land, classification I	sq.m	27,400	28,000	102.2	28,000
2	Pond land, classification II	sq.m	23,000	25,000	108.7	25,000
3	Pond land, classification III	sq.m	18,500	20,000	108.1	20,000
4	Pond land, classification IV	sq.m	14,000	15,000	107.1	15,000
5	Pond land, classification V	sq.m	9,100	10,000	109.9	10,000
6	Pond land, classification VI	sq.m	5,000	6,000	120.0	6,000
Mai Tung station						
I	Cultivated land					
1	Cultivated land, classification I	sq.m	12,200	13,000	106.6	13,000
2	Cultivated land, classification II	sq.m	10,200	11,000	107.8	11,000
3	Cultivated land, classification III	sq.m	8,200	9,000	109.8	9,000
4	Cultivated land, classification IV	sq.m	6,200	7,000	112.9	7,000
5	Cultivated land, classification V	sq.m	4,100	5,000	122.0	5,000
6	Cultivated land, classification VI	sq.m	2,200	3,000	136.4	3,000
II	Residential land	sq.m	20,000	20,000	100.0	20,000
III	Garden land					
1	Garden land, classification I	sq.m	18,600	19,000	102.2	19,000
2	Garden land, classification II	sq.m	9,700	10,000	103.1	10,000
3	Garden land, classification III	sq.m	7,800	8,000	102.6	8,000
4	Garden land, classification IV	sq.m	5,900	6,500	110.2	6,500
5	Garden land, classification V	sq.m	3,900	4,500	115.4	4,500
IV	Pond land					
1	Pond land, classification I	sq.m	6,100	7,000	114.8	7,000
2	Pond land, classification II	sq.m	5,100	6,000	117.6	6,000
3	Pond land, classification III	sq.m	4,100	5,000	122.0	5,000
4	Pond land, classification IV	sq.m	3,100	4,000	129.0	4,000
5	Pond land, classification V	sq.m	2,000	2,000	100.0	2,000
6	Pond land, classification VI	sq.m	1,100	1,200	109.1	1,200

Table C.2: Survey result on price of works and architectural works

(VND)

No	Type of works & architecture	Unit	Price of People Committee of province	Surveyed price	Comparison (%)	Suggested price
1	House category III	sq.m	-	1,300,000	-	1,300,000
2	House category IV	sq.m	-	718,000	-	718,000
3	Bamboo cottage, bamboo stall, bamboo fish cottage	sq.m	30,000	28,000.0	93.3	30,000
4	Built kitchen, toilet, cage works	sq.m	70,000	65,000.0	92.9	70,000
5	Temporary kitchen, toilet, cage	sq.m	30,000	28,000.0	93.3	30,000
6	Plastered wall 110cm (*)	sq.m	80,000	62,000.0	77.5	80,000
7	Non-plastered wall 110cm	sq.m	70,000	54,000.0	77.1	70,000
8	Steel hedging wall	sq.m	22,500	20,000	88.9	22,500
9	Soil grave	pc	300,000	250,000	83.3	300,000
10	Buil grave	pc	-	1,200,000	-	1,200,000
11	Brick court	sq.m	35,000	40,000	114.0	40,000
12	Concrete, cement court	sq.m	191,000	190,000	99.5	191,000
13	Pipe for drainage	m	3,500	5,000	143.0	5,000
14	Kitchen doorsill tiled with enamelled tiles	sq.m	92,700	90,000	97.1	92,700
15	Fish bamboo cottage	sq.m	30,000	28,000.0	93.3	30,000
16	Outhouse (toilet)	sq.m	70,000	65,000.0	92.9	70,000
17	Irrigational cannal					

(*)Hedging wall's unit is sq.m, price 80,000VND/sq.m.

Table C.3: Result of price survey on crops and trees.

(VND)

No	Type of crops & trees	Unit	Price of People's Committee of provinces	Surveyed price	Comparison (%)	Suggested price
1	Banana with fruits	Tree	18,000	14,000.0	77.8	18,000
2	Banana h>2m	Tree	10,000	8,000.0	80.0	10,000
3	Banana with height 2m<h<1.5	Tree	8,000	4,000.0	50.0	8,000
4	Rice	sq.m	-	2,000.0		2,000.0
5	Maize	sq.m	-	1,000.0		1,000.0
6	Vegetables of all kinds	sq.m	4,000	3,500.0	87.5	4,000
7	Papaya	Tree	20,000	20,000	100.0	20,000
8	Eucalyptus	Tree	10,000	8,000	80.0	10,000
9	Taro	sq.m	-	3,000	-	3,000
10	Mango	Tree	600,000	560,000	93.3	600,000

No	Type of crops & trees	Unit	Price of People's Committee of provinces	Surveyed price	Comparison (%)	Suggested price
11	Litchi	Tree	600,000	570,000	95.0	600,000
12	Areca	Tree	150,000	135,000	90.0	150,000
13	Jack fruit	Tree	400,000	400,000	100.0	400,000
14	Bead-tree	Tree	10,000	11,000	110.0	11,000
15	Bamboo	Tree	6,000	6,500	108.3	6,500
16	Custard-apple	Tree	300,000	280,000	93.3	300,000
17	Ornamental plant of all kinds	Tree	20,000	18,000	90.0	20,000
18	Flower plant of all kinds	Tree	8,000	9,000	112.5	9,000
19	Pineapple	Tree	600	600	100.0	600
20	Galingale	Tree	3,000	2,600	86.7	3,000
21	Sweet potato, water potato	Tree	2,000	1,800	90.0	2,000
22	Kudzu, cassava	Tree	10,000	8,500	85.0	10,000
23	Chayote	Tree	2,500	2,500	100.0	2,500
24	Betel	Tree	10,000	7,500	75.0	10,000
25	Citronella	Tree	3,000	2,300	76.7	3,000
26	Oleaster	Tree	50,000	52,500	105.0	52,500
27	Guava	Tree	300,000	280,000	93.3	300,000
28	Dog-nail	Tree	20,000	13,000	65.0	20,000
29	Pomelo	Tree	300,000	276,000	92.0	300,000
30	Asparagus	Tree	10,000	10,500	105.0	10,500
31	Orange	Tree	150,000	157,000	104.7	157,000
32	Madarin orange	Tree	100,000	98,000	98.0	100,000
33	Lemon	Tree	100,000	95,000	95.0	100,000
34	Areca palm	Tree	150,000	129,000	86.0	150,000
35	Lemon	Tree	300,000	260,000	86.7	300,000
36	Coconut	Tree	400,000	340,000	85.0	400,000
37	Rose apple	Tree	250,000	197,000	78.8	250,000
38	Persimmon	Tree	200,000	200,000	100.0	200,000
39	Sapodila	Tree	200,000	200,000	100.0	200,000
40	Keo l, trưm	Tree	10,000	9,800	98.0	10,000
41	Carambora	Tree	300,000	252,000	84.0	300,000
42	Custard apple	Tree	300,000	285,000	95.0	300,000
43	Jack fruit	Tree	400,000	288,000	72.0	400,000
44	Sugar apple	Tree	300,000	230,000	76.7	300,000

Survey Result: Yen Bai**Table D.1: Result of survey on land price**

(VND)

No	Classification of land	Unit	Price of People's Committee of provinces	Surveyed price	Comparison (%)	Suggested price
Co Phuc station						
I	Cultivated land	sq.m	18,000	20,000	111.1	20,000
1	Cultivated land, classification II	sq.m	15,000	18,000	120.0	18,000
2	Cultivated land, classification III	sq.m	12,000	15,000	125.0	15,000
3	Cultivated land, classification IV	sq.m	10,000	12,000	120.0	12,000
4	Cultivated land, classification V	sq.m	8,000	10,000	125.0	10,000
5	Cultivated land, classification VI	sq.m		144,000		
II	Resident land					
Lang Thip station						
I	Cultivated land					
1	Cultivated land, classification II	sq.m	18,000	20,000	111.1	18,000
2	Cultivated land, classification III	sq.m	15,000	18,000	120.0	15,000
3	Cultivated land, classification IV	sq.m	12,000	15,000	125.0	12,000
4	Cultivated land, classification V	sq.m	10,000	12,000	120.0	10,000
5	Cultivated land, classification VI	sq.m	8,000	10,000	125.0	8,000
II	Resident land	sq.m	20,000	25,000	125.5	25,000
III	Garden land					
1	Garden land, classification II	sq.m	15,000	15,000	100.0	15,000
2	Garden land, classification III	sq.m	12,500	13,000	104.0	13,000
3	Garden land, classification IV	sq.m	8,500	9,000	105.9	9,000
4	Garden land, classification V	sq.m	5,000	5,500	110.0	5,500
IV	Pond land					
1	Pond land, classification II	sq.m	17,000	17,000	100.0	17,000
2	Pond land, classification III	sq.m	14,000	14,000	100.0	14,000
3	Pond land, classification IV	sq.m	1,000	1,200	120.0	1,200
4	Pond land, classification V	sq.m	9,000	10,000	111.1	10,000
5	Pond land, classification VI	sq.m	7,000	7,000	100.0	7,000
V	Other land (if forest land for production)					
1	Forest land, classification II	sq.m	6,000	6,000	100.0	6,000
2	Forest land, classification III	sq.m	5,000	5,000	100.0	5,000
3	Forest land, classification IV	sq.m	3,500	4,000	114.3	4,000

Table D.2: Survey result on price of works and architectural works

(VND)

No	Type of works & architecture	Unit	Price of People's Committee of provinces	Surveyed price	Comparison (%)	Suggested price
1	Unsettled house	sq.m	300,000	260,000	86.7	300,000
2	House C4 wall 110cm	sq.m	718,000	650,000	90.5	718,000
3	House C4 wall 220cm	sq.m	842,000	720,000	85.5	842,000
4	House C3 without enforced framework	sq.m	1,200,000	1,200,000	100.0	1,200,000
5	House C3 with enforced framework	sq.m	1,300,000	1,250,000	96.2	1,300,000

No	Type of works & architecture	Unit	Price of People's Committee of provinces	Surveyed price	Comparison (%)	Suggested price
6	House's foundation	cu.m	343,000	320,000	93.3	343,000
7	Eaves Broximen	sq.m	25,000	30,000	120.0	30,000
8	Kitchen		113,000	120,000	106.2	120,000
9	Concrete house's foundation	sq.m	20,000	20,000	100.0	20,000
10	Brick court	sq.m	25,000	25,000	100.0	25,000
11	Cement court	sq.m	20,000	20,000	100.0	20,000
12	Plant hedge	sq.m	-	2,000	-	2,000
13	Water pipe for drainage	m	-	5,000	-	5,000
14	Kitchen doorsill tiled with enamelled tiles	sq.m		90,000	-	90,000
15	Outhouse (toilet)	sq.m	-	65,000	-	65,000
16	Cage (buffalo cage, cow cage, chicken cage, pig cage)	sq.m		65,000	-	65,000
17	Drilled well	m	-	50,000	-	50,000
18	Bathroom	sq.m	-	120,000	-	120,000
19	Hedging wall	sq.m	-	40,000	-	40,000
20	Cistern	sq.m	318,000	300,000	94.3	318,000

Table D.3: Result of price survey on crops and trees.

(VND)						
No	Type of crops & trees	Unit	Price of People's Committee of provinces	Surveyed price	Comparison (%)	Suggested price
1	Rice	sq.m	1,200	1,000.0	83.3	1,200
2	Ornamental plant	Tree	-	15,000	-	15,000
3	Maize	sq.m	600	500.0	83.3	600
4	Vegetables	sq.m	4,000	4,000	100.0	4,000
5	Cassava	sq.m	500	500	100.0	500
6	Banana	Tree	15,000	15,000	100.0	15,000
7	Cinnamon tree	Tree	200,000	190,000	95.0	200,000
8	Longan	Tree	1,200,000	1,100,000	91.7	1,200,000
9	Apricot-tree	Tree	112,000	110,000	98.2	112,000
10	Custard apple	Tree	103,000	100,000	97.1	103,000
11	Bamboo	Tree	6,000	7,000	116.7	7,000
12	Keo la tram	Tree	7,000	8,000	114.3	8,000
13	Flower	sq.m	3,000	3,000	100.0	3,000
14	Peach	Tree	224,000	220,000	98.2	224,000
15	Papaya	Tree	48,000	50,000	104.2	48,000
16	Encalyptus	Tree	7,000	7,000	100.0	7,000
17	Pomelo	Tree	350,000	330,000	94.3	350,000
18	Lemon	Tree	500,000	445,000	89.0	500,000
19	Chay	Tree	140,000	135,000	96.4	140,000

Result Survey: Lao Cai**Table E.1: Result of survey on land price**

(VND)

No	Classification of land	Unit	Price of People's Committee of provinces	Surveyed price	Comparison (%)	Suggested price
Xuan Giao station						
I	Cultivated land					
1	Cultivated land, classification II	sq.m	20,000	20,000	100.0	20,000
2	Cultivated land, classification III		14,000	15,000	107.1	15,000
3	Cultivated land, classification IV		8,000	9,000	112.5	9,000
4	Cultivated land, classification V		4,000	5,000	125.0	5,000
5	Cultivated land, classification VI		1,000	1,000	100.0	1,000
II	Resident land					
Lao Cai station						
I	Cultivated land					
1	Cultivated land, classification II		20,000	20,000	100.0	20,000
2	Cultivated land, classification III		14,000	15,000	107.1	15,000
3	Cultivated land, classification IV		8,000	9,000	112.5	9,000
4	Cultivated land, classification V		4,000	5,000	125.0	5,000
5	Cultivated land, classification VI		1,000	1,000	100.0	1,000
II	Resident land		72,000	160,000	222.2	160,000
II	Garden land					
1	Garden land, classification I		16,000	18,000	112.5	18,000
2	Garden land, classification II		10,000	12,000	120.0	12,000
3	Garden land, classification III		6,000	6,500	108.3	6,500
4	Garden land, classification IV		5,000	5,500	110.0	5,500

Table E.2: Survey result on price of works and architectural works

(VND)

No	Type of works & architecture	Unit	Price of People Committee of provinces	Surveyed price	Comparison (%)	Suggested price
1	Shelter	sq.m	300,000	270,000	90.0	300,000
2	Buiding C4 wall 110cm	sq.m	600,000	520,000	86.7	600,000
3	C4 wall 220cm	sq.m	800,000	680,000	85.5	800,000
4	Building C3 with non resistant-force frame	sq.m	1,200,000	1,100,000	91.7	1,200,000
5	Building C3 with resistant-force frame	sq.m	1,300,000	1,200,000	92.3	1,300,000
6	Kitchen,	sq.m	70,000	70,000	100.0	70,000
7	Kitchen, toilet, unsettled cage	sq.m	30,000	25,000	83.3	30,000
8	Built shelter	sq.m	40,000	40,000	100.0	40,000
9	Bamboo, wooden shelter	sq.m	5,000	5,000	100.0	5,000
10	Plant shelter	sq.m	2,000	2,000	100.0	2,000
11	Non-built well	m	65,000	65,000	100.0	65,000
12	Well's part on land	C.i	80,000	75,000	93.8	80,000

No	Type of works & architecture	Unit	Price of People Committee of provinces	Surveyed price	Comparison (%)	Suggested price
13	Drilled well	m	50,000	55,000	110.0	50,000
14	Cistern wall 110cm	cu.m	150,000	145,000	96.7	150,000
15	Cistern wall 220cm	cu.m	225,000	210,000	93.3	225,000
16	Non-built grave	C, i	800,000	720,000	90.0	800,000
17	Built grave	C, i	1,200,000	1,150,000	95.8	1,200,000
18	Lavatory pan	C, i	100,000	95,000	95.0	100,000
19	Lavabo	C, i	30,000	30,000	100.0	30,000
20	Aluminum arch	sq.m	200,000	180,000	90.0	200,000
21	Ceiling of lime and straw	sq.m	35,000	40,000	114.3	40,000
22	Ceiling of fiberboard, plywood, mica	sq.m	25,000	30,000	120.0	30,000
23	Wooden ceiling	sq.m	180,000	170,000	94.4	180,000
24	Wooden tiled wall's foot	sq.m	50,000	50,000	100.0	50,000

Table E.3: Result of price survey on crops and trees

(VND)

No	Type of crops & trees	Unit	Price of People's Committee of provinces	Surveyed price	Comparison (%)	Suggested price
1	Banana h>2m	Tree	10,000	10,000	100.0	10,000
2	Banana h<2m	Tree	7,000	7,000	100.0	7,000
3	New planted banana	Tree	4,000	4,000	100.0	4,000
4	Potato of all kinds	sq.m	3,000	3,000	100.0	3,000
5	Vegetables	sq.m	4,000	3,000	95.0	4,000
6	gourd, pumpkin, loopah	sq.m	5,000	3,800	76.0	5,000
7	Longan, litchi	Tree	250,000	250,000	100.0	250,000
8	Jackfruit, dracontomelum, tamarind, fig	Tree	100,000	100,000	100.0	100,000
9	Papaya	Tree	15,000	12,000	80.0	15,000
10	Persimmon of all kinds	Tree	150,000	140,000	93.3	150,000
11	longan, litchee	Tree	250,000	220,000	88.0	250,000
12	Pear, peach	Tree	150,000	145,000	96.7	150,000
13	Citrus	Tree	150,000	144,000	96.0	150,000
14	Persimmon of all kinds	Tree	150,000	135,000	90.0	150,000
15	Pomelo, grape fruit	Tree	230,000	220,000	95.7	230,000
16	Jack fruit, dracontomelum, tamarind	Tree	100,000	90,000	90.0	100,000
17	Plum, apricot-tree	Tree	150,000	150,000	100.0	150,000
18	Coconut	Tree	180,000	185,000	102.8	185,000
19	Lemon, kumquat	Tree	90,000	100,000	111.1	100,000
20	Areca	Tree	60,000	65,000	108.3	65,000
21	Tree for wood	Tree	40,000	45,000	112.5	45,000
22	Bamboo, apricot, pearl-oyster	Tree	15,000	15,000	100.0	15,000
23	Chayote, gourd, pumpkin, loopah	sq.m	5,000	4,500	90.0	5,000
24	Rice	sq.m	2,000	1,200	60.0	2,000
25	Fruits of the earth	sq.m	700	500	71.4	700
26	Sugar-cane	sq.m	700	500	71.4	700

List of disclosed households

No	Full name	Address	Type	
			PAP	Non-PAP
1	Nguyen Van Toan	Dong Anh overpass	x	
2	Nguyen Quang Long	Dong Anh overpass	x	
3	Nguyen Xuan Hien	Dong Anh overpass	x	
4	Nguyen Thi Phuong	Dong Anh overpass	x	
5	Duong Quoc Binh	Dong Anh overpass	x	
6	Doan Ngoc Mung	Dong Anh overpass	x	
7	Nguyen Thi Tuyet Mai	Dong Anh overpass	x	
8	Tran Van Hoi	Dong Anh overpass		x
9	Dinh Van Soan	Dong Anh overpass		x
10	Luu Van Dung	Dong Anh overpass		x
11	Doan Ngac Long	Dong Anh overpass		x
12	Nguyen Dinh Be	Dong Anh overpass		x
13	Pham Thu Tra	Dong Anh overpass		x
14	Nguyen Van Ly	Dong Anh overpass		x
15	Do Van Bao	Dong Anh overpass		x
16	Le Van Thu	Huong Canh Station	x	
17	Bui Doan Ngo	Huong Canh Station	x	
18	Dinh Van Lich	Huong Canh Station		x
19	Hoang luong	Huong Canh Station		x
20	Nguyen Kim Tuyen	Huong Canh Station		x
21	Pham Dinh Khu	Viet Tri Station	x	
22	Pham Van Thanh	Viet Tri Station	x	
23	Pham Thi Phuong	Viet Tri Station	x	
24	Le Van Loi	Viet Tri Station	x	
25	Chu Van Duc	Viet Tri Station		x
26	Trinh Hoai Anh	Viet Tri Station		x
27	Nguyen Ngoc Quang	Viet Tri Station		x
28	Mai Van Dung	Mai Tung Station		x
29	Kieu Thi Hoa	Mai Tung Station		x
30	Dinh Van Lam	Mai Tung Station		x
31	Ho Dinh Loi	Mai Tung Station	x	
32	Nguyen Van Lam	Mai Tung Station		x
33	Nguyen Trong Bao	Mai Tung Station		x
34	Dao Duc Binh	Mai Tung Station	x	
35	Phung Ngoc Van	Mai Tung Station		x
36	Nguyen Van Nghia	Mai Tung Station	x	
39	Nguyen Van Sy	Mai Tung Station		x
40	Hoang Van Bich	Mai Tung Station	x	
41	Bui Van Hung	Co Phuc Station	x	
42	Do Thi No	Co Phuc Station		x
43	Hoang Thi Nhiep	Co Phuc Station	x	
44	Nong Thi Y	Co Phuc Station		x
45	Luong Thi Hanh	Co Phuc Station	x	
49	Pham Van Bay	Co Phuc Station		x
50	Pham Thi Mui	Co Phuc Station	x	
51	Vu Hong Van	Lang Thip Station	x	
52	Nguyen An Nhanh	Lang Thip Station	x	
53	Luu Van Hoang	Lang Thip Station		x
54	Phung Thi Minh Hieu	Lang Thip Station	x	
55	Trinh Dinh Son	Lang Thip Station		x
56	Vu Chi Hao	Lang Thip Station	x	
57	Ngo Tuan Ngoc	Xuan Giao Station		x
58	Hoang Van Dung	Xuan Giao Station	x	
59	Lu Van No	Xuan Giao Station		x

No	Full name	Address	Type	
			PAP	Non-PAP
60	Lu Van Leng	Xuan Giao Station	x	
61	Hoang Minh Dao	Xuan Giao Station		x
62	Vu Chi Hung	Xuan Giao Station		x
63	Hoang Van Sam	Xuan Giao Station	x	
64	Vu Tuyet Anh	Lao Cai Station	x	
65	Pham Manh Dung	Lao Cai Station		x
66	Lu Thi Chung	Lao Cai Station	x	
67	Le Ngoc Dang	Lao Cai Station	x	
68	Luu Van Dat	Lao Cai Station		x
69	Quach Tuan Dat	Lao Cai Station		x
70	Nguyen Thi Ha	Lao Cai Station	x	
71	Thao Thi Vu	Lao Cai Station	x	
72	Ha Van Hoa	Lao Cai Station		x
73	Vu Van Nui	Lao Cai Station	x	
74	Nguyen Van Nguyen	Lao Cai Station	x	
75	Mai Thi Luong	Lao Cai Station	x	
76	LeThi Viet	Lao Cai Station		x
77	Ha Huy Giap	Lao Cai Station		x
78	Nguyen Tien Trung	Lao Cai Station		x
79	Nguyen Thi Men	Lao Cai Station	x	
80	Hoai Thanh Tinh	Lao Cai Station	x	

ANNEX 9

Investment Plan for Pho Moi and Van Hoa Resettlement Sites

INVESTMENT PLAN OF LAO CAI CITY'S PEOPLE'S COMMITTEE FOR PHO MOI RESETTLEMENT SITE (ENGLISH TRANSLATION)**A. Preface****1. Project information:**

1.1 Project name: Pho Moi Resettlement construction project – Lao Cai city.

1.2 Employer: Lao Cai city people committee – Lao Cai Province.

1.3 Project preparing company: Lao Cai Construction & Architecture Plan center.

1.4 Project location: Pho Moi Ward – Lao Cai city – Lao Cai Province.

1.5 Investment: New Construction.

1.6 Work Scope and Class.

a/ Scope:

- The studied land area: 4.67ha.
- The total length of road: 709.98m:
- Embankment width $B_n=12m$; Pavement width $B_m=6m$.
- The resettlement land area: 8.800sq.m
- The area for landscaping and common work: 9.884sq.m

b/ Work Class: The Work class III, urban road.

1.7 Investment fund:

- Investment source: State own budget
- Investment total cost: 9,005,786,963 (VND)

2. Basics for preparing Project:

- Decree No.16/CP dated 24 Jan 2005 by Government regarding to construction investment project management.
- Based on Decree No. 209/2004/ND-CP dated 16/12/2004 by Government regarding to construction work quality management.
- Based on Decision No. 10/QD-BXD dated 15 April 2005 by Minister of MOC regarding to norm of management fee for construction investment project.
- Based on the Decision No: 11/QD-BXD dated 15 April 2005 by Minister of MOC regarding to norm of preparation cost for investment construction project.
- Based on the Circular No: 04/2005/TT-BXD dated 01 April 2005 by Minister of MOC guiding for preparation and management of cost for investment construction project.
- Notice No.471/TB.VPUBND dated 01 Sep 2005 by Lao Cai Provincial People Committee regarding to assigning the provincial construction Department to adjust the area near Pho Moi bridge – Lao Cai city, Lao Cai Province.
- Based on the Decision No. 3077/QD-UBND dated 24th November 2005 by Lao Cai Provincial People Committee regarding to

approval for Plan adjustment for Resettlement site near Pho Moi bridge, Pho Moi ward – Lao Cai city.

- Based on the Decision No. 389/QD-UBND dated 14/02/2006 by Lao Cai provincial people Committee regarding approval for the proposal constructing resettlement site in Pho Moi ward, Lao Cai city.
- Based on the construction material price quotation in the first Quarter 2006 of the interdisciplinary construction – finance.

B. Content

Chapter I

The investment necessity, investment purpose

1. The investment necessity

Pho Moi ward is a very important area in Lao Cai city which has East Pho Moi Industrial Zone and Lao Cai International Station, so Pho Moi can be considered as one of the important gateway in Lao Cai city. Acknowledge of that important role, in the recent years Lao Cai has focused on constructing the infrastructure for Pho Moi, to deserve its inherent role. However, the investment has not yet been completed, especially the area at Pho Moi bridge head which has not yet been constructed, there are puddles remaining, low-roofed houses have been built in urban area illegally which do not please the eyes when passing Pho Moi bridge to Lao Cai city, destining Sa Pa tourist area.

The development of Lao Cai city as well as the increasing demand on houses, some areas must be acquired to invest for construction resulting in critical resettlement demand.

Due to the above-mentioned actual requirements, the construction investment for Pho Moi bridge head area is very necessary and critical, meeting the existing requirement and as future basic sustainable development.

2. Investment Purpose.

Construction investment for technical infrastructure works in Pho Moi bridge area, in addition to completing the landscape in this area, it also provide the land for residents and trees planting as well as for schools which brings effective socio-economic result in Pho Moi ward particularly and Lao Cai city generally.

Chapter II

Project Name, Construction Scope, and Investment mode

1. Project name:

Pho Moi Bridge resettlement site – Lao Cai city – Lao Cai Province.

Item: Internal transport – Grading – Water Drainage – Water Supply – Power Supply

2. Construction Scope

Originating from the actual demands and detailed master plan of Pho Moi bridge area, which was approved by Lao Cai provincial people committee, the detailed project scope is as follows:

- The studied land area: 4.67ha.
- The total length of road: 709.98m:
- Embankment width $B_n=12m$; Pavement width $B_m=6m$.
- The resettlement land area: 8.800sq.m
- The area for landscaping and common work: 9.884sq.m

3. Investment Mode

New Construction.

Chapter III

Construction location

1. ROW

Pho Moi bridge area resettlement site has an area of 4,6700 sq.m, in Pho Moi ward, Lao Cai city, Lao Cai province, it is situated as follows:

- North is adjacent to Khanh Yen street
- South is adjacent to river side road M12
- West is adjacent to K3 road
- East is adjacent to M16 road.

2. Natural Condition

2.1 Geographical location

Even and flat terrain, fertile soil for agriculture, there are some low ponds in this area so it is required technical treatment when constructing.

2.2 Climate and Hydrology Characteristics

Climate:

+ Temperature:

- Average highest temperature: 41⁰C
- Average lowest temperature: 15⁰C
- Average annual temperature: 22⁰C

+ Rain fall

- Annual average rain fall: 2128mm
- Daily highest rain fall: 1909mm
- Monthly highest rain fall: 318mm
- Yearly average raining days: 152 days

+ Humidity:

- Annual average humidity: 86%
- Lowest humidity: 86%

+ Evaporation:

- Yearly average evaporated water: 815.8mm
- Monthly average evaporated water: highest 76.3mm, lowest 18mm

+ Wind:

Due to the affect of geography, wind is mainly South and Southeast wind

- Highest wind speed: 8-12m/s
- Average wind speed: 1.8-2m/s

+ Typhoon

Lao Cai city is mainland, far from coast so there is no typhoon, local whirlwinds have occurred which damaged the trees, crops and blew up the houses. It is often affected by typhoon in North Delta area; there are often heavy rains in upstream causing floods in the adjacent areas of river and streams.

+ Sunlight:

Yearly total sunlight hours: 1588 hours
 Monthly sunlight hours: Winter: 150 hrs
 Summer: 92 hrs.

+ Mist:

Yearly total days with mist: 44.1 days.

Hydrology:

The studied area has climate characteristic of Lao Cai city as well as northwest mountainous region.

2.3 Ecosystem

Lao Cai city is rich of ecosystem, typical of Northern mountainous region. It is required to select the trees, which is suitable with soil and climate in this region.

2.4 Land status.**A/. Land use status.**

In the scope of construction land, there are no permanent works, mainly land is used for agricultural purpose and fallowed land, and it is evaluated in detail as follows:

- Residential land occupied illegally: including rows of houses built illegally by people, mainly concentrated in Khanh Yen, K3 roads.
- Landscaping land: Including 2 plots of land at 2 starting points of Pho Moi bridge, they are managed by Environmental Company, and now they nursery garden, however, there are at least +82.5m, they are often flooded.
- Fallowed land, miscellaneous garden; it is remaining area, there is no using purpose, dedicated for wastewater, grass growing...

B/ Technical infrastructure status.

Technical infrastructure system has been invested quite overall but not complete, some projects are implementing as follows:

+ Transport system:

Road: There are Nguyen Hue, Minh Khai, Dinh Bo Linh, Ngo Van So, Khanh Yen, K3, M12, M16 routes which are being well operated.

Waterway: Waterway along Red river, which is used mainly for exploiting sand and gravel in riverbed.

Big bridge: Pho Moi bridge passing Red river starting from Lao Cai station to Ngac 6 going Kim Tan and New Residential Area Lao Cai – Cam Duong.

+ Drainage system: Along the routes, there are longitudinal drainage system; concrete box ditch 600x800.

+ Water supply: Water supply pipe D100 on Nguyen Hue and Khanh Yen originating from Lao Cai water company.

+ Power supply: Now there is power supply system for people there; and there are two transformer stations 250 KVA-10/0.4KV, one transformer station 160 KVA – 10/0.4KV, and one transformer station 180KVA-10/0.4 KV.

Estimated related projects.

+ Red river stone embankment project section from Coc Leu Bridge to Pho Moi is implementing and is finishing soon.

3. Materials supply condition and other input characteristics.

Materials supply condition is quite convenient, materials are carried by road, railway. Construction site can access with the completed transport roads.

- The main construction materials (sand, stone...) they are available in local region.
- Backfill earth will be from Bitis hill (1km in distance) and behind Viaduct (Chui) bridge (2kms in distance).

Chapter IV

The main design alternatives

1. Transport design and grading.

1.1 The applied Process and Norm

- Survey process 22TCN 263 – 2000.
- Design Standard for street, road, square in Urban TCXD 104-1983.
- Motorway design standard TCN 4054-98.
- Flexible Pavement Design Process 22TCN 211-93.
- Environmental Impact Assessment process.
- TCVN 33-68 water supply standard.
- Based on the electrical equipment norm – Section II, electrical transmit system 11 TCN-19-84, section III, transformer station TCN/1984 and some other regulations of the Power Authority.
- Based on the design standard for artificial lighting for urban road, street, square: TCXDVN 259:2001.

1.2 Design Alternatives.

Based on the selected option, construction purpose and actual topography at site, the specific solutions are as follows:

1.2.1 Grading design solution.

Grading purpose is to create land for resettlement, services and common works. Grading level is defined by the approved plan level and must be suitable with architectural landscape and other infrastructure facilities, which were constructed.

Design solution: Divide each functional area in to small pieces following the approved plan to calculate for grading (applying square grading net 10x10m), backfill must be compacted to meet the density $\geq K90$. Except the scope of transport road calculated for each route must ensure the required compacting coefficient of transport road $\geq K95$.

- The residential grading level is 50 cm higher than the embankment elevation, landscaping construction level is same as sidewalk level.
- Backfill earth will be taken from Bitis hill (1km in distance) and behind Viaduct (Chui) bridge (2kms in distance)

1.2.2 Transport design solution.

Following the current regulations, the design road class is A2 with traffic flow of 100 vehicles per day and night (Road class is in accordance with Construction Standard TCXD 104:1983 - Design Norm for urban street, road and square).

A/ The main technical coefficients

- + Design speed : $V_{tt}=30\text{km/h}$
- + Traffic volume : 100 vehicles/ day and night
- + Longitudinal Gradient: $I_{\max} = 1.35\%$
- + Booc duya radius: $R_{\min} = 8\text{m}$.

Pavement structure:

Layer 1: Asphalt concrete of 3cm thickness

Layer 2: Pavement of stone with 0 4x6 bituminous macadam of 15cm thickness, bitumen standard 3kg/sq.m.

Layer 3: The standard macadam aggregate foundation after rolling is 15cm

Layer 4: The top base layer of 30cm, which is compacted by K98 (with the full compacted base meeting K98).

Layer 5: Compacted base K95

The required elastic modulus of pavement $E_{yc}=1150\text{daN/cm}^2$.

The Work design standard:

- The drainage ditch is designed having water drainage cross-section 80x60, at the location-crossing road; it is designed with load bearing of H13-X60 load.

B/ Design solution:

* / Plan design: The sections follow the approved plan. Boocduya radius at junctions $R_m=12m$, except at the tops of D8 and D11, $R=8m$.

* / Profile design:

- + ROW design level must be higher than yearly flood level.
- + The minimum longitudinal gradient for drainage must ensure $i_{min}=0.3\%$, the gradient drainage direction must base on the overall water drainage in the studied area.
- + Maximum longitudinal gradient $i_{max}=1.35\%$.
- + Level at junctions is controlled following the approved plan level and basing on the existing facilities' level.

* / Cross section:

For 2 traffic lanes and sidewalk to supply sub-facilities. Roadbed width 12m, and 6m of pavement having slope 2%, 3m sidewalk each, sidewalk level is 15cm higher than pavement, gutter gradient is 1%.

1.2.3. Drainage design solution:

Drainage water volume including run-off and wastewater generated from residential houses, drainage ditches are designed following the road. Box ditches of concrete M150 60x80cm are designed along the sidewalk, gradient following road. Load bearing box culverts are constructed at road crossing locations (with load H13-X60).

2. POWER SUPPLY DESIGN SOLUTION.**2.1 The applied standard and process.**

- Based on the actual site survey.
- Based on the design standard for artificial lighting for urban road, street, square: TCXDVN 259:2001.
- Based on the electrical equipment norm – Section II, electrical transmit system 11 TCN-19-84, section III, transformer station TCN/1984 and some other regulations of the Power Authority.

2.2 The construction quantity.

- Construct 150m DDK 22KV originating from C3 pole and 22KV line along the resettlement area to 250KVA newly constructed transformer station to serve the new residential area. Connection point from C3 pole over A1, A2 and A3 poles to newly constructed transformer station. The thermal galvanized anti-rust cast steel bar is used (galvanized layer thickness $\geq 80\mu m$), VHD-24KV vertical supporting porcelain is used, conducting-wire is AC50.
- Construct 01 transformer station 250KVA-22KV/0.4KV hanging on the concrete pole 12m, connecting together by bar and supporting plate for transformer, ABB transformer made in Viet Nam will be used, cast poles are designed every 2.7m; all the steel details are galvanized.
- Construct 783m of 0.4KV wire: 03 branches originating from 250KVA-22/0.4KV newly constructed transformer station on sidewalk along the power supply section for Pho Moi resettlement site; 01 branch connecting C3 pole of the existing M-4 transformer station on Minh Khai supplying power for N1 residential area. There are 25 poles along the section, they are 10mB and 10C centrifugal concrete poles manufactured in Lao Cai or equivalent, insulated enclosed aluminum twisted cable ELPE-ABC (4x70) is used; spare parts accompanying cable; pole concrete foundation cast in place MC-01 and MC-02.
- Construct 783m of wire for lighting, lampshades are used on the low-tension pole BTLT 10B, MOCCOT lights manufactured by Hapulico, Sodium 250W bulbs, insulated enclosed aluminum twisted power conducting cable XLPE-ABC (4x25) is used and accompanying spare parts.

2.3. The main technical alternatives:**2.3.1 22KV wire system.**

- Connecting point at C3 pole 10 (22) KV wire going along Pho Moi resettlement site, now it supply for transformer station of Hong Son company 160KVA-10/0.4 KV. The terminating point is at newly constructed transformer 160KVA-10 (22)/ 0.4KV to supply power for the resettlement site.
 - Bar: It is manufactured by cast steel and galvanized before installing. The diverted bar XCH is used for transition point, lop-sided bars XL-SD are used at the single poles, XLD-SD for the couple poles on the section. Porcelain supporting bar at the starting point of station XDSDT for TBA location.
 - Porcelain: Vertical VHD – 24 is installed for every location of pole on the section and porcelain supporting bar at the starting point of station.
 - Conducting wire: Due to short section, only supplying power for Pho Moi resettlement site and it is sub branch, therefore we select the aluminum with steel core AC-50/8.0 having following characteristics:
- + Electrical technical characteristics:
- Calculated section: $48.2/8.04 \text{ mm}^2$.
 - Conducting wire dia: $d=9.6/3.2\text{mm}$
 - Specific weight: 195 kg/km .
 - Allowed electric current: $I_{cp}=215\text{A}$
 - Electric resistance 1Km/wire (at 20°C): $R_o=0.5951 \Omega/\text{Km}$
- + Physic mechanic property characteristic:
- Cutting force: $T_D=1711.2 \text{ daN}$.
 - Maximum stress $\sigma_{max}=13.6 \text{ daN/mm}^2$ corresponding to 40% of cut tension of the wire ($K=2.5$).
 - Stress at yearly average temperature $\delta_{TB}=6\text{daN/mm}^2$.

2.3.2. Transformer station (TBA):

a/ Location:

TBA will be situated at landscaping area on sidewalk near Pho Moi bridge (see drawing DCS-01: Overall power supply layout)

B/ Transformer capacity:

Based on the power supply standard for households, common facilities, regional services to calculate the power consumption capacity for Pho Moi resettlement site.

Power supply standard table

No	Item	Standard	Quantity	Capacity (KW)
1	Domestic power supply	330W per capita	$110 \times 4 = 440$ persons	145.2
2	Services	30W/sq.m	$65\% \times 2438 \text{sq.m}$	47.5
3	Kindergarten	100W per head	$440 \times 0.085 = 38$	3.8
4	Car park	10W/sq.m	$40\% \times 1568 \text{sq.m}$	6.2
5	Road lighting	250W/ light pair	28 pairs	7.0
Total				209.7

Total capacity is 209.7KW

- Concurrent coefficient: $K_{dt}=0.7$

- Highest capacity coefficient: $K_{sd}=0.9$

We have the highest usage capacity of line as follows:

$$P_{sd\max}=P_d \times K_{dt} \times K_{sd}=209.7 \times 0.7 \times 0.9=132.1 \text{ KW}$$

Total calculated capacity: $Stt=132.1/0.85=155 \text{ KVA}$ (in which $\cos\varphi$ coefficient = 0.85).

Based on the actual demand to serve the transport we select the transformer having capacity 160KVA-10(22)/0.4KV manufactured by ABB Viet Nam, it is three phase transformer having cooling system by oil.

C/ Station scope:

The transformer stations are designed by hanging on 2 centrifugal concrete poles 12m connecting together by bars and supporting plates. 2 poles are installed 2.7m apart.

- Pole foundation is cast in place by Concrete M150.
- Bars, supporting plates on station are cast steel and galvanized.

D/. Control and protection equipment for station.

- High-tension 10(22) KV

Installing 01 interruptor 24KV-600A at incoming wire of station to close and open the system, and then 01 thunderbolt resistance valve PBC-24KV or equivalent to protect when exceeded power in atmosphere spreading from wire in case of thunderbolt, and final fuse PK-24KV to protect and stop current of MBA.

- Low-tension:

- - Install 01 low tension cabinet 500V-600A having 3 exposed (100-200A) supplying power for 03 branches controlled on and off as well as protected by automat devices, general protected by main automat 250A.
- Install 01 low tension anti-thunderbolt device DZa-500V to protect the distributor devices and MBA whenever the thunderbolt current spreading from low tension wire to the cabinet.
- The outgoing cable: Based on the capacity of the transformer, Cu/XLPE cable (3x1230+9) is used from transformer to cabinet.

* **Earthing station**

- Due to the main gravelly soil in this area where has high soil modulus power resistance, so the transformer station is earthed by combined ray stake system including 34 steel cast stakes L63x63x6x2000 which is fix in the ground 0.8m, the stakes are connected together by steel CT3 1. (or similar), earthing station ensures the index $R_{td} \leq 4\Omega$. All the steel portions of station (except the platform) are connected to the earthing system.

* **Measurement**

01 meter 0-500V, 03 meters 300A/5A, 01 three-phase meter indirectly gauging the consumed power and 01 three-phase meter indirectly gauging the power capacity in the distributor low tension cabinet. Based on that to check the consumption capacity coefficient $\cos\varphi$ of the power wire for installing the compensated copper when the operating the wire.

2.3.3. 0.4 KV power line

a, *Pole*: The centrifugal concrete poles 10B and 10C manufactured by Lao Cai (or similar) are used. 35m in average distance.

- *Pole foundation*: Cast in place foundation M150 stone 2x4, MC-01 and MC-02 foundations are used.

Twisted cable spare parts: spare parts accompanying with cable including:

- Heavy load hook (MTN) with clamp (EA) is used for pole tightening angle and end.
- Hanging hook (MT) with hanging clamp (ES) is used for the location of vertical supporting pole.

c, Repeating earthing: To ensure the stability of power, the repeating earthing sets are provided along the road, earthing used stakes L63x63x6x1500 which is fixed in the

ground 0.8m in every 3m and connected together by steel ϕ 12, earthing station ensures the index $R_{td} \leq 30\Omega.ss$

d, Cable: Low tension originated from the transformer 160KVA-10(22)/0.4 KV which is divided in to 3 branches:

Branch 1: Originating from the transformer along N2 branch to Minh Khai supplying power for resettlement households on Minh Khai road (from pole C1N1 to pole C6N1), section having 6 locations of poles. ABC (4x70) mm² twisted cable is used.

Branch 2: Originating from the transformer along N4 branch supplying power for resettlement households on N4 access road (from pole C1N2 to pole C4N2), section having 4 locations of poles. ABC (4x70) mm² twisted cable is used.

Branch 3: Originating from the transformer along N2 branch over Minh Khai street to N1 access road supplying power for resettlement households on N1 and N2 access road (from pole C1N3 to pole C15N3), section having 15 locations of poles. ABC (4x95) mm² twisted cable is used.

Turning branch under branch No.3 originating from pole C2N3 supplying power for households on N3 access road. ABC (4x70) mm² twisted cable is used.

Power conductive cable is bought from the local companies ensuring Vietnamese quality standard.

2.3.4 Lighting

a. Lampshade and light: Lampshade on single low tension pole CD-10 and on double low tension pole Cd-10D on centrifugal concrete pole 10B. Lampshade CD-16 on the centrifugal pole 16m. MACCOT sodium 250W lights manufactured by Hapulico is used.

b. Spare parts: Heavy load hook + clamp for the tightened pole, hanging hook + hanging clamp for the supporting pole.

c. Cable: A1/XLPE ABC (4x25) twisted cable is used.

3. WATER SUPPLY DESIGN

3.1 Design standard and basics.

- TCXD 33: 1985 Water supply. External network and work. Design standard.

- Based on the plan of land plots in the approved area including: Plot houses (110 plots) and 8 plots for public service.

3.2. Design solution

3.2.1 The existing water supply system status.

There are water supply pipe D100 made of galvanized steel on Nguyen Hue and Khanh Yen streets, with run-off water in Lao Cai city.

3.2.2 Design solution.

a. Water source.

Water supply system in Lao Cai city using run-off water is main source so protection for water source is very important.

Fresh water is from Lao Cai Water Company with capacity 12.000cu.m/ day and night.

Water supplying for the resettlement area is in the water supply system of Lao Cai city, taken from the existing water supply pipe D100.

b. Basic for calculation.

Water supply standard: domestic water supply, public activities and service and watering (tree and road watering).

Domestic (l/ person/ day): 140

Public activities and service (cu.m/day): 20% QSH

Irrigation (l/sq.m): 10% QSH

Standby water: (cu.m/day): 25% ΣQ

Based on the above water demand we have below calculation table:

No.	Properties	Standard	Consumption water volume (cu.m)
1	Daily domestic water demand (cu.m/day) Total of popu: 440 (persons) Tourists, non-residential people: 110 (pers.) Total: 550 (pers.)	140 (l/per./day)	77
2	Public activities and service water demand daily (cu.m/day)	20% QSH	15.4
3	Tree and road watering demand (cu.m/day)	10% QSH	7.7
4	Standby water (cu.m/day)	25% ΣQ	19.25
5	Daily water demand (cu.m/day)		119.35
6	Daily maximum water demand (cu.m/day)		179

- Hourly maximum water volume is:

$$Q_{\text{hour}} = 179/24 = 7.46 \text{ cu.m/h}$$

- Secondly maximum water volume is:

$$Q_{\text{second}} = 7.46/3.6 = 2.07 \text{ l/s}$$

c. Design solution: Water is taken from pipe D100 by 2 initial water hoops (horizontal type) supplying water for land plots and public services; water for DV4 area is from line 3.

- Water pipe across road is fix 0.8m in depth and has plate supporting pipe (see drawing CN11/11)

- Pipe on sidewalk is fix 0.6m (by sleeve connection every 8m): at turning point, pipe is connected by cutting and welding in accordance with turning corner.

- The terminal point of pipe is closed by stiff cover.

- Profile designed for 5 pipe lines and air discharge valve is provided at the highest point of the pipe line and exhausted outlet at the lowest point.

- Design the water distribution point, 1 point for 6 households.

Project includes 4 water pipe pipe lines HDPE with diameter from D40-D75; 2 initial water hoops; 3 stopping valves. Details are as follows:

- Water pipe pipe line 1: L=185m (from HV2 to C7 stake) supplying water for 34 households (136 persons) and 2 public services with average demand $Q_{\text{day, night}}=36.89$ cu.m/ day, night.

With in Lao cai city urban area, non-equable coefficient for day and night is $K_{\text{dh}} = 1.5$; $Q_{\text{Max}}=55.335$ cu.m/ day, night = 0.64 lit/s following hydraulic power table of Construction Publisher 2001 selected D50, $v=0.31\text{m/s}$, $1000i = 5.97$.

- Water pipe pipe line 2: supplying water for pipe lines 3, 4, 5 with L = 135m (from HV1 to A4 stake), $Q=1.45$ l/s following hydraulic power table of Construction Publisher 2001 selected D50, $v=0.32\text{m/s}$, $1000i = 4.2$.

- Water pipe pipe line 3: L=150m (from A2 stake to B4) supplying water for 31 households (155 persons) and 3 public services with average demand $Q_{\text{day,night}}^{\text{aver.}} = 34.425$ cu.m/ day, night; $Q_{\text{Max}}=51.64$ cu.m/ day, night = 0.6 l/s following hydraulic power table of Construction Publisher 2001 selected D50, $v=0.28\text{m/s}$, $1000i = 5.18$.

- Water pipe line 4: L=112m (A3 to B5 stake) supplying water for 23 households (115 persons) and 2 public service with average demand $Q_{\text{day,night}}^{\text{aver.}} = 24.8$ cu.m/ day, night; $Q_{\text{Max}}=37.2$ cu.m/ day, night = 0.43 l/s following hydraulic power table of Construction Publisher 2001 selected D40, $v=0.34\text{m/s}$, $1000i = 10$.

- Water pipe line 5: L=110m (stake A4 to B6) supplying water for 22 households (110 persons) and 2 public services with average demand $Q_{\text{day,night}}^{\text{aver.}} = 24.21 \text{ cu.m/ day, night}$; $Q_{\text{Max}} = 36.31 \text{ cu.m/ day, night} = 0.42/\text{s}$ following hydraulic power table of Construction Publisher 2001 selected D40, $v=0.33\text{m/s}$, $1000i = 9.5$.

The main material quantity of project

No.	ITEM	UNIT	QUANTITY
1	HDPE pipe . 75	m	135
2	HDPE pipe . 50	m	380
3	HDPE pipe . 40	m	222
4	Steel coupler BB D65 (11 ⁰ ; 22 ⁰)	each	8:1
11	Steel coupler 90 ⁰ D75; D50; D40	each	2; 1; 1
12	Coupler <90 ⁰ D50	each	10
13	Welded steel BB D75x50	each	2
14	Welded steel BB D75x40	each	1
15	Welded steel BB D50x32	each	4
16	Cover D50	each	1
17	Cover D40	each	3
18	Valve BB D75	each	3
19	Valve BB D50	each	1
20	Valve BB D40	each	2
21	Bubu D75	each	2
22	Diameter D75; D50; D40	each	3; 1; 2
23	Change cone D75/40	each	1
24	Sediment discharge valve D40	each	2
25	Air discharge valve D40	each	2
26	Air discharge device D40	each	2
27	Stopping valve hole, water initial hole	hoop (hole)	3:2
28	Water initial hoop D100/75; D100/50	each	1:1
29	Water initial hoop D50/25	each	4
30	Water initial hoop D40/25	each	4
31	Coupler plate	each	14

Chapter V Organization and Management

1. Investment Phase

- Phase 1:

- + Population
- + Embankment and macadam aggregate pavement, bituminous macadam
- + Drainage system: Concrete ditches with cover, triangular ditch for run-off and domestic water drainage.
- + Domestic water supply
- + Power supply.

- Phase 2

- + Asphalt concrete pavement.
- + Sidewalk + landscape
- + Lighting system
- + Implementation phase:
 - Project name: Construction of Pho Moi resettlement site in Lao Cai city.
 - Internal road – grading – drainage – water supply – power supply
 - Location: Pho Moi ward – Lao Cai city – Lao Cai province
 - Investment: New construction
 - Employer: People Committee of Lao Cai

- Design company: Lao Cai Architectural and Plan center
- Construction: Bidding following the state current regulation of investment construction management.

2. Schedule

Phase 1:

- Quarter II/2006: Finish preparing and submitting the design drawing + cost estimate, ground breaking ceremony of the Work.
- Quarter IV/2006: Acceptance and handover the Work for operation.

Phase 2: In 2007

Project Management

Project management is implemented in accordance with the regulation of investment and construction management regulations promulgated following Decree No.16/ND-CP dated 07/02/2005 by Government regarding to investment construction management: Decree No.209/NDD-CP dated 16/12/2004 by Government regarding to construction Work quality management and Decision No: 08/QD-UBND dated 10/02/2006 by Lao Cai people committee promulgating some specific regulations regarding to plan management, investment construction project management and Work quality management in Lao Cai Province.

Based on the ability of Employer and actual nature of the project, Employer can establish a PMU to directly manage the project, or hire the consultant company who meet the requirements as specified to manage the project.

4. Maintenance management

When the work is going to operation, the management company has responsibility to maintain, repair regularly, periodically (following the current maintenance regulation) to be well performed.

Chapter V ENVIRONMENTAL IMPACT ASSESSMENT

Environmental impact on construction needs to perform in compliance with Environmental laws, implementing air protection in the Decision No. 29/1999/BXD dated 22nd Oct 1990 issued by Ministry of Construction. Environmental Impact Assessment is based on 22TCN-98 issued by Ministry of Transport.

1. Main impacts:

EFFECT TO THE AIR:

Environment of water: causing erosion, waste sedimentation due to construction, change of nature, filling of streams caused by leveling and land filling.

Effect of waste on environment:

Mobilized workers cause pollution such as motorbike operation (gas, oil and bitumen smokes, splintered stones from construction. The contractor shall prepare a detail plan for control these pollution (waste tanks)

Effect on ecosystem:

Construction leads to change of ecosystems. The line can cause diversity of water flow on the surface and deep water, adversely effecting to ecosystem and limiting plant growth.

Polluted air, noise and vibration:

Using construction diesel machines with high capacity causes serious pollution of air, noise and vibration, especially dust of stone and cement.

2. Solutions:

- *Soil and ecosystem:*
 - + First of all, site clearing shall be performed to built infrastructure of city and to choose optimal alternatives minimizing effect on creatures in the region or to protect them during construction periods.
 - + It is necessary to set retaining wall or cover over construction sites. Besides, transport for materials shall be fully covered to diminish dust in the air. Sanity waste shall be treated preliminarily before discharging into environment. Construction waste and sanitary waste shall be collected to a regulated place.
 - + To apply methods for erosion prevention in regions nearby construction sites as regulated.
 - + To construct drainage system of rain-water and waste water, and Vietnamese standard waste treatment station for small areas and cities.
 - + Sanitary waste from resident regions and classified small regions will be daily collected and treated by suitable methods.
 - + To invest in a separate project for a system of collecting and treating waste solids, waste water and sanitation for small urban regions, etc.
- *Water environment protection*

To improve using water quality in resident regions, etc.

- *Air protection:*
 - + Using cover system to isolate from areas causing dust, hazardous gas and noise, and minimize their effect on other areas.
 - + To manage waste and excrement avoiding air pollution
 - + To design standard traffic system to reduce arisen air pollution
 - + Regularly cleaning urban roads by water near construction sites
- *Collecting and managing waste solids:*
 - Arranging and installing a system of public rubbish bins, mobile toilets in small urban regions. Collection and treatment for industrial waste solids, etc.

3. Conclusion:

In summary, construction of resettlement regions for people under Upgrading Lao Cai Station Project significantly effects to environment, society and human living. Environmental effect is indirect and acceptably less negative.

Chapter VII

Total Investment Estimation

Budget usage solution:

The project objective is to complete the adjusted detailed plan, which was approved to provide a residential area in Pho Moi ward, enhancing socio-economic development.

1. Investment total:

a. Basics for calculation

Based on the Decree No: 16/2005/ND-CP dated 07/02/2005 by Government regarding to investment construction project management.

Based on construction work cost estimate norm promulgating following Decision No: 34/2005/QD-BXD dated 29/7/2005 by Minister of MOC.

Based on the Circular No. 04/2005/TT-BXD dated 01/4/2005 by Minister of MOC guiding to prepare and manage the investment construction work cost.

Decision No.10/2005/QD-BXD dated 15/4/2005 by Minister of MOC promulgating the investment construction project management fee norm.

Decision No.11/2005/QD-BXD dated 15/4/2005 by Minister of MOC promulgating the project preparation cost and work construction and design.

Based on the price quotation attached with the Decision No.369/QDUB dated 16/12/2005 by Lao Cai people committee.

Material price quotation Quarter I/2006 by Inter Financial – Construction Department.

b. Total investment indicative cost estimate:

Total investment: 9.005.786.963 (VND).

(In word: Nine billion, four hundred seven million, two hundred thousand, three hundred and seventy).

Cost estimate

No.	Content	Remark	Amount		Total
			Phase 1	PHASE 2	
A	Construction cost		3.430.961.569	1.199.222.584	4.630.184.153
1	Grading + transport road		1.767.032.963	194.705.525	1.961.738.488
2	Sidewalk + curb + tree hole			587.926.925	587.926.925
3	Drainage		981.636.823		981.636.823
4	Transformer		194.517.241		194.517.241
5	Domestic power supply		267.285.528		267.285.528
6	Road Lighting		0	416.590.134	416.590.134
7	Domestic water supply		220.489.014		220.489.014
B	COMPENSATION COST FOR LAND ACQUISITION	Provisional	3.000.000.000		3.000.000.000
C	PROJECT MANAGEMENT COST AND OTHER COST		435.629.462	121.265.442	556.894.904
D	CONTINGENCY	10%	686.659.103	132.048.803	818.707.906
E	TOTAL		7.553.250.134	1.452.536.826	9.005.786.963

II. Economic effect – Financial option.

After finishing the Work, land will be created to serve the resettlement household, for land acquisition stabilizing the life people contributing to socio-economic development in Lao Cai province.

2. Source: State budget

Phase 1 – Investment cost:

Construction total cost	3.430.961.569	VND
Project management cost and other costs	435.629.462	VND
Compensation cost for land acquisition (provisional)	3.000.000.000	VND
Total	6.866.591.031	VND

Therefore, we have average investment amount as follows

S investment = $6.866.591.031 / (110 \times 80 \text{sq.m} + 2.448 \text{sq.m}) = 610.472 \text{ VND/sq.m.}$

Averagely, 48.8 million VND/ 1 plot of land 80sq.m.

Total project investment:

Construction total cost	4.630.184.153	VND
Project management cost and other costs	556.894.904	VND
Compensation cost for land acquisition (provisional)	3.000.000.000	VND
Total	8.187.079.057	VND

Therefore, we have average cost as follows

S investment = $8.187.079.057 / (110 \times 80 \text{sq.m} + 2.448 \text{sq.m}) = 727.870 \text{ VND/sq.m.}$

Averagely, 58.229.600 million VND/ 1 plot of land 80sq.m.

In the contingency, the common land is not calculated in the investment amount

Chapter VII

Conclusion and Recommendation

1. Conclusion

It is very necessary to construct Pho Moi resettlement site in Lao Cai city, the completed technical infrastructure in Pho Moi will create a good-looking urban area, partly solve the urgent demand of people.

2. Recommendation

It is requested Lao Cai People committee to approve the above mentioned project to carry out the next step, ensuring the plan of Province.

**INVESTMENT PLAN OF LAO CAI CITY'S PEOPLE'S COMMITTEE FOR VAN HOA
RESETTLEMENT SITE (ENGLISH TRANSLATION)****LAO CAI PEOPLE'S COMMITTEE****SOCIALIST REPUBLIC OF VIETNAM****TRANSPORT CONSTRUCTION CONSULTANT**

Independence - Freedom - Happiness

JOINT-STOCK COMPANY

Lao Cai, 30th September 2005

STATEMENT FOR TOTAL INVESTMENT

WORK: M12 ROAD AND HONG SON-VAN HOA RESIDENTIAL AREA

BASIS FOR COST ESTIMATION:

Pursuant to Contract between Lao Cai Transport Construction Consultant Joint-stock Company and Lao Cai Project Management Unit.

Pursuant to Design Document for Basic Design stage issued by Lao Cai Transport Construction Consultant Joint-stock Company in September 2005.

Unit Price Norms:

- Material price as in price announcement " Quarter 3- 2005" of Lao Cai Finance - Price Department.
- Price of machine shift: Applying the MOC's machine shift price table No. 1260/1998/QD-BXD dated 28th November 1998.
- Norm of basic construction cost estimation issued in accordance with MOC's Decision No. 24/2005/BXD dated 29th July 2005.
- Pay sheets in A6 form, new salary regulation and subordinate expenses under the current regulations.

Present Decrees and Policies:

- Output Basic Construction VAT 10%.
- Expenses for project establishment and design in accordance with MOC's Decision No. 11/2005/QD-BXD dated 15th April 2005.
- MOC's Decision No. 10/2005/QD-BXD dated 15th April 2005 on promulgating norms for construction investment management expenses.
- MOC's Decree No. 04/2005/TT-BXD dated 1st April 2005 on guiding preparation and management of the expenses for construction under the projects.
- Construction machines and manpower adjustment coefficient in accordance with Decree No. 03/2005/TT-BXD dated 4th March 2005.
- Surveying and design expenses of design stage - feasible projects have specific details.
- Cost for Verification and payment approval in accordance with Decree No. 70/2000/TT-BTC dated 17th July 2000 by Ministry of Finance.
- Purchase of Construction insurance in accordance with Decision No. 663-TC/QD-TCNH.
- Area Allowance: 0.3 Lao Cai centers in accordance with Decree No. 15/LDTBXH-TT dated 2nd June 1993 and supplementation of 0.2 mobile allowance coefficient.

TOTAL INVESTMENT EXPENSES: 6.405.27.000D

(Six billion four hundred and five million two hundred and thirty seven thousand dong)

1) Construction cost:**4.642.171.000D**

- In which: + Spare cost: 4.220.155.388D
- + VAT included: 422.015.539D

2) Other Cost:**629.102.000D****3) Compensating Cost:****870.400.000D****4) Contingency:****263.564.000D**

Calculator**Examiner****Lao Cai Transport Construction
Consultant Joint-stock Company**
(Signed)

(Signed)

(Signed)

Do Trung Son

**PART V:
CONSTRUCTION EXPENSES****I-/ MAJOR CONSTRUCTION QUANTITY:**
(THERE IS ENCLOSED DETAIL TABLE OF TOTAL QUANTITY)**II-/ TOTAL INVESTMENT EXPENSES:**
(THERE IS THE ENCLOSED SUB-TABLE)**III-/ TIME OF PROJECT IMPLEMENTATION: 2005****IV-/ EMPLOYER: LAO CAI PROJECT MANAGEMENT UNIT****CONSULTANT****TRANSPORT****CONSTRUCTION****JOINT-STOCK COMPANY****WRITER**

Phan Thanh Duong

LAO CAI PEOPLE'S COMMITTEE
TRANSPORT ENGINEERING CONSULTING COMPANY
----- *** -----

EXPLANATION AND SUMMARY INDECATIVE COST BASIC DESIGN DOCUMENT

WORKS: ROAD M12 AND RESIDENT AREA
HONG SON – VAN HOA
VAN HOA COMMUNE – LAO CAI CITY

EXPLANATION FEASIBLE PROJECT DESIGN M12 ROAD AND LEVELLING ON RESIDENTAL AREA VAN HOA COMMUNE – LAO CAI CITY

SECTION I – GENERAL INTRODUCTION

1/ PRINCIPLES OF PROJECT PREPARATION

1.1 Base

- Based on plan layout of Dong Pho Moi Industrial zone prepared by Center of Study and Urban – Rural Plan under Rural – Urban Planning Institution – Ministry of Construction, approved by Lao Cai People's Committee on 10th April 2002.
- Based on notice and conclusion of Provincial People's Committee at the meeting on project approval on 4th August 2005
- Based on the contract between Project Management Unit of Lao Cai city and Lao Cai city Transport Engineering Consulting Company, Lao Cai city Transport Engineering Consulting Company carries out to prepare documents of M12 Road – Plan of Dong Pho Moi Industrial zone – Lao Cai city

1.2 Applied norms and standards:

- Documents of basic survey at site
- Drawings of detail plan and Decision on approval of Chairman's Lao Cai city People's Committee.
- Norm of bus road survey 22TCN-84, MOT
- Standard of pavement design 22TCN223 – 95 – MOT
- Standard of bus road design TCVN4054 – 98
- Location of reinforced concrete pipe culvert in the bus road 533-01-01; 533-01-02 and 78-02x

1.3 Necessity of investment and study scope:

Lao Cai city locates in the North of country bordering with Yunnan province – China at Lao Cai – Ha Khau international entry-exit gate. Lao Cai city is an economic – cultural – social center of Lao Cai province, will be a competitor of neighboring provinces on commerce, tourism and services, etc.

Investment on new construction of commercial and industrial zones is very necessary for attraction of foreign and domestic investment to enhance socio-economical development.

Under construction of Dong Pho Moi industrial zone, it must be site-cleared and made removes households within project scope to Hong Son resettlement zone. At present, due to socio-economical development and demand, railway and intermediate freight yard of Lao Cai station shall be extended and constructed. In order to carry out this project, 300 households nearby station shall be removed and resettled.

Thus, it is extremely necessary to construct road and residential land of M12. At the same time, it is a chance for planning of urban residential area in compliance with urban development.

Study scope:

- Road M12 locates within plan of Dong Pho Moi industrial zone.
- On the north: Going to Pho Moi street
- On the west: Border is Red river
- On the east: Border is Hanoi – Lao Cai city
- On the South: Giang Dong direction

Requirement of project

- Residential land, other infrastructure and roads in the area are planned to create favorable condition for arrangement and resettlement for households living in the area, and favorable traffic as strategy of urban development.
- Creating a detail general plan of Lao Cai up to 2020. Contributing in management of land use, issuing overall construction license as planned and step by step completing infrastructure ensuring stably urban development ; meet the demand for forecasted population up to 2010.

1.4 Process of study and implementation

- After Project Management Unit of Lao Cai city and Lao Cai Transport Engineering Consulting Company signed the contract on design survey for technical economic report, we carried out survey in the line and prepared design documents – Works estimation.

SECTION II

DESIGN**I/. TECHNICAL STANDARDS**

- Project covers two lines, including M12 road and supplementary one.
1. M12 road: length $L=673.11\text{m}$
 - Beginning at pile No.9 on the M10 road (now, Pho Moi street – Phong Hai) – Ending point links with Road 5 to go Giang Dong
 2. Supplementary road with length of $L = 190\text{m}$
 - The beginning point links with M11 road – The ending point links with Road 1, Road M12
 3. Design of embankment
 - Embankment, pavement of 02 roads designed as follows:
 $B_{\text{embankment}} = 3\text{m}+6\text{m}+3\text{m}=12\text{m}$
 $B_{\text{pavement}} = 6.0$ sidewalk at two sides $2*3\text{m}$
 4. Design of pavement
 Road pavement structure consists of 2 levels
 Level 1: Lower level is 20cm macadam
 Level 2: Upper level is cement concrete M250, 20cm thickness
 5. Design of drainage
 Along drainage is cement concrete box culvert $\text{KT}60*80$ with reinforced concrete cover M200 within residential land, outside bordering with river bank, not arranging with along drainage but catch-basin into triangle ditches and draining off through cement concrete D20 M200 pre-casted box culverts.
 6. Design of walk-side
 Designed sidewalk is paved by brick with concrete M200, 6cm thickness, brick plant holes $\text{KT } 1.2*1.2\text{m}$, and distance between holes is 5cm.
 7. Supply of electricity and water
 (Specified explanation and documents)
 8. Design of land space and resettlement
 - Filling soil is taken from mine (Bao Bi hill), transport distance is $L = 500\text{m}$
 - Stripping and filling soil of residential land is 30cm higher than elevation of sidewalk.
 Total land area: $S = 30483 \text{ sq.m}$
 In which: Public land $S = 4108.00 \text{ sq.m}$
 Park land $S = 1790.00 \text{ sq.m}$
 Road land $S = 11250.00 \text{ sq.m}$
 Resident area $S = 13335.00 \text{ sq.m}$
 - Construction of M12 road will create land space for resident area
 Planning 120 resident land block with 5m front area and 20m length
 - Compensation for resettlement and arrangement for 57 households living in this area, and the remaining is for households removed from Pho Moi ward and Van Hoa commune.

SECTION III

CONSTRUCTION

1. Solution for construction quality

In order to construct in compliance with processes, construction phases, acceptance for quality and quantities of materials using for construction as regulated, it is necessary to note some following items:

2. Construction of embankment

- Properly classification of levels is based on thickness of filling embankment as filling embankment by soil. Before filling, it is necessary to clean and to do organic excavation.

- If it rains during construction, embankment filling, especially soil filling must be not carried out.

3. Construction of culvert

- Progress acceptance for quality, quantities, materials using for construction and construction phase.

- Ensure maintaining of built blocks and in-place-casted concrete blocks, and enough time for maintaining and new loading test for traffic open.

- It must be constructed ditches outside of construction scope to replace culverts which is supplying water, in order that foundation of culvert is always dry.

TA No. 4050-VIE

**KUNMING – HAIPHONG TRANSPORT CORRIDOR PROJECT
UPGRADING HANOI – LAO CAI RAILWAY**

Feasibility Study and Preliminary Design

DRAFT FINAL REPORT

**Technical Appendix D.1
SOCIO-ECONOMIC SURVEY**

July 2006

CURRENCY EQUIVALENTS
(05 MAY 2006)

Currency Unit	–	Vietnamese Dong (VND)
VND 1.00	=	\$ 0.00006272
\$1.00	=	VND 15,950

ABBREVIATIONS

ADB	-	Asian Development Bank
AFD	-	Agence Française de Développement
AP	-	Affected People
BCR	-	Benefit cost ratio
CAD	-	Computed Aided Design
CARB	-	Compensation and Resettlement Board
CPC	-	Commune People's Committee
CPI	-	Consumer Price Index
DFR	-	Draft Final Report
DGTPE	-	Direction Générale du Trésor et de la Politique Economique
DMC	-	Developing Country Member (of ADB)
DPC	-	District People's Committee
EA	-	Executing Agency
EIRR	-	Economic internal rate of return
EMSA	-	Ethnic Minority Special Actions
EPMD	-	Environmental Protection and Management Division
GDP	-	Gross Domestic Product
GOV	-	Government of Vietnam
GSO	-	General Statistical Office
GTZ	-	Gesellschaft für Technische Zusammenarbeit
IBRD	-	International Bank for Reconstruction and Development (World Bank)
ICB	-	International competitive bidding
IEE	-	Initial Environmental Examination
IoL	-	Inventory of Loss
IP	-	Indigenous People
IPDP	-	Indigenous Peoples' Development Plan
IMO	-	Independent Monitoring Organization
IPSA	-	Initial Poverty and Social Analysis
IRR	-	Internal rate of return
ISA	-	Initial Social Assessment
LURC	-	Land Use Rights Certificate
MOF	-	Ministry of Finance
MONRE	-	Ministry of Natural Resources and Environment
MOT	-	Ministry of Transport
MPI	-	Ministry of Planning and Investment
NGO	-	Non Government Organization
NPV	-	Net present value
OCR	-	Ordinary Capital Resources (of ADB)
O-D	-	Origin Destination
ODA	-	Official Development Assistance
OSPF	-	Office of the Special Project Facilitator
PIB	-	Project Information Booklet
PPTA	-	Project Preparatory Technical Assistance
PRC	-	People's Republic of China
PSA	-	Participatory Social Appraisal

ABBREVIATIONS

RALC	-	(Department of) Resettlement and Land Clearance
RoW	-	Right of way
RP	-	Resettlement Plan
RPI	-	Retail Price Index
RPUC	-	Railway Public Utility Company
RPMU	-	Railway Projects Management Unit
RRP	-	Report and Recommendation of the President (to ADB Board of Directors)
RRP	-	Report and Recommendation of the President (to ADB Board of Directors)
SAP	-	Severely Affected People
SES	-	Socio-Economic Survey
SIEE	-	Summary Initial Environmental Examination
TA	-	Technical Assistance
VOC	-	Vehicle operating costs
vpd	-	Vehicles per day
VRA	-	Vietnam Roads Authority

WEIGHTS AND MEASURES

Metric system

NOTES

1. In this report, "\$" refers to US dollars.

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B	Environment
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E	Preliminary Project Design
E.1	Preliminary Design Drawings
E.2	ToR for Design & Supervision
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F	Economic and Financial Analysis
F.1	Economics
F.2	Financial

1 OVERVIEW

Viet Nam has a total area of 330,991.5 square kilometers (sq. km) which is politically subdivided into eight (8) regions with 61 provinces, 576 districts¹, 22 cities, 656 towns and 9000 communes. The country has three highly urbanized areas, which are magnets for urban migration, namely, Hanoi in the north, Da Nang at the central and Ho Chi Minh City in the south. The country's provinces occupy different areas of land with varied topographic characteristics that largely influence the population distribution and climate as well as natural resources that basically establish the type of industries and livelihood of the people.

As of July 2004, Viet Nam has a total population 80 million, 10% of which are indigenous peoples (IPs)². Based on the average size of 4.4 persons per family³, the households all over the country are calculated at 18.3 million. The current population also indicates the population density at 242 persons per sq. km, or 10.5% higher than the 219 persons per sq. km. in 1995. About 23.3 % is found in urban areas while 76.7% lives in the countryside. The population growth rate has fallen from 1.7% p.a in 1995 to 1.4% p.a in 2004.

Between 2000 and 2004, based on 1994 constant prices, the country's Gross Domestic Product (GDP) grew by 7.3%, which was largely pushed by agriculture, manufacturing and trade accounting for 21.8%, 20.4% and 16.3% respectively of GDP. The other industries, i.e. mining, electricity, gas and water, construction and transport and communications, have also exhibited sustainable growth. While the share of transportation and communications on GDP, at 3.9%, is among the lowest, this sector should be largely credited for its indirect role on the impressive economic growth of the country. It employs 1.2 million workers⁴, or 3% of the total persons employed in the country in 2004, that has been instrumental for the mobility of trade and for facilitating the services by industries, in which role of this sector is undisputable. Indirectly, the transportation and communication sector was also instrumental in poverty reduction through the creation of employment by industries it served. From 37.6 million workers in 2000, employment in the country rose to 41.6 million in 2004 at the yearly rate of 2.5%.

In less than a decade, the Government of Viet Nam (GOV) has greatly reduced the country's poverty incidence. From 58 percent of the population in 1993, the poverty level declined to 29 % in 2002⁵, an achievement considered as one of the great success stories in terms of economic development. A brief assessment of the reforms undertaken by the government during the last decade identifies the four key elements of this success, such as: (i) the decentralization of national government basic services like education, health, water and sanitation and agricultural extension that reached to the poor population; (ii) investment in strategic infrastructure like roads and irrigation projects that largely benefited the agricultural sector; (iii) economic reforms that promote growth and job creation; and (iv) the provision of safety nets, specifically the Hunger Eradication and Poverty Reduction Program. These reforms led to sustainable growth in the economy and poverty reduction in the country.

But, there are still areas in Viet Nam where gains from economic growth have yet to be distributed equitably. Among the country's eight regions, four have poverty incidence

¹ This total includes 42 urban districts and 534 rural districts.

² Vets With a Mission: Ethnic Minorities of Vietnam

³ General Statistical Office (GSO); Result of the Survey on Households Living Standards 2002; Statistical Publishing House, Hanoi, 2004.

⁴ The 3% share was adapted from the 2002 GSO social survey and the same rate was applied to 2004.

⁵ Joint Donor Report to the Vietnam Consultative Group Meeting; Vietnam Development Report 2004: Poverty; Hanoi, December 2-3, 2003 (p. ix)

that are still higher than the 29 % national poverty level, as follows: (a) Northeast Region (with 11 provinces), at 38.4 %; (b) North Central Coast (6 provinces), 43.9%; (c) Central Highlands (4 provinces), 51.8%; and (d) Northwest Region (3 provinces), 68.0%.

A brief assessment of the basic social indicators identifies three main constraints on poverty reduction in Viet Nam. First is the lagging quality of human resources, where only 8% of the population with ages of 15 years old and above has technical training and higher education, despite the country's literacy rate of 92.1%. Vietnam has a total of 214 colleges and universities as of 2003, of which 187 are public and 27 are private. The need for quality human resources is already manifested in the changing pattern of the national economy since the share of manufacturing sector to Gross Domestic Product (GDP) has already overtaken that of agriculture^{6,6}. Second, despite the considerable increase on incomes, 40% of the households are experiencing deficits owing to higher expenses on basic needs than what they earn from their livelihoods. And finally, larger family members are still noted among the poor households, including the ethnic minorities.

These constraints on poverty reduction are among the major challenges to the GOV. Given the different characteristics of the eight regions, poverty reduction should be addressed through a variety of means, one of which is the development of the transportation sector that will link the poor rural areas to the more prosperous urban centers. As a strategy, the GOV is targeting the Northeast Region where there is still high incidence of poverty. While the link with the Red River Delta Region already exists, the GOV is proposing the upgrading of the railway lines of VNR from Yen Vien to Lao Cai. The link is also envisioned to enhance international trade between Viet Nam and the Peoples' Republic of China (PRC).

⁶ At constant 1994 prices, the share of agriculture to GDP in 2000 was 23.3% while manufacturing was 18.8%, where the latter was gradually catching up year-by-year. In 2004, agriculture declined to 20.2% while manufacturing has increased to 21.7%.

2 THE RED RIVER DELTA AND NORTH EAST REGIONS

2.1 PHYSICAL CHARACTERISTICS

Five of the 22 provinces in the Red River Delta and North East Regions are traversed by the VNR railway lines between Yen Vien and Lao Cai, namely: Hanoi, Vinh Phuc, Phu Tho, Yen Bai and Lao Cai. Their physical conditions, i.e. size, land use and topography vary, as in the other provinces of the two regions and that of the country. These basic physical characteristics largely influence the people's social conditions since their socioeconomic activities such as, the establishment of human settlements, economic activities and mobility, depend on lands. Table 1 shows the respective sizes and land use in five provinces that have jurisdictions in the project areas.

Table 2. 1: Size and Land Use Distribution in the Five Provinces of North East and River Delta Regions

Provinces	In Thousand Hectares except the percent share				
	Total Area	Agricultural Land	Forest Land	Special Use	Home- stead Land
Hanoi	92.1*	42.5	6.6	21.7	11.8
Vinh Phuc	137.2*	66.5	30.3	19.0	5.2
Phu Tho	352.0*	97.2	144.3	21.7	7.7
Yen Bai	688.3*	69.3	282.2	29.2	3.8
Lao Cai	805.7*	92.0	288.7	13.5	3.3
Total	2,075.3	367.5	752.1	105.1	31.8
% to total of two regions	25.9	20.7	25.4	23.1	20.9
% to total of Viet Nam	6.3	4.0	6.2	6.5	7.0

Source: Statistical Year Book, 2002, published by General Statistical Office

The totals are what were actually reflected in the source document.

While the provinces of Hanoi and Vinh Phuc in the Red River Delta Region have smaller areas than the three provinces in the North East Region, they are all flat lands. Except for forest lands, the agricultural lands, lands for special use, and homestead lands have higher shares to their total land areas that can be converted into maximum and best use. These advantages are lacking in Phu Tho, Yen Bai and Lao Cai where flat lands for agriculture is very limited, as they are mountainous. Protected areas and forest lands, which account for 36% to 41% respectively, of their total areas, largely dominate their land use.

The five provinces have two (2) cities, nine (9) urban districts, 37 rural districts, 49 towns and 788 communes. Hanoi is the most urbanized among the five provinces.

2.2 POPULATION AND ETHNICITY

The five (5) provinces have a total population of 6.8 million, or 25.3% of the combined population of the two regions as of 2004. Hanoi and Vinh Phuc, with 4.2 million people account for 61% while the three (3) provinces in the North East Region at 2.6 million, share only 39% despite the larger size of land areas they occupy. Of these provinces, Lao Cai has the lowest population and followed by Yen Bai. Hanoi accounts for 45.0% of the total population.

Population density in the provinces also varies. Hanoi tops the list by having 33 persons per ha. and is distantly followed by Vinh Phuc with 8 persons per ha. Lao Cai, which borders with the PRC, is the most sparsely populated province. The population distribution and population density in the five provinces is shown in Table 2.2.

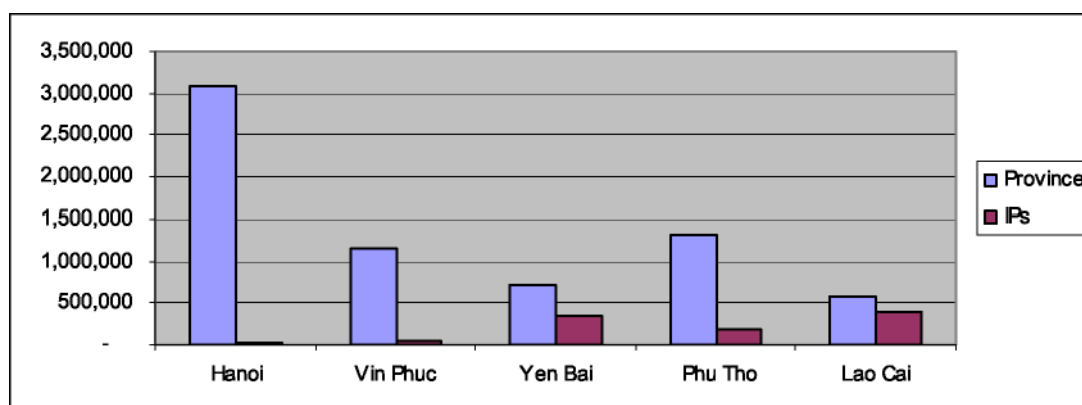
Table 2.2: Population and Population Density in the Five Provinces in 2004

Provinces in the Project Area	Population		Population Density per Ha.
	Number	% of Total	
Hanoi	3,082,810	45.0	33 persons
Vin Phuc	1,154,800	16.9	8 persons
Phu Tho	1,314,500	19.2	4 persons
Yen Bai	723,500	10.6	1 person
Lao Cai	565,600	8.3	1 person
Total	6,841,210	100.0	8 persons

Source: Information Services Center, 1080 Hanoi

* This is a rounded figure.

The five provinces are also home to IPs. In the last census (1999) of the General Statistics Office (GSO), the population of the IPs represents 14.3% of the combined population of the five provinces where the five largest groups are the Tay, H'mongs, Muongs, Daos and Thais. Knowing their preferences for upland areas, 94.5% of the IPs live in the North East Region; only 5.5% are found in the Red River Delta. About 40.7% live in Lao Cai, 35.0% in Yen Bai and 18.8% in Phu Tho. Figure 2.1 shows the distribution of the IPs in comparison with the population of the five provinces.

Figure 2.1: Population of the Provinces and the IPs

2.3 ECONOMY AND EMPLOYMENT

The local economy in the area is largely dominated by agriculture, except in Hanoi. This sector accounts for 75.2% of the total employed labor force in four (4) provinces; 70.7% in Vinh Phuc, 76.3% in Yen Bai, 79.6% in Phu Tho and 74.1% in Lao Cai. About 15.0% are employed in the service sector like hotels, restaurants, transportation and variety stores, among others. Only 9.8% is employed in the industry and construction sector. Hanoi Province has 50.6% of its employed labor force in the services sector and where the players are located in its nine (9) urban districts. About 29.3% works for industry and construction sector and 20.1% in agriculture. As a highly urbanized province, Hanoi is the center of business, education and gateway to tourists in northern Viet Nam. Hanoi City, the province's capital, is the seat of the national government of Viet Nam.

2.4 POVERTY ANALYSIS

2.4.1 Monthly Income and Expenses

According to the 2002 Survey of Living Standards (GSO), at current prices, Hanoi Province has a monthly per capita income of 620,980 VND per month, which is higher than the national average of 356,080 VND per month. This is followed by Vinh Phuc, but in much lower amount of 265,040 VND. Their averages are higher than that of Yen Bai,

Phu Tho and Lao Cai where monthly incomes are 252,770 VND, 256,200 VND and 205,940 VND, respectively. As to the factors why Hanoi Province's economy is superior compared with the four provinces, the following were observed: (i) 54.6% of the employed labor force are wage earners receiving regular incomes from state enterprises and private companies, of which 3.4% works for foreign companies; (ii) the non-wage earners, at 45.4%, sell products which have high value-added and have access to large markets; and (iii) it has 9,460 active enterprises that employ hundred thousands of workers. In the four provinces, 81.2% of the employed labor force is non-wage earners, 75.2% of which works in agriculture that has the lowest value-added among the industry sectors of the country's economy. Only 18.8% receives their regular wages.

An average of 85% of the monthly per capita income goes to the expenses of the people in five provinces. But the percentage of total expenditures varies from each location due to the different standards of living: (a) 83.4% in Hanoi; (b) 72.4% in Vinh Phuc; (c) 85.9% in Yen Bai; (d) 80.0% in Phu Tho; and, (e) 105.5% in Lao Cai. The people in four (4) provinces appear that they have savings from their monthly incomes. Lao Cai is lagging behind because 50.1% of its population is poor that included the IPs that represent 70.1% of its population.

2.4.2 Income Distribution

The GSO in Viet Nam has grouped the households according to their income quintile:

Quintile 1: Lowest income per capita (poorest)

Quintile 2: Near poorest

Quintile 3: Middle

Quintile 4: Near richest

Quintile 5: Highest income per capita group (richest)

Data is only available at province level. Table 3 below shows average per cap. income for each quintile.

Table 2.3: Average Income Per Head by Quintile (000 VND per month)

	Q1	Q2	Q3	Q4	Q5	Average
Ha Noi	204.6	368.4	499.8	672.8	1360.5	621.0
Vinh Phuc	106.4	162.6	220.0	293.1	543.2	265.0
Lao Cai	78.8	106.4	147.4	222.9	475.2	205.9
Yen Bai	100.8	142.6	195.2	292.6	532.7	252.8
Phu Tho	102.7	148.1	198.4	271.7	560.6	256.2
Viet Nam	107.7	178.3	251.0	370.5	872.9	356.1

Source: GSO: Household survey 2002

2.4.3 Household Size

The households in Hanoi and Phu Tho have an average size of 4.03 persons and 4.39 persons, respectively, which are lower than the national average of 4.44 persons per family. Compared with the national average, the size of the households in three provinces remains higher; Vinh Phuc has 4.69, Yen Bai at 4.58, and Lao Cai with 4.95. The table below shows clearly that average income is associated with smaller household size.

Table 2.4: Household size by Income Quintile 2002

	Q1	Q2	Q3	Q4	Q5	Average
Ha Noi	4.47	4.26	4.48	4.12	3.86	4.03
Vinh Phuc	5.06	4.93	4.68	4.49	3.85	4.69
Lao Cai	5.75	5.05	4.38	3.97	3.57	4.95
Yen Bai	5.43	4.87	4.43	3.97	3.54	4.58
Phu Tho	4.87	4.53	3.34	3.95	3.68	4.39
Viet Nam	4.92	4.69	4.46	4.25	3.98	4.44

Source: GSO Household survey 2002

Based on the above classifications, about 36.8% of the households in Hanoi and Vinh Phuc belong to Quintiles 1 and 2, while a larger 50.1% of the households in Yen Bai, Phu Tho and Lao Cai are also grouped in the these categories. These households suffer from income deficits as they have big number of persons in their families. The households grouped in Quintiles 3, 4 and 5 have small families.

Poverty is most severe for many families of the IPs in Lao Cai, particularly the H'mongs and Thais which account for 31.0% of the province's population. While they have very limited source of incomes, they have large number of persons in their families; seven (7) persons for the H'mongs and six (6) persons for the Thais.

2.4.4 Employment Opportunities

What also contributes to poverty in the four (4) provinces, in addition to lack of technical skills, low educational attainment and inadequate incomes, is the limited employment opportunities as enterprises are greatly concentrated in Hanoi. In comparing the numbers of active enterprises in the five provinces, Hanoi has the biggest. As of 2002, the province has 9,460 active enterprises, from small to large scale, while the four (4) provinces have a combined total of 1,555 employing a small number of workers, and they are spread in different districts. This suggests that there are great competitions for employment in the four provinces. Those who were not accommodated were absorbed in agriculture. Table 2.5 presents the distribution and size of active enterprises in the five provinces.

Table 2.5: Distribution of Active Enterprises (2002)

Sizes of Enterprises (Number of Persons)	Number of Enterprises				
	Hanoi	Vinh Phuc	Yen Bai	Phu Tho	Lao Cai
Less than 5 persons	1,362	39	16	76	19
5 – 9 persons	3,032	105	32	112	57
10 – 49 persons	3,495	156	80	236	236
50 – 199 persons	947	63	46	88	52
200 – 299 persons	187	10	8	13	9
300 – 499 persons	177	10	19	27	6
500 – 999 persons	158	7	4	11	3
1,000 – 4,999 persons	100	3	-	11	1
5,000 persons and over	2	-	-	-	-
Total	9,460	393	205	574	383

Source: Statistical Yearbook 2002

2.4.5 The Spatial Dimension of Poverty

Land is a precious commodity in Viet Nam, but more important is the flat topography. The flat lands are invaluable in Hanoi because of the great number of uses. Despite the very limited space, the people of the province have transformed their lands into maximum and best use as exemplified by the large number of active enterprises. Some of these features are seen in Vinh Phuc as some of its districts benefit from the economic spill over from Hanoi although its economy depends on agriculture.

However, the limited availability of flat lands in the North East Region toll to the livelihoods of the households. Based on the combined areas of agricultural and homestead lands, an average of only 0.48 ha. is cultivated by each household in the three provinces, in which yield is not enough for their family. The average area of agricultural lands cultivated by each family in the three provinces is as follows: (i) 0.35 ha. for Phu Tho with 299,430 households; (ii) 0.46 ha. in Yen Bai with 157,969 households; and (iii) 0.83 ha. in Lao Cai with 114,485 households. The limited supply of agricultural land is already affecting the environment in these areas as there are people clearing the forest for agricultural use.

3 THE PROJECT AREAS

3.1 PROJECT COVERAGE

The existing railway line from Yen Vien to Lao Cai has a total length of 285 km with 36 stations.⁷⁹ The railway traverses to 18 districts and cities. Of which stations, 15 are being proposed for tracks improvement and upgrading, two (2) are for expansion and one (1) is proposed for construction located between km 237 and km 247.

3.1.1 Physical and Geographic Characteristics

The 88 communes traversed by the railway have different topographic characteristics. From Station No. 1 at Yen Vien to Station No. 19 in Van Phu, topography is generally flat while the sections from Station No. 20 in Yen Bai to Station No. 35 in Lao Cai have hilly terrains, and where the railway line is curved out from the foot of the mountains and established parallel with the Red River. All the stations in flat areas are accessible to all land transportation systems while those in the highlands are limited to motorbikes. The train is the major means of transportation by people living in the highlands for long journeys.

3.1.2 Population

Summarized in Table 3.1 is the combined population of the 18 districts and cities which is estimated at 2.435 million as of 2004. The total represents 9.0% of the combined population of Red River Delta and North East Regions and 3.0% of the country's population.

Table 3.1: Population of Districts Traversed by Railway Line

Region	Province and Districts	Population	% of Province's Population	% of Region's Population
Red River	Hanoi Province			
	Gia Lam	278,900	9.0	1.6
	Dong Anh	280,100	7.8	1.6
	Vinh Phuc Province			
	Me Linh	262,255	22.7	1.5
	Vinh Xuyen	116,981	10.1	0.6
	Vinh Yen	71,944	6.2	0.4
	Tam Duong	127,802	11.1	0.7
	Vinh Tuong	191,812	16.6	1.0
North East	Phu Tho Province			
	Viet Tri	138,360	10.5	1.5
	Lam Thao	115,549	8.8	1.2
	Phu Tho	61,983	4.7	0.7
	Thanh Ba	116,020	8.8	1.2
	Ha Hoa	110,918	8.4	1.2
	Yen Bai Province			
	Tran Yen	96,897	13.4	1.0
	Yen Bai	78,041	10.8	0.8
	Van Yen	112,204	15.5	1.2
	Lao Cai Province			
	Bao Yen	73,820	13.0	0.8
	Bao Tang	101,122	17.8	1.0
	Lao Cai	100,225	17.7	1.0
Total Population of 18 Districts		2,434,933		

Source: Population projections from the General Statistics Office

⁷ Including Cau Nho station, which is currently under construction

3.1.3 Number of Households

The total households of 18 districts are estimated at 549,162 as of 2004, with an average size of 4.43 persons per family.

The size of the households differs according to their income groups. The groups with large number of family members are in lowest income groups (Quintiles 1 and 2), at 5.03 and 4.68 per family respectively, while the lowest family size is observed in Quintile 3, at 3.78 persons per family. The three districts in Lao Cai are consistent for having bigger sizes of the households in Quintiles 1 and 2, at 5.76 and 5.06 persons per family respectively, since majority of the IPs belongs to these groups.

3.2 SOCIOECONOMIC CHARACTERISTICS

3.2.1 The Inhabitants

Two groups of people, the Kinhs and the Tays live within the influence areas of 18 stations being proposed for upgrading. The Kinhs who belong to the largest group of Vietnamese people are seen throughout the vicinity of the railway lines, while the Tays who are identified with the IPs are seen in Lao Cai. There are also IPs from the group of H'mongs but which stations are not included in the upgrading. They live in the village of Bao Ha.

3.2.2 Housing and Settlement Patterns

Owing to the urban characteristics of villages, the houses from Station 1 at Yen Vien to Station No. 19 in Van Phu, that included those proposed for upgrading, are built side-by-side with each other and are established parallel to the railway lines. They occupy government lands nearest the rights-of-way (ROW), in which clusters of settlements have evolved into ribbon type of development over time. The houses are made of bricks and concrete materials with narrow frontages, at 4 m to 5 m, facing the railways. Their floor areas vary in sizes which range from 30 sq. m to 40 sq. m. Such types of houses and settlement patterns are also observed at the last station in Lao Cai.

In approaching the highlands through Station No. 20 in Yen Bai, the distances between houses have become wider and they are established lower than the ROW of railway lines. The yards have vegetable gardens and the households are engaged in backyard raising of chicken, ducks, swine and goats. Some households have spaces for water buffalos that are use for tilling the paddy lands. While ribbon type of development is also observed in some settlement clusters, there are still forested areas nearest their backyards. However, there is a long stretch of the railway where human settlements do not exist. This is located between Station No. 25 in Trai Hut to Station No. 27 in Lang Khay, as this area has steep slopes and where soils are unstable.

Along the project influence areas, one basic distinguishing factor for knowing the ethnicity of the people is through their dwellings. The Kinhs have small rectangular houses with slightly elevated floors from the grounds and have sizes that range from 30 sq. m to 40 sq. m, their rooftops are made of bricks. The H'mongs have also rectangular houses with sizes of 40 sq. m to 50 sq. m, much bigger than the Kinhs, made of use temporary materials, and their roofs are covered with palm leaves or sturdy wild grasses. Those of the Tays have also bigger areas with sizes of 45 sq. m to 60 sq. m, and made also of temporary materials, but with many wooden poles in which floorings are elevated by 2.5 m from the ground and the roofs are covered with palm leaves. The Kinhs and Tays live in lower areas but the H'mongs are nestled on high grounds, particularly in the protection areas. They live in separate settlement clusters.

3.2.3 Livelihoods and Occupations

The people in the influence areas of 18 stations are engaged in various livelihoods and some have dual occupations, as revealed by the respondents during focused group discussions. In the urban villages, the Kinhs are engaged in various micro enterprises, like selling noodles in the sidewalks, tending of small variety stores, motorbike services for short distance travels, vegetable gardening and peddling of vegetables and/or food stuffs. Young adult members of the families work in small restaurants and/or business shops in their districts or in Hanoi.

Practically all the people who are near the railway lines in the uplands are engaged in agriculture. They plant vegetables, rice, corn and teas which is a major industry. They also raise livestock and fowls in their backyards. People living within the distance of the Red River largely benefit from this common resource as it provide them fish while some portions of the river banks are cultivated to vegetables. Men and women alike are hired for occasional construction works.

3.2.4 Income and Expenses

Incomes of the families vary due to the different nature of their occupations as there are retirees, barbers, food shop owners, nurse, salesmen and government employees. Of the persons interviewed 31.2% are wage earners while 68.8% are self-employed. The average monthly income is 871,000 VND where the highest is 1,900,000 VND while the lowest is 200,000 VND. Their incomes are spent on food, electricity, cooking gas, education-related expenses, clothes, payment of debts, transportation and water bills, and medicines. About 28.1% has no sufficient incomes. Occasionally, they have to borrow from relatives or neighbors as some are receiving financial assistance from children working in urban center of their province or in Hanoi.

It can be assumed that the living conditions of the IPs are more difficult given their location, and poverty is manifested in their settlements. They live under a subsistence economy, cultivate a very limited space of agricultural land, and have big families. However, they have assets that can be turned into cash when they need for money like the vegetables grown in the gardens, the fish caught in the river, and the ducks and chicken raised in their backyards.

3.2.5 The Role of Women

The women play a vital role in their family. As validated during the focused group discussions, the mothers are responsible for taking care of young children, cook food for the family, while the daughters help in household chores. About 21.9% of the respondents confirmed that there are women working in restaurants, 62.5% for the sales ladies, and 25.0% for working in the offices. Women are also engaged in selling agricultural products like fruits and vegetables, and they assist in cultivating and weeding the grasses in paddy lands. While some occupations were not covered in the discussions, there are women seen in the project influence areas who work in the construction.

About 84.4% of the respondents also informed that there are women from their commune who work in another places to help their families. They either work in the capital town of their province or in Hanoi, some were recruited by certain persons or relatives as others applied for by themselves. They are also active in community organizations. Neither a case of abuse nor trafficking women was revealed during the discussions.

3.2.6 Access to Social Services

Six social services were identified with the people and confirmed the physical availability in their area. About 81.3% confirmed that five of these social services are within their vicinity like hospital or clinic, primary school, secondary school, public market and government office, while 62.5% informed that a college institution is also found in their areas.

As to the most import social services, the primary school ranks first (84.4%), secondary school (65.6%) is the second, and the hospital (46.9%) is third. On the most second important, the government office is first (53.1%) while the public market as second (46.9%). The college institution is the least important and agreed by 56.3% of the respondents, which validated the finding that the quality of human capital in Viet Nam is lagging (para. 5). While social services are important, 15.6% of the respondents expressed that they cannot access to hospital due to poor roads. As to the constraints for the access of children to college education, the reasons given are due to high cost of transportation fare and the inadequacy of family incomes.

3.2.7 Health

Information on health situation were obtain from railway station managers as the respondents have no idea on what diseases affect the people in the villages. Despite the very limited information, it was informed that there are women who have goiters due to lack of iodine as men have kidney problems. There are also cases of pulmonary diseases, but the estimated numbers are unknown.

3.3 TRANSPORTATION AND MOBILITY

3.3.1 The Hierarchy of Local Transportation

As in other parts of the country, the people in 18 districts served by VNR are highly mobile and transportation is very essential for them. Within the project influence areas, the mode of land transportation can be classified according to the hierarchy of their use depending on the location and topography of the place. Given the distance between Hanoi and Lao Cai, the train dominates the services for long travel and has the shortest distance compared with mini buses that pass the winding routes. While the cars and private vehicles are also used, it only caters to small segment of users. Between districts and capital towns, travel is served mainly by buses and their mini bus counterparts. The motorbikes are used for short distances between neighboring districts and communes or villages. The bicycles are mainly used by school children.

While the same modes of transportation are seen in the flat lands and urban areas, there are other means that are more convenient for use of the people in the highlands. The farmers and the ethnic minorities are using horses and water buffalos from their houses to farms. In the villages or districts separated by the Red River, travel and trade is facilitated by boats.

3.3.2 Demand for Transportation

The significance of the railway lines for transportation and trade between Yen Vien and Lao Cai is undisputable. In every station, the trains have important functions that buses cannot perform: (i) from Lao Cai, they carry the great numbers of imported machineries and manufactured items from China to Viet Nam; (ii) from Yen Vien, it carries the goods from Ho Chi Minh City to Lao Cai for exports to China; and (iii) in between stations, it carries iron ores, coal, grind stones and petroleum products and agricultural products for

distribution to companies served by train stations. The trains also serve the industrial zones, as exemplified in Phuc Yen Station.

Some stations have directly helped the economy of certain districts. The trains bring 600 foreign and local tourists every day to Tien Kien which is known for its historical tourism, and in the highland areas of Bao Ha which is host to two known temples; one is for prosperity, the other for fertility. The area is also known for its tea industry.

The respondents were also asked to validate the demand for transportation in their communes, in which four modes of transportation utilities were given to choose from.

About 93.8% use the motorbike, 59.4% for the bicycles, 87.5% ride on the train, and none for other means. Except for the train, however, all transportations are used only for short distances. As to convenience for long travel, 56.3% prefers for the train, 21.9% for the bus and 3.1% for motorbikes. About 68.8% confirmed that the train facilities need improvement, and the same respondents agreed that traveling in a train save more time on long travel. Some 56.3% affirmed that they are willing to pay for a new fare on the train if the services are improved.

3.4 THE SOCIOECONOMIC ROLE OF THE RAILWAY

3.4.1 Facility for Trade

The railway sections being supervised by 35 stations have significant contributions on trade in Viet Nam. Although the total value of trade in the area was not available during the conduct of this study, the 2.2 million tons of freight and 3.0 million passengers carried annually on these sections represent 13.7% and 27.0% respectively, of the overall VNR operations from 2000 to 2004. During the last five years, the average yearly increase on the overall tonnage loaded was calculated at 9.5% while the growth in passengers was registered at 7.3%. At 1994 current market prices, the value of yearly revenues and receipts of VNR share 6.8% of the total transport and communications sector and 0.3% of the GDP.

3.4.2 Direct Role in Job Creation

The 35 stations have also become instrumental for the creation of livelihood and self-employment in their host communes. The socioeconomic impacts, aside from the government revenues on trade and fare of passengers, are seen on types of livelihood created within their vicinities and immediate peripheries, such as, (a) small variety stores, (b) small noodles shops, (c) refreshment parlors, (d) service motorbikes, and (e) ambulant vendors as well as other types of services. The Yen Vien – Lao Cai railway route has four major stations, i.e. Yen Vien, Viet Tri, Yen Bai and Lao Cai, where hundreds of these services cater to passengers. The mid-size stations have 20 – 30 micro enterprises while the cargo servicing stations have 5 – 10 small stores. Their daily operating capital varies with income range of VND 10,000 – VND 18,000 at the end of the day. From these micro enterprises, a passenger buys to at least two vendors, thus it is safe to assume a livelihood ratio of 1 : 2 in every station. The ratio means that for every passenger waiting for or coming out from the train, two vendors or small business shops are assisted in their livelihoods.

3.4.3 Interaction with Other Modes of Transport

There are different modes of public transportations in the areas traversed by Yen Vien - Lao Cai railway section, and their operations were observed to have horizontal and vertical relationships with that of the train. Horizontal relationship exists if the train and buses are competing for passengers to reach their destinations, while vertical relationship appears if the two transportation systems complement in serving the riding

public. From Yen Vien to Viet Tri (with distance of 62 Km) and from Co Phuc to Bao Ha (71.89 Km), the trains may be theoretically competing against big and small buses on long travel since the railway and the national road are established in parallel locations. It may affect the receipts of buses along these sections at the time when the train passes since the passengers with heavy luggage would prefer the latter for convenience. However, the passenger trains have their own schedules, which do not affect the operations of other passenger buses.

From Viet Tri to Yen Bai (82.84 Km) and from Bao Ha to Lao Cai (56.55 Km), the buses and the trains are complementing each other as the national road has been deviated distantly from the railway stations but numerous provincial or district roads cross the railway lines. The orientations of the roads under these sections have favorable impacts to other public transportation since they are not competing against the trains for passengers. It was noted, however, that some stations were inappropriately established as they are either distantly located from the main road or served by a distressed narrow roads passing the built-up areas.

3.5 DISTRIBUTION ANALYSIS

The distribution analysis is based on the population data described in Table 3.1. The approach used for grouping the population in 18 districts was adapted from the percentage distribution applied by GSO in their 2002 household survey on living standards in Viet Nam (see Table 2.3 in section 2.4 above). Relevant statistical data⁸ from that survey were used for classifying the socioeconomic group of persons in this study, such as the following:

1. *Quintile 1:* They are persons belonging to the poorest, having the lowest income and suffering from deficits, who have very limited access to government social services. They belong to families with memberships of five (5) persons or more. About 52.4% derive their incomes from agriculture, 19.2% from wages or salaries, 6.5% from forestry products, 3.8% in trade, 3.7% in fishery and 10.0% from other sources.
2. *Quintile 2:* This group of persons is near the poorest category. They also belong to families with big memberships of five (5) persons. About 43.5% are engaged in agriculture, 25.0% are salaried workers or wage earners, 6.2% from trade, 3.2% from forest products and 10.9% from other sources.
3. *Quintile 3:* This group of persons is considered the middle-income group with average membership of four (4) persons in their family. The people derived their incomes from the following: (a) 35.9% in agriculture; (b) 29.3% from salaries and wages; (c) 8.4% in trade; (d) 4.5% in service; and (e) 11.9% from other sources.
4. *Quintile 4:* The persons in this category are already considered near to the richest group. About 33.3% derived their incomes from salaries and wages, 25.0% from agriculture, 10.7% from trade, 6.5% in service, 5.3% from industry. About 14.0% has income from other sources.
5. *Quintile 5:* This category is applied to the richest group of persons. Of which persons, 36.6% are salary earners, 11.0% are engaged in trade, 10.9% from agriculture, 9.3% in providing services and 6.8% from industry. About 20.1% derived their incomes from other sources.

⁸ The educational attainment of the persons was not included as a variable since there are also professionals and those with postgraduate education who belong to Quintiles 1 and 2.

Estimates of the numbers of people in each national income quintile⁹ have been prepared, using regional data, see Table 3.2 and Table 3.3 below.

Table 3.2: Percentage of Regional Population by National Income Quintile

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Red River Delta	16.1	20.6	22.5	21.7	19.0
North East	27.9	22.3	20.7	17.5	11.7
Viet Nam	20.0	20.0	20.0	20.0	20.0

Table 3.3: Population Distribution in 18 Districts Traversed by the Railway Line

Districts	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	Total
<i>Hanoi:</i>	<i>90,111</i>	<i>115,378</i>	<i>125,999</i>	<i>121,471</i>	<i>106,042</i>	<i>559,001</i>
Gui Lam	44,959	57,565	62,864	60,605	52,907	278,900
Dong Anh	45,152	57,813	63,135	60,866	53,135	280,100
<i>Vinh Phuc</i>	<i>124,252</i>	<i>159,091</i>	<i>173,737</i>	<i>167,493</i>	<i>146,221</i>	<i>770,794</i>
Me Linh	42,276	54,129	59,112	56,988	49,750	262,255
Vinh Xuyen	18,857	24,145	26,368	25,420	22,191	116,981
Vinh Yen	11,597	14,849	16,216	15,633	13,649	71,944
Tam Duong	20,602	26,378	28,807	27,771	24,244	127,802
Vinh Tuong	30,920	39,590	43,234	41,681	36,387	191,812
<i>Phu Tho</i>	<i>151,232</i>	<i>120,943</i>	<i>112,312</i>	<i>94,833</i>	<i>63,510</i>	<i>542,830</i>
Viet Tri	38,547	30,827	28,627	24,171	16,188	138,360
Lam Thao	32,192	25,744	23,907	20,187	13,519	115,549
Phu Tho	17,268	13,810	12,824	10,829	7,252	61,983
Thanh Ba	32,323	25,849	24,005	20,269	13,574	116,020
Ha Hoa	30,902	24,713	22,949	19,377	12,977	110,918
<i>Yen Bai</i>	<i>79,997</i>	<i>63,976</i>	<i>59,410</i>	<i>50,164</i>	<i>33,595</i>	<i>287,142</i>
Tran Yen	26,995	21,589	20,048	16,928	11,337	96,897
Yen Bai	21,742	17,388	16,147	13,634	9,130	78,041
Van Yen	31,260	24,999	23,215	19,602	13,128	112,204
<i>Lao Cai</i>	<i>76,662</i>	<i>61,307</i>	<i>56,932</i>	<i>48,072</i>	<i>32,194</i>	<i>275,167</i>
Bao Yen	20,566	16,447	15,273	12,897	8,637	73,820
Bao Tang	28,173	22,530	20,922	17,666	11,831	101,122
Lao Cai	27,923	22,330	20,737	17,509	11,726	100,225
Total of 18 Districts	522,254	520,695	528,390	482,033	381,562	2,434,934
Percent of Total	21.4	21.4	21.7	19.8	15.7	100.0

By assessing the preceding table on which population groups would use the train, it can be safely assumed that they may come from Quintiles 2, 3 and 4. The exclusion of Quintile 1 is already obvious since the peoples from this group are constrained by income deficits while that from Quintile 5 are assumed to have their own vehicles. It can be stated also that the people in all income groups from the two districts of Hanoi would not use the train since they are already nearest to the urban centers, unless they have some business to the north. Some sections of the railway are also competing with public transportations for long travel, as observed from Yen Vien to Viet Tri and from Cho Puc to Bao Ha. But given the distance and the monthly incomes of the majority of the people in Quintile 5, it is assumed that they would also use the train, particularly those from the provinces of Phu Tho, Yen Bai and Lao Cai. Their combined totals represent 5.3% of the total population of the 18 districts.

⁹ The national income quintiles are the levels of income which divide the whole population into 5 equally size groups. Income is unevenly distributed between regions and in rich regions, there will be less than one fifth of the population falling into quintile 1, and more than one fifth falling in to the higher quintiles.

3.6 POTENTIAL SOCIAL IMPACTS

3.6.1 Risks of Spreading the HIV/AIDS Virus

Situationer

As of 2005, the Ministry of Health (MoH) has recorded a total of 197,500 persons found positive with HIV/AIDS virus. About 48,864 persons were confirmed to have full blown cases of AIDS, and 44,102 persons have already died. The figure on persons positive with HIV/AIDS virus still represents a very small percentage of 0.24% of the country's population but according to MoH the number is growing. Based on its records on people affected with HIV/ADS in Viet Nam, the five provinces traversed by Yen Vien – Lao Cai section of the railway are among the areas where some people are afflicted with the virus, yet very small. Of the cases accumulated for the five provinces, the number of people found positive with HIV/AIDS virus represents 0.14% of the population in Hanoi, 0.03% in Yen Bai, 0.01% in Phu Tho and 0.02% in Lao Cai. The percentage of people with HIV/AIDS is still negligible in Vinh Phuc, despite its proximity to Hanoi. Also from that record, 203 persons from the five provinces have already died; 175 in Hanoi, 1 in Vinh Phuc, 12 in Yen Bai, 11 in Phu Tho and 4 in Lao Cai.

The risk of transmission is found among injecting drug users and commercial sex workers. And among the likely carriers of the virus are the mobile groups like truck drivers, bus drivers, dock workers and boat crews who spend their working life on the highways or at sea. They use the sex industry to fulfill their desires when separated from their families. Women are also likely carriers of the HIV/AIDS virus, particularly those in the commercial sex industry, but most often they are victims.

Government Programs

The GOV has been implementing numerous programs for the prevention of HIV/AIDS virus in the country. The AIDS Division of the MoH is responsible for the implementation of HIV/AIDS prevention throughout the country. Related to this program, the GOV has issued a policy for implementation; Decision 190/2001/ QD-TTg which approves the National Target Programs to prevent and curing diseases, dangerous epidemics and HIV/AIDS covering the period from 2001 to 2010. In response to this policy, the AIDS Division has: (i) held consultation meeting to review the national operation plan on HIV/AIDS care and support for the period 2001-2005; (ii) completed the HIV sentinel surveillance in 30 provinces; (iii) disseminated results of the baseline survey in five (5) project provinces for the project Community Action for Preventing HIV/AIDS" supported by Japan Fund for Poverty Reduction through ADB; (iv) implemented voluntary donation movement in 46 provinces to ensure blood transfusion safety; (v) improvement of the HIV/AIDS treatment system; and (vi) implementing some projects supported by WAF, ADB and the World Bank.

The AIDS Division has also formed partnerships with different government agencies, national research institutes, international foundations, multilateral/bilateral donors and international and local non-government organizations (NGOs) to (a) provide concrete technical inputs for further improvement of the policy framework for a stronger multi-sectoral response against the spread of HIV/AIDS virus, and (ii) enable more effective coordination of efforts on HIV/AIDS prevention in Viet Nam.

In June 2005, the GOV has implemented a five-year program, through the General Department of Preventive Medicine and HIV/AIDS Control of the MoH, which is aimed at keeping HIV/AIDS prevalence in the country low. The program is being assisted through the \$35.0 million grant from the World Bank that will support specific action plans for the

country's national AIDS strategy to: (a) reduce HIV incidence; (b) increase awareness about the disease; and (c) change the attitudes and behaviors toward the epidemic among the general population and policy makers. The government's program also attempts to improve the management and treatment of sexually transmitted disease as well as increase the number of health care workers in the country.

Given the programs, it can be said that the GOV efforts are already sufficient for the control of HIV/AIDS in the country.

Risk Assessment in Project Areas During Construction

The risk of acquiring the HIV/AIDS virus depends on the decision of individual person. Given the factors on the spread of HIV/AIDS virus in Viet Nam, the agents are usually the highly mobile persons. The workers who will be recruited to work in 18 sub-projects may be also suspect for the spread of the virus for they will have the money that would give them the capacity to satisfy their biological needs. After the assessment of sub-project locations, the possibility in spreading the virus is low, as articulated in the following observations:

1. the study in Viet Nam revealed that the accumulated cases of HIV/AIDS virus in the five provinces represent small percentages of their provincial population
2. the construction workers belong to the poorest population who suffer from income deficits;
3. the workers who will be hired are mostly residents of the communes hosting the railway stations, which is the common practice of VNR station management in hiring the utility workers;
4. being residents of the commune, the workers are guarded by their families;
5. all stations of the VNR are secluded and guarded at night and none of the workers, will be allowed to stay in temporary shelters;
6. the stations are kilometers apart which could dampen the interest of commercial sex workers to visit the work areas at night especially in the upland areas;
7. except in Hanoi and Vinh Phuc, majority of the stations are distantly located from the bars and massage parlors, which are known sanctuaries of commercial sex workers;
8. VNR is among the government agencies which cooperate with MoH on information dissemination of its various health programs including the campaign against the spread of HIV/AIDS virus. Posters are seen in the train stations.

3.6.2 Human Trafficking

Viet Nam is among the countries identified by the U.S. Department where human trafficking is a serious problem. The country is placed under a special watch list because it does not comply with the minimum standards for eliminating trafficking, but the government is making significant efforts to do so. Poverty is the main issue on human trafficking. Although 92% of the country's population is literate and school attendance rates are relatively high, many people living in remote and mountainous areas are unable to read or write. The illiteracy rate is particularly high in IP communities, and women are twice as likely to be illiterate in these areas.

Trafficking of women is undertaken in various forms. But the most common practice is that they are recruited from rural areas with the promise of lucrative job in urban centers, only to be deceived and sold for forced marriages in China and Taiwan, and/or prostitution in urban centers in Viet Nam and its neighbors. There are no statistics on women and children trafficked from Viet Nam, since they may come practically from all the provinces and in highly urbanized areas where there are great supplies of women.

The 1997 study by the Institute of Human Geography in Hanoi identified the routes being used for human trafficking, including the five provinces traversed by the VNR railway between Yen Vien and Lao Cai. Accordingly, the women from Hanoi are brought in Laos and in Taiwan through the narrow roads in inland provinces. Those from the provinces of Vinh Phuc, Phu Tho and Yen Bai are brought to China via Lao Cai. As it borders with China, the residents of Lao Cai can cross the border anytime, including the trafficked women. It can be suggested that given the long route, women trafficked from the three provinces have used the railway.

The GOV has formulated an action plan that committed itself to fight human trafficking. It has established a Central Anti-Human Trafficking Committee for curbing human trafficking by 50 percent by 2010. Implemented in early 2005, the Committee focuses on prevention, protection of victims and prosecution of traffickers. The government agencies are involved in public awareness campaigns, waging of large-scale prevention, offer assistance to repatriated victims and formulation of stringent anti-trafficking legislation. Since human trafficking is a transnational issue, the GOV has established partnership with its neighboring countries to fight against this crime.

On these efforts of the GOV, it can be assessed that its programs against human trafficking is satisfactory.

3.6.3 Potential Impacts and Displacements

Land acquisitions from 14 of 18 railway stations shall affect the people living within their immediate vicinities. The adverse impacts are seen on lands being used for agriculture and residential, houses and structures, business shops, crops and trees, and common property resources. Based on the rapid assessments following an inquiry on the types of rehabilitation proposed by the technical engineering group of the TA consultants, the potential social impacts and displacements are as follows:

Lands – land acquisitions shall be permanent and temporary. It shall affect the government lands being used as residential and agricultural by private persons. However, further verification is required on land ownership being used for residential in Station No. 35 in Lao Cai.

Houses and structures – more or less than 450 houses shall be resettled, where 400 houses are seen at Station 35 in Lao Cai. Land acquisition shall also affect concrete fences, small business shops and electric poles.

Crops and Trees – reduced production of rice is expected from permanent acquisition of agricultural lands. The permanent land acquisition shall also affect sugar cane, bananas and cassava. More than 100 trees of various species shall be cleared during the construction in 14 stations.

Common Property Resources – these are composed of irrigation canals, creek, pond and access roads which shall be temporarily affected during construction. However, there are illegal crossings that will be permanently closed.

Affected Persons – they are composed of farmers, small business shop owners, government workers and retirees. The IPs that shall be affected by permanent acquisition of land being used as residential are found in the proposed expansion area at Station No. 35 in Lao Cai. However, no IPs shall be affected in other stations as their settlements are distantly located from the railway ROWs.

However, all the above impacts are subject for validation during the joint census and detailed measurement survey (DMS) of project affected persons (APs).

3.7 RECOMMENDED SOCIAL ACTION PLANS

3.7.1 Prevention of HIV/AIDS Virus during Construction

The on-going efforts of the GOV in fighting against the spread of HIV/AIDS virus are already sufficient as it provides all the logistical supports and close coordination with government agencies, including the VNR. The MoH disseminates information materials to generate public awareness. Specific to the Project, the following supplementary measures are recommended for fighting against the spread of HIV/AIDS virus during the construction:

1. The VNR management should write a policy memorandum to all railway station managers that the contractor(s) and construction workers should attend a brief orientation on the prevention of HIV/AIDS virus during their mobilization;
2. The VNR management should request the relevant MoH office for the resource person(s) who will conduct orientation to contractor(s) and workers on the risks of acquiring HIV/AIDS virus, and secure posters from the MoH to be displayed in each stations from Yen Vien to Lao Cai;
3. With assistance from the MoH, the VNR should commission the recording of information campaign that should be played in train stations at least three (3) times a day when there are many waiting passengers so that it will be heard by the public and the construction workers;

3.7.2 Campaign Against Human Trafficking During Construction

The following social action plans are recommended as supplementary measures to the on-going government programs against human trafficking:

1. The VNR management should write a policy memorandum to all railway station managers advising them to display posters that will make the people aware about human trafficking;
2. The VNR management should request the Central Anti-Human Trafficking Committee for posters that will be displayed in all stations as a means to discourage human trafficking and for commissioning the recording of anti-human trafficking campaign that will be played in stations at least three (3) times a day when there are many waiting passengers for their awareness.

3.7.3 Social Safeguards on Impacts of Land Acquisition

More than 400 households shall be physically displaced from their present locations due to the relocation of their houses, and possibly losing 10% or more of their productive assets. Majority of the affected persons (APs), including the IPs, have no title to the lands they occupy, but this condition does not exclude them from receiving

compensations. Rather, they should be compensated for their lost assets and extended assistance for them to rehabilitate themselves, equal or better than their pre-project conditions.

They should be compensated for their lost assets based on current market replacement rates. To determine the appropriate amount for compensation of each individual APs, they should be classified according to their social categories to assess the level of their vulnerability. Additional assistance should be given to vulnerable groups, i.e. women-headed households, households headed by the elderly, the disabled, the poorest, and the IPs, among others. The DMS questionnaire to be used in the survey of 100 percent APs should be tailored to this requirement.

The resettlement of APs should be treated as a development project and component of the main Project. As such the resettlement plan (RP) should provide information on the following aspects: (a) scope of land acquisition and resettlement; (b) socioeconomic information about the APs; (c) objectives, legal and policy framework, and entitlements, including entitlement matrix; (d) gender impact and mitigating measures; (e) information dissemination, consultation, participatory approaches and disclosure requirements; (f) grievance redress mechanisms; (g) relocation of housing and settlements; (h) income restoration strategy; (i) institutional framework; (j) resettlement budget and financing; (k) implementation schedule; and (l) monitoring and evaluation.

3.8 Budgets for the Social Action Plans

A total budget of 6,864,000 VND was estimated for the implementation of social action plans for the campaign for prevention of HIV/AIDS virus and the campaign against human trafficking during construction (Table 3.3). The budget is based on the activities described above. The budget for land acquisition and resettlement will be presented in the RP.

Table 3.3: Budget for Social Action Plan Implementation

Cost Items	Quantity and Unit	Unit Cost (in VND)	Total Amount (in VND)
I. Campaign for HIV/AIDS Prevention			
A. MoH Resource Person:			
Per diem for one person	9 days	120,000	1,080,000
Hotel Accommodation	8 nights	300,000	2,400,000
B. Campaign Materials			
Recording tape	1 piece	30,000	30,000
Copying and burning of CDs	18 pieces	75,000	1,350,000
Sub-Total			4,860,000
II. Campaign Against Human Trafficking			
A. Campaign Materials			
Recording tape	1 piece	30,000	30,000
Copying and burning of CDs	18 pieces	75,000	1,350,000
Sub-Total			1,380,000
Total			6,240,000
Add-10% Contingency			624,000
Total Budget			6,864,000
In Dollars			431.70

The budget is not provided for the procurement of loudspeakers or amplifiers since these are already available in all stations, and the construction areas are nearest the stations. Likewise, no budget is allocated for posters for the prevention of HIV/AIDS virus as they shall be obtained from the MoH. It is more practical to play the records for information campaigns in all stations than giving leaflets or flyers to passengers since the printed materials will be thrown to garbage boxes after reading them. It is expensive as well.

TA No. 4050-VIE

**KUNMING – HAIPHONG TRANSPORT CORRIDOR PROJECT
UPGRADING HANOI – LAO CAI RAILWAY**

Feasibility Study and Preliminary Design

DRAFT FINAL REPORT

Technical Appendix D.2

SUMMARY POVERTY REDUCTION AND SOCIAL STRATEGY

July 2006

CURRENCY EQUIVALENTS
(05 MAY 2006)

Currency Unit	–	Vietnamese Dong (VND)
VND 1.00	=	\$ 0.00006272
\$1.00	=	VND 15,950

ABBREVIATIONS

ADB	-	Asian Development Bank
AFD	-	Agence Française de Développement
AP	-	Affected People
BCR	-	Benefit cost ratio
CAD	-	Computed Aided Design
CARB	-	Compensation and Resettlement Board
CPC	-	Commune People's Committee
CPI	-	Consumer Price Index
DFR	-	Draft Final Report
DGTPE	-	Direction Générale du Trésor et de la Politique Economique
DMC	-	Developing Country Member (of ADB)
DPC	-	District People's Committee
EA	-	Executing Agency
EIRR	-	Economic internal rate of return
EMSA	-	Ethnic Minority Special Actions
EPMD	-	Environmental Protection and Management Division
GDP	-	Gross Domestic Product
GOV	-	Government of Vietnam
GSO	-	General Statistical Office
GTZ	-	Gesellschaft für Technische Zusammenarbeit
IBRD	-	International Bank for Reconstruction and Development (World Bank)
ICB	-	International competitive bidding
IEE	-	Initial Environmental Examination
IoL	-	Inventory of Loss
IP	-	Indigenous People
IPDP	-	Indigenous Peoples' Development Plan
IMO	-	Independent Monitoring Organization
IPSA	-	Initial Poverty and Social Analysis
IRR	-	Internal rate of return
ISA	-	Initial Social Assessment
LURC	-	Land Use Rights Certificate
MOF	-	Ministry of Finance
MONRE	-	Ministry of Natural Resources and Environment
MOT	-	Ministry of Transport
MPI	-	Ministry of Planning and Investment
NGO	-	Non Government Organization
NPV	-	Net present value
OCR	-	Ordinary Capital Resources (of ADB)
O-D	-	Origin Destination
ODA	-	Official Development Assistance
OSPF	-	Office of the Special Project Facilitator
PIB	-	Project Information Booklet
PPTA	-	Project Preparatory Technical Assistance
PRC	-	People's Republic of China
PSA	-	Participatory Social Appraisal

ABBREVIATIONS

RALC	-	(Department of) Resettlement and Land Clearance
RoW	-	Right of way
RP	-	Resettlement Plan
RPI	-	Retail Price Index
RPUC	-	Railway Public Utility Company
RPMU	-	Railway Projects Management Unit
RRP	-	Report and Recommendation of the President (to ADB Board of Directors)
RRP	-	Report and Recommendation of the President (to ADB Board of Directors)
SAP	-	Severely Affected People
SES	-	Socio-Economic Survey
SIEE	-	Summary Initial Environmental Examination
TA	-	Technical Assistance
VOC	-	Vehicle operating costs
vpd	-	Vehicles per day
VRA	-	Vietnam Roads Authority

WEIGHTS AND MEASURES

Metric system

NOTES

1. In this report, "\$" refers to US dollars.

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C	Resettlement
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E	Preliminary Project Design
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Summary Poverty Reduction and Social Strategy

1 LINKAGES TO THE COUNTRY POVERTY ANALYSIS

Sector is identified as a National Priority in Country Poverty Analysis	Yes	The sector is identified as a National Priority in the Country Poverty Partnership Agreement ¹	Yes
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1.1 CONTRIBUTION OF THE SECTOR/SUB-SECTOR TO REDUCE POVERTY IN VIET NAM:

1. Between 2000 and 2004, based on 1994 constant prices, the country's Gross Domestic Product (GDP) grew by 7.3%, which was largely pushed by agriculture, manufacturing and trade accounting for 21.8%, 20.4% and 16.3% respectively of GDP. The other industries, i.e. mining, electricity, gas and water, construction and transport and communications, have also exhibited sustainable growth. While the share of transportation and communications on GDP is among the lowest, at 3.9%, this sector should be largely credited for its indirect role on the impressive economic growth of the country. It accounts for 1.248 million workers², or 3% of the total persons employed that has been instrumental for the movement of trade, commerce and industries in Viet Nam. Indirectly, the transportation and communication sector was also instrumental in poverty reduction by helping the industries it serves that create employment. From 37.6 million workers in 2000, employment in the country rose to 41.6 million in 2004 at the yearly rate of 2.5%, and they are growing.

2. The railway sections covered by the proposed Project have also made significant contributions on trade in Viet Nam. It carries 2.2 million tons of freight and 3.0 million passengers³ representing 13.7% and 27.0% respectively, of the overall VNR operations from 2000 to 2004. During the last five years, the average yearly increase on the overall tonnage loaded was calculated at 9.5% while the growth in passengers was registered at 7.3%. At 1994 current market prices, the value of yearly revenues and receipts of VNR share 6.8% of the total transport and communications sector and 0.3% of the GDP.

3. In every station, the trains have important functions: (i) from Lao Cai, they carry the great numbers of imported machineries and manufactured items from China to Viet Nam; (ii) from Yen Vien, it carries the goods from Ho Chi Minh City to Lao Cai for exports to China; and (iii) in between stations, it carries iron ores, coal, grind stones and petroleum products and agricultural products for distribution to companies served by train stations. The trains also serve the industrial zones, as exemplified in Phuc Yen Station. Some stations have directly helped the economy of certain districts. The trains bring 600 foreign and local tourists every day to Tien Kien which is known for its historical tourism, and in the highland areas of Bao Ha which is host to two known temples; one is for prosperity, the other for fertility.

4. The 35 train stations in this section have also become instrumental for the creation of livelihood and self-employment in their host communes. Apart from the government revenues on trade and fare of passengers, the socioeconomic impacts are seen on types of livelihood created within their vicinities and immediate peripheries, such as, (a) small variety stores, (b) small noodles shops, (c) refreshment parlors, (d) service motorbikes, and (e) ambulant vendors as well as other types of services. The Yen Vien – Lao Cai railway route has four major stations, i.e. Yen Vien, Viet Tri, Yen Bai

¹ Country Strategy and Program Update: Vietnam 2006-2008; Asian Development Bank; August 2004

² The 3% share was adapted from the 2002 GSO social survey and the same rate was applied to 2004.

³ TOR of TA No. 4050 – VIE, (para 3).

and Lao Cai, where hundreds of small business shops cater to passengers. The mid-size stations have 20 – 30 micro enterprises while the cargo servicing stations have 5 – 10 small stores. Their daily operating capital varies with incomes that range at VND 10,000 – VND 18,000 per day. From these micro enterprises, a passenger buys to at least two business shops, or a livelihood ratio of 1 : 2 in every station. The ratio means that for every passenger waiting for or coming out from the train, two vendors or small business shops are assisted in their livelihoods.

2 POVERTY ANALYSIS

5. In less than a decade, the programs and projects implemented by the GOV has greatly reduced the country's poverty incidence; from 58 percent in 1993 to 29 % in 2002⁴. This achievement is considered as one of the great success stories in terms of economic development.

6. However, there are still poor areas in Viet Nam where gains from economic growth have yet to be distributed equitably where poverty incidence is much higher than the 29% national average, such as: (a) Northeast Region (with 11 provinces), at 38.4 %; (b) North Central Coast (6 provinces), 43.9%; (c) Central Highlands (4 provinces), 51.8%; and (d) Northwest Region (3 provinces), 68.0%. As revealed in the Rapid Social Assessment (RSA) of the country's basic social indicators, three factors have been identified as the main constraints of the Government of Viet Nam (GOV) on poverty reduction: (i) the lagging quality of human resources, where only 8% of the population with ages of 15 years old and above has technical training and higher education, despite the country's literacy rate of 92.1%; (ii) 40% of the households are experiencing income deficits; and, (iii) larger size of families among the poor households, including the indigenous peoples (IPs).

7. In the areas of Project influence, what also contribute to the peoples' poverty, apart from the lack of technical skills, low educational attainment and inadequate incomes, are the limited employment opportunities and the limited availability of agricultural and homestead lands, particularly in the highlands. The limited supply of agricultural land in these areas is already tolling the environment as there are people clearing the forest for agricultural use. However, the GOV should address these issues in other sector programs where they are most appropriate.

3 SOCIAL ISSUES IDENTIFIED IN THE RSA

The RSA which involved the collection of primary and secondary data through field surveys and focus group discussions identified the following critical social issues that should be addressed under the proposed Project to ensure that poverty reduction objectives are achieved and that the potential adverse impacts are mitigated.

3.1 HUMAN TRAFFICKING

The issue on human trafficking disclosed in the 1997 study by the Institute of Human Geography in Hanoi that may be related to the Project is that women from Hanoi are brought in Laos and in Taiwan through the narrow roads in inland provinces. Those from the provinces of Vinh Phuc, Phu Tho and Yen Bai are brought to China via Lao Cai. Lao Cai is among the provinces of Viet Nam that shares its borders with China and the residents of Lao Cai can cross the border anytime, including the trafficked women.

⁴ Joint Donor Report to the Vietnam Consultative Group Meeting; Vietnam Development Report 2004: Poverty; Hanoi, December 2-3, 2003 (p. xi).

Given the train is the most convenient transportation for long travel, it can be suggested that women trafficked from the three provinces could have used the railway.

3.2 LAND ACQUISITION AND RESETTLEMENT

11. Fourteen of the 18 railway stations being proposed for upgrading and rehabilitation would affect the people living nearest the ROWs of the railway due to land acquisition. The permanent acquisition of lands will be used for the following. (a) extension of the loops to accommodate the 400-m trains; (b) expansion of the stations through the provisions of additional 450 m loops; (c) realignment of the railway in some sections to enhance the speed of the trains; (d) improvement of drainage and strengthening the base of the railway and embankment in one (1) station; and (e) improvement and construction of new flat forms for riding and outgoing passengers. The temporary acquisition of lands shall be used for borrow pits as work stations and for storage of construction materials for the railways. Except in Lao Cai, all affected lands are owned by the VNR. The adverse impacts are seen on lands being used for agriculture and residential, houses and structures, business shops, crops and trees, and common property resources, and more than 400 households shall be relocated. Attachment A, shows the matrix summarizing the impacts of land acquisition in 18 stations.

4 PARTICIPATION PROCESS

12. Focus group discussions were held during the field surveys to get the perceptions of the people about the project. However, there is a need for follow up consultations with key stakeholders to generate their views, issues and priority concerns prior to Project implementation and solicit their suggestions on how best the Project can address their interests. Table 4.1 below shows the list of stakeholders and their key interest in the project.

Table 4.1: Participation Process/Stakeholders Analysis Matrix

Stakeholder	Primary	Secondary	Key Stakeholders' Interest in the Project
Government Agencies: VNR MoH	X X		Executing Agency Information dissemination on campaign against HIV/AIDS virus during construction
Station Managements District Government(s)	X X		Implementing arm of the Executing Agency Assistance to EA and Project Affected Persons (APs) for resettlement site(s)
Non-Government Organizations (NGOs)		X	Community mobilization, training and monitoring of project APs
Private Contractor(s)		X	Construction of the Project
Community Base Organizations Households Women Individuals	X X X X		Information dissemination, implementation and as beneficiaries Beneficiaries Participate in implementation, beneficiaries APs and IPs who shall be relocated due to land acquisition

13. Focus group discussions were already undertaken and Project Information Booklets (PIBs) were disseminated by TA consultants during the joint census and detailed measurement survey (DMS) of APs. But prior to construction, the EA shall reproduce the PIBs, coordinate with institutional stakeholders, NGOs and community-based organizations to solicit their assistance/cooperation and inform their roles in Project implementation. The VNR management shall advise their station managers to

coordinate with community base organizations to assist them in the distribution of PIBs. The APs will be consulted on their suggestions/recommendations that will be considered in project design.

5 GENDER AND DEVELOPMENT PLAN

The Socioeconomic Analysis report has identified the different roles of women in their families. Generated from the RSA, the report disclosed that the visible impacts on women are those in the families of persons who shall be affected by land acquisitions and that gender and development plan will be discussed as a separate sub-section in the Resettlement Plan (RP).

6 SOCIAL SAFEGUARDS AND OTHER SOCIAL RISKS

Concerns	Significance	Strategy/ Mitigating Measures to Address Social Issues	Plan Required
Resettlement	Significant	Land acquisition and resettlement will affect nearly 600 households. The EA, assisted by the TA Consultants, is in the process of preparing the RP that spells out its commitments and forms of support during RP implementation. The RP will detail: (a) scope of land acquisition and resettlement; (b) socio-economic information about the APs; (c) objectives, legal and policy framework, and entitlements, including entitlement matrix; (d) gender impact and mitigating measures; (e) information dissemination, consultation, participatory approaches and disclosure requirements; (f) grievance redress mechanisms; (g) relocation of housing and settlements; (h) income restoration strategy; (i) institutional framework; (j) resettlement budget and financing; (k) implementation schedule; and (l) monitoring and evaluation. The EA will have to substantially comply with the RP provisions prior to the release of Project loan from ADB.	Full Resettlement Plan
Ethnic Minorities	Significant	Their rights, compensation and entitlements will be spelled out in the RP being prepared by the TA Consultants. Specific Actions have been identified, which take into consideration their distinct needs and aspirations, with which the EA will have to comply as a condition for the release of the Project loan.	Ethnic Minorities Specific Actions
Labor	None	The Project will not result to downsizing the VNR personnel working in this area nor facilitate for violating the country's existing labor codes. Neither will it affect labor-intensive enterprises that will displace their workers, but rather the project will provide employment to construction workers. Its impact to other public transportation systems due to possible competition for passengers, like the displacement of drivers for passenger buses, is nil.	None
Affordability	None	The VNR management will see to it that the increase on fares for passengers will be affordable to the riding public. Bulk of its revenue comes from the transport of cargoes.	None
Other Risks/ Vulnerabilities	Significant	As the result of land acquisition, the Project will give special assistance and support for the elderly, the disabled, women-headed households and IPs. The likelihood of human trafficking and children will be addressed through the active participation of VNR on information campaign in all railway stations in cooperation with the on-going programs of the GOV.	None

ATTACHMENT A**Table A.1: Profile of Potential Social Impacts in Railway Right of Way**

Station Numbers and their Locations		Permanent & Temporary Land Acquisition	Houses and Structures	Types of Affected Persons (APs)	Crops and Trees	Common Property Resources
3	Dong Anh (Km 21+212)	Only Track No. 3, located in the middle will be extended. Temporary land acquisition for borrow pit is unlikely.	None.	None.	None.	None.
5	Thach Loi (Km 33+170)	Permanent impact is seen on the acquisition of agricultural land being used for growing rice.	None.	They are farmers but not IPs..	None.	None, but subject to validation if there is an irrigation canal for water distribution.
7	Huong Canh (Km 47+510)	Permanent impact is seen on land acquisition for additional platform.	Fences should be moved back as two electric posts should be transferred.	Retirees but they do not belong to any group of IPs.	More or less than 18 trees would be affected.	Temporary closure of a narrow access road due to construction of the platform.
11	Viet Tri (Km 72+710)	None.	None.	None.	None.	None.
12	Phu Duc (Km81+770)	None.	None.	None.	None.	None.
13	Tien Kien (Km 90+700)	Permanent impacts to lands being used for residential.	Four or five houses made of temporary materials shall be affected.	Four or five households with their ethnicity will be known during the detailed measurement survey (DMS).	Banana trees in which numbers will be known during the DMS.	Temporary effect to access road that shall be closed during construction.
15	Chi Chu (Km 108+150)	Temporary impact on land during construction. Land is owned by the government.	Two houses made of temporary materials may be affected.	The owners will be known during the DMS. But they are not IPs.	None.	None.
	Mai Tung (New Stn.) (Km 124)	Permanent effect to agricultural land(s).	None.	None.	Rice crops.	None

Station Numbers and their Locations		Permanent & Temporary Land Acquisition	Houses and Structures	Types of Affected Persons (APs)	Crops and Trees	Common Property Resources
16	Vu En (Km 118+170)	Permanent effect on paddy lands of private persons, and the residential lands occupied by station employees.	Five houses made of permanent materials; concrete fence; 8 electric poles	Farmers residing nearby the station and ten families of employees working for the station. They are not IPs.	More or less than 30 trees of different species.	There is one pond.
19	Van Phu (Km 148+434)	None.	None.	None.	None.	None.
21	Co Phuc (165+110)	At the station, impacts shall be on paddy lands, gardens and residential lands. At Km 168+893, impacts shall be on 3 ha. paddy lands and residential lands. Temporary land acquisition shall be needed on both locations.	Four (4) houses will be relocated from the station area. Six (6) houses of made of concrete and temporary materials shall be relocated.	Farmers but they are not IPs. They are also farmers but not IPs.	Rice and vegetables planted thereon shall be affected. Production of rice and vegetables and more than 10 fully grown palm trees shall be affected at Km 168+893	None. The realignment of the railway at Km 168+893 shall temporarily affect an irrigation system and a creek. Beyond this section, the closure of illegal crossing will affect the present access to graveyard and paddy lands.
23	Mau A (Km 186+153)	The extension of the loop at the station area will permanently affect paddy lands and residential lands.	One concrete residential structure shall be affected.	The Kinhs are believed to be affected at the station area. They are not IPs.	Impacts shall be on rice and vegetables, but none on trees.	None.
23	Mau A (Cont.) (Km 186+153)	The construction at Km 188 shall require temporary land acquisition.	None.	The Kinhs shall be affected at Km 188 by temporary land acquisition.	None.	None.
24	Mau Dong (Km 194+840)	The additional loop of 450 m shall require permanent acquisition of land being used for residential, and also of temporary land for safekeeping of construction materials.	An estimate of 4–5 residential structures made of temporary materials shall be affected.	The persons that are likely to be affected belong to the group of Kinh. No IPs will be affected.	Impacts shall be on crops and a number of trees.	None.
		The extension of the loop by 100 m shall permanently	None.	Owners of affected lands belong to the	The paddy lands are planted to sugar and	None.

Station Numbers and their Locations		Permanent & Temporary Land Acquisition	Houses and Structures	Types of Affected Persons (APs)	Crops and Trees	Common Property Resources
26	Lam Guiang (Km 210+000)	affect paddy land(s). Temporary land acquisition is not likely as railway materials for construction can be accommodated in the station.		Kinh. No IPs will be affected.	cassava. There are no impacts on trees.	
28	Lang Thip (Km227+803)	The addition of a 450-m loop shall permanently affect residential lands, and may require temporary land acquisition for housing the railway construction materials.	20-25 residential structures and some small business shops shall be affected permanently.	The Kinhs are the owners of the affected properties. There is no affected IP.	A number of fruit bearing trees shall be affected.	A creek shall be also affected.
30	Thai Van (Km 247+450)	The extension of Line No. 3 by 90 m towards the southern direction shall only require temporary land acquisition.	None.	None.	None.	None.
33	Thai Nien (Km 277+280)	The extension of the loop by 80 m shall require the permanent acquisition of lands being used for residential.	The frontages of four (4) houses shall be affected. Measurement of ROWs shall indicate if resettlement is required.	The owners of the structures are Kinhs. They are not IPs.	None.	None.
35	Lao Cai (Km 293+500)	Addition of 9.7 hectares of residential lands shall be required for the construction of new station.	Relocation and resettlement is likely to 400 houses of which 200 are built illegally; made of concrete and temporary materials, measuring 25 – 30 sq. m.; some have fences; and, have electricity connections. There are also small business shops.	The APs are composed of Kinhs and IPs from group of Tays.	More or less than 70 trees of various species and ages shall be affected.	None.

TA No. 4050-VIE

**KUNMING – HAIPHONG TRANSPORT CORRIDOR PROJECT
UPGRADING HANOI – LAO CAI RAILWAY**

Feasibility Study and Preliminary Design

FINAL REPORT

Technical Appendix F.1

ROAD AND RAIL OPERATING COSTS

August 2006

(Revised June 2007)

CURRENCY EQUIVALENTS

(21 August 2006)

Currency Unit	–	Vietnamese Dong (VND)
VND 1.00	=	\$ 0.00006245
\$1.00	=	VND 16,013
VND 1.00	=	€ 0.00004829
€1.00	=	VND 20,704
€1,00	=	\$ 1.293
\$1.00	=	€ 0.773

ABBREVIATIONS

ADB	-	Asian Development Bank
AFD	-	Agence Française de Développement
AP	-	Affected People
BCR	-	Benefit cost ratio
CAD	-	Computed Aided Design
CARB	-	Compensation and Resettlement Board
CPC	-	Commune People's Committee
CPI	-	Consumer Price Index
DFR	-	Draft Final Report
DGTPE	-	Direction Générale du Trésor et de la Politique Economique
DMC	-	Developing Country Member (of ADB)
DPC	-	District People's Committee
EA	-	Executing Agency
EIRR	-	Economic internal rate of return
EMSA	-	Ethnic Minority Special Actions
EPMD	-	Environmental Protection and Management Division
FIRR	-	Financial Internal Rate of Return
FYRR	-	First Year Rate of Return
GDP	-	Gross Domestic Product
GOV	-	Government of Vietnam
GSO	-	General Statistical Office
GTZ	-	Gesellschaft für Technische Zusammenarbeit
IBRD	-	International Bank for Reconstruction and Development (World Bank)
ICB	-	International competitive bidding
IEE	-	Initial Environmental Examination
IoL	-	Inventory of Loss
IP	-	Indigenous People
IPDP	-	Indigenous Peoples' Development Plan
IMO	-	Independent Monitoring Organization
IPSA	-	Initial Poverty and Social Analysis
IRR	-	Internal rate of return
ISA	-	Initial Social Assessment
LURC	-	Land Use Rights Certificate
MOF	-	Ministry of Finance
MONRE	-	Ministry of Natural Resources and Environment
MOT	-	Ministry of Transport
MPI	-	Ministry of Planning and Investment
NGO	-	Non Government Organization
NPV	-	Net present value
OCR	-	Ordinary Capital Resources (of ADB)
O-D	-	Origin Destination

ABBREVIATIONS

ODA	-	Official Development Assistance
OSPF	-	Office of the Special Project Facilitator
PIB	-	Project Information Booklet
PPTA	-	Project Preparatory Technical Assistance
PRC	-	People's Republic of China
PSA	-	Participatory Social Appraisal
RALC	-	(Department of) Resettlement and Land Clearance
RoW	-	Right of way
RP	-	Resettlement Plan
RPI	-	Retail Price Index
RPUC	-	Railway Public Utility Company
RPMU	-	Railway Projects Management Unit
RRP	-	Report and Recommendation of the President (to ADB Board of Directors)
RRP	-	Report and Recommendation of the President (to ADB Board of Directors)
SAP	-	Severely Affected People
SES	-	Socio-Economic Survey
SIEE	-	Summary Initial Environmental Examination
TA	-	Technical Assistance
VNR	-	Vietnam Railways
VOC	-	Vehicle operating costs
vpd	-	Vehicles per day
VRA	-	Vietnam Roads Authority

WEIGHTS AND MEASURES

Metric system

NOTES

1. In this report, "\$" refers to US dollars.

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Technical Appendices (Presented Separately)

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A	Technical Survey and Prioritization of Interventions
A.1	Operations
A.2	Infrastructure
A.3	Rolling Stock
A.5	Topographical Survey
A.6	Geological Survey
B	Environment
B.1	Initial Environmental Examination
B.2	Summary Initial Environmental Examination
C	Resettlement Plan
D	Socio-Economic
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D.2	Summary Poverty Reduction & Social Strategy
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E.5	ToR for Design & Supervision
E.6	Outline ToR for Technical Assistance
F	Economic and Financial Analysis
F.1	Road and Rail Operating Costs
F.2	Financial Analysis

1 ROAD VEHICLE OPERATING COSTS

1.1 GENERAL APPROACH

Vehicle operating costs have been divided into time related and distance related elements, following the same general approach as used in the recent COWI study of traffic volumes and modal split on the Kunming – Haiphong corridor¹, rather than generating estimates through HDM-4. This has been done to facilitate comparisons between the findings of this study and the work by COWI, and ensures a consistent basis for comparing road and rail costs.

It was not possible, with the time and resources available, to carry out detailed investigations of road vehicle operating patterns and costs, so extensive use has been made of previous studies.

Data Sources

There have been a number of studies of vehicle operating costs (VOC) in Vietnam in recent years. Notably, the Network Preservation Program, currently being carried out by BCEOM, has produced a useful summary document², which provides up-to-date information on the economic prices of vehicle, tyres and other inputs, together with the most recent estimates of vehicle kilometrage. The BCEOM study did not provide details of labour costs or estimates of the values of passenger time, so values from a recent road transport study were used³.

The cost of freight to Vietnam has been taken as US\$ 6 per tonne, and it has been assumed that internal distribution costs add a further 25% to total costs. For the purposes of economic analysis, the current international price of petroleum products has been used.

1.2 UNIT OPERATING COSTS

In developing the vehicle operating costs, it has been assumed that depreciation of the vehicle can be split 50/50 between time and distance. Labour and insurance have been treated as time based costs, while maintenance, tyres and fuel are treated as distance costs. Overheads have been split between distance and time costs in proportion to the totals.

VOC have been calculated with and without passenger time.

Table 1.1 below shows the basic unit cost inputs and operating parameters. Table 1.2 sets out the estimation procedure to build up time costs and Table 1.3 sets out distance costs. Table 1.4 shows the average vehicle costs per hour and per kilometre, together with unit costs per passenger kilometre or per tonne-km. The current fuel price is shown in Table 1.5.

¹ TA-4050: *Kunming-Haiphong Transport Corridor: Multimodal Transport Study*, Oct 2005: COWI

² *HDM-4 Analysis of Road Network, First Draft Report*, June 2006: BCEOM

³ *Third Rural Transport Study: Technical Assistance for Project Preparation*, June 2005: Roughton & Partners

Table 1.1: Vehicle Operating Costs Basic Inputs

	Motor-cycle	Passenger Car	Pickup / LGV	Minibus	Large Bus (46 seats)	Medium Truck (2 axle)	Heavy Truck (3-axle)	Artic Truck (4 & 5 axle)	Sources & Comments
Price Data									
New Vehicle Purchase Price	1,250	19,350	20,700	23,780	70,200	38,370	86,800	117,000	
Scrap Value	125	1,935	2,070	2,378	7,020	3,837	8,680	11,700	
Fuel Price (\$/litre)	0.58	0.58	0.58	0.58	0.60	0.60	0.60	0.60	Current price (July 2006)
Oil Price (\$/litre)	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	
Tyre Price	24	56	73	73	193	140	195	220	BCEOM
Interest rate (% p.a.)	12	12	12	12	12	12	12	12	
Operating Data									
Load capacity (passenger or tonnes)	2	5	1.5	25	46	8	17.3	25	BCEOM & Others
Average load (passenger or tonnes)	1.5	2.0	2.0	12.0	30.0	4.0	9.0	13.75	BCEOM & Others
Life (years)	8	10	10	10	12	12	12	12	
km p.a.	8000	12000	25000	25000	60000	40000	50,000	60,000	
Hours p.a.	320	400	1000	1000	1500	1600	1,667	2,000	
Number of tyres	2	4	4	4	6	6	10	14	
Tyre life (km)	30,000	60,000	60,000	60,000	55,000	55,000	55,000	55,000	COWI
Percent Business Use	30	30	100	100	100	100	100	100	
Labour Costs (US\$ per hour)									
Driver & Assistants (total)	1.00	0.60	0.60	0.75	1.00	1.00	1.07	1.07	COWI / RT3
Maintenance Costs (\$ pa)									
Parts	1	18	40	46	324	118	334	540	Pro-rated from COWI price & km
Labour	0	5	10	12	82	30	84	136	
Other									
Insurance	1	18	39	45	320	117	330	534	Pro-rated from COWI price & km
Overhead (%) (Business Use)	5	10	10	10	10	10	10	10	
Value of Time (US\$ per person-hour)									
Average (work & other)	0.14	0.18	0.18	0.14	0.14	0.00	0.00	0.00	

Table 1.2: Vehicle Operating Costs – Time Component

	Motor-cycle	Passenger Car	Pickup / LGV	Minibus	Large Bus (46 seats)	Medium Truck (2 axle)	Heavy Truck (3 axle)	Articulated Truck (4 & 5 axle)
Annual Time Costs (\$ p.a.)								
Depreciation (50%)	70	871	932	1,070	2,633	1,439	3,255	4,388
Interest	75	1,161	1,242	1,427	4,212	2,302	5,208	7,020
Overhead	2	68	277	325	834	534	1,025	1,355
Crew								
per hour (\$)	0.03	0.60	0.60	0.75	1.00	1.00	1.07	1.07
p.a. (\$)	10	240	600	750	1,500	1,600	1,784	2,140
Passengers	67	144	360	1,680	6,300	0	0	0
Time Costs in Productive Use								
Subtotal (time) - inc passengers	121	1,014	3,411	5,252	15,479	5,875	11,271	14,902
Subtotal (time) - exc passengers	54	870	3,051	3,572	9,179	5,875	11,271	14,902
Cost per vehicle-hour (\$)								
Including passengers	0.38	2.53	3.41	5.25	10.32	3.67	6.76	7.45
Excluding passengers	0.17	2.17	3.05	3.57	6.12	3.67	6.76	7.45
Cost per hour per net unit load (passenger or tonne)								
Including passengers	0.25	1.27	1.71	0.44	0.34	0.92	0.75	0.54
Excluding passengers	0.11	1.09	1.53	0.30	0.20	0.92	0.75	0.54
Average vehicle speed (km/h)	25.0	30.0	25.0	25.0	40.0	25.0	30.0	30.0
Time cost per unit load per km (\$ per passenger or tonne-km)								
Including passengers	0.0101	0.0422	0.0682	0.0175	0.0086	0.0367	0.0250	0.0181
Excluding passengers	0.0045	0.0362	0.0610	0.0119	0.0051	0.0367	0.0250	0.0181

Table 1.3: Vehicle Operating Costs – Distance Component

	Motor- cycle	Passenger Car	Pickup / LGV	Minibus	Large Bus (46 seats)	Medium Truck (2 axle)	Heavy Truck (3 axle)	Articulated Truck (4 & 5 axle)
Distance Costs p.a. (\$)								
Depreciation (50%)	70	871	932	1,070	2,633	1,439	3,255	4,388
Maintenance	1	22	50	57	406	148	418	676
Tyres	13	45	122	122	1263	611	1773	3360
Fuel								
Current price	312	601	1,527	1,911	7,608	5,071	12,677	19,017
Overhead	4	37	183	215	770	446	1111	1691
Subtotal (distance)								
Current price	400	1,576	2,814	3,375	12,678	7,715	19,234	29,132
Distance Costs per km (\$) – using Current Fuel Prices								
Distance Costs per vehicle km	0.050	0.131	0.113	0.135	0.211	0.193	0.385	0.486
Distance costs per unit-km load	0.033	0.066	0.056	0.011	0.007	0.048	0.043	0.035

Table 1.4: Vehicle Operating Unit Cost Summary (US\$ per passenger-km or tonne-km)

	Motor-cycle	Pass Car	Pickup / LGV	Minibus	Large Bus (46 seats)	Medium Truck (2 axle)	Heavy Truck (3 axle)	Articulated Truck (4 & 5 axle)
Time Costs per passenger or tonne –km (\$)								
Including passengers	0.0101	0.0422	0.0682	0.0175	0.0086	0.0367	0.0250	0.0181
Excluding passengers	0.0045	0.0362	0.0610	0.0119	0.0051	0.0367	0.0250	0.0181
Distance Costs per Passenger or Tonne-km (\$)								
Current fuel prices	0.0334	0.0657	0.0563	0.0112	0.0070	0.0482	0.0427	0.0353
Total costs per Passenger or Tonne-km – using Current Fuel Prices								
Including passengers	0.0435	0.1079	0.1245	0.0288	0.0156	0.0849	0.0678	0.0534
Excluding passengers	0.0379	0.1019	0.1173	0.0232	0.0121	0.0849	0.0678	0.0534

Table 1.5: Petroleum Product Prices (US\$)

Current (July 2006) Prices		
Per barrel (\$)	82.84	85.86
Per litre (cents)	52.1	54.0

Table 1.6: Fuel Price Assumptions (US cents per litre)

	Gasoline	Diesel
fob Singapore	52.1	54.0
Freight	0.4	0.5
Import Price	52.5	54.5
Distribution (25%)	5.8	5.7
Total	58.2	60.2

Notes:

Freight at US\$ 6 per tonne

1.3 COST ESTIMATES USED IN ECONOMIC EVALUATION**1.3.1 Capacity Increases and Rehabilitation**

The basic assumption of the economic evaluation of the rail improvement project is that lack of capacity on the rail system will force long-distance traffic onto the roads. This traffic will normally be carried in the larger trucks, and an average road transport cost has been estimated on the assumption that 50% of the diverted traffic will move in heavy trucks and the remaining 50% in articulated trucks. Table 1.7 below shows the average costs .

Table 1.7: Average Truck Transport Costs (US\$ per km)

	Summary of Truck Costs		
	Heavy Truck	Articulated Truck	Average
Fuel Price (US cents / litre)	60.2	60.2	60.2
Cost per veh-hr	6.76	7.45	7.11
Average speed (km/h)	30	30	30
Time cost per veh-km	0.2254	0.2484	0.2369
<i>Fuel Cost per km</i>	<i>0.2408</i>	<i>0.3010</i>	<i>0.2709</i>
Distance cost per veh-km	0.3719	0.4696	0.4208
Total cost per veh-km	0.5973	0.7179	0.6576
Average load	9.0	13.8	11.4
Time cost per tonne-km	0.0250	0.0181	0.0216
Distance cost per tonne-km	0.0413	0.0342	0.0377
Total cost per tonne-km	0.0664	0.0522	0.0593

1.3.2 Overpasses

Constructing overpasses where heavily trafficked roads cross the railway at grade will eliminate the delays to road traffic which arise when the barrier is closed. The economic

analysis therefore requires the use of time values for each vehicle type, to evaluate the benefits of the time saving.

The traffic data for the overpass sites was not as detailed as for the VOC estimation, so vehicle types had to be combined. The values used are shown in Table 1.8 below.

Table 1.8: Calculated Time Values for Overpass Evaluation (\$ per hour)

	Motor- cycle	Light Vehicles		Buses		Trucks		
		Car	LGV	Mini	Large	Med	Heavy	Artic
Composition		0.35	0.65	0.65	0.35	0.60	0.30	0.10
Value of Time	0.38	2.53	3.41	5.25	10.32	3.67	6.76	7.45
Average	0.38	3.10		7.03		4.98		

2 RAIL OPERATING COSTS

2.1 GENERAL APPROACH

Rail operating costs have been divided into time and distance costs, following the same general approach as used in the COWI study. As with the road costs, extensive use has been made of secondary sources, notably the COWI study and a review of prices⁴ in the rail sector, produced by the Laboratoire d'Intermodalité des Transports Et de Planification (LITEP) in Lausanne, Switzerland.

Costs have been estimated for different locomotive types (see below) and for different train compositions, as the proposed improvements will permit the use of longer and heavier trains.

2.2 UNIT COSTS

Capital costs for locomotives and wagons used in the COWI study were checked against recent international prices. The COWI study assumed that both locomotives and wagons would be sourced from China. The locomotive prices, at US\$ 750,000 are significantly below international market prices; a price of US\$ 1.2 to 1.5 million for 2000 hp locomotives would be more normal for North American manufacturers, while the new D20Es, produced by Siemens, are priced at € 3.5 million (US\$ 4.4 million).

Similarly, the COWI study assumed that wagons would be sourced from China, where wagon prices, at US\$ 21,000, are significantly below international levels – US\$ 40,000 to 60,000 is more normal for US or European sources.

Long-run (or life cycle) maintenance for locomotives consists of routine maintenance, periodic maintenance, running repairs and at least one major general overhaul. LITEP gives a range of € 1.50 – € 2.50 (\$1.88 to \$ 3.12) per km, significantly higher than the 20 US cents used by COWI. The lower end of the LITEP range has been used here, to reflect lower labour costs and less exacting operating conditions in Vietnam for Chinese and North American locos. It corresponds to approximately 15% of capital cost per annum for North American locos, but closer to 25% when applied to Chinese locos. The life cycle maintenance costs for the D20E is given by the manufacturer as € 3 per km.

Life cycle costs for wagons are given as € 0.05 to € 0.13 per km in LITEP. The lower end of the range has been used here, which corresponds to approximately 10% of capital costs, the same rate as used in the COWI study.

Fuel costs are identical to those used in the road vehicle operating cost estimates, and are shown in Table 1.5.

The wage rates used in the COWI study were VND 5,390 per hour, based on average wage levels in Vietnam in 2002. These rates are significantly lower than those paid to road operators. No data on current VNR rates could readily be obtained, and it has been assumed that crew costs for the locomotives would be similar to those for heavy road vehicles, assuming a crew of three (two in the cab and one in the guard's van).

2.3 UTILIZATION

VNR's operating statistics for 2003 and 2004 were used to establish utilization levels for both locomotives and wagons. Locomotive utilization, at 96–98,000 km p.a. is relatively

⁴ *Prices and Costs in the Railway Sector*, Jan 2001, Prof. J.P.Baumgartner, LITEP

normal, but wagon utilization, at over 30,000 km p.a., is quite high (and certainly higher than assumed in the COWI study).

Table 2.1: Key VNR Operating Statistics – Metre Gauge

	2003		2004	
Overall Performance	Freight	Passenger	Freight	Passenger
Gross tonne-km (mn)	4,982.4	4,965.3	4,982.5	5,380.0
Net tonne-km (mn)	2,573.9	~	~	
Loco km p.a.(mn)	8.7	11.7	8.7	12.5
Gross tonne / train	574	424	572	429
Locomotives				
Km per loco per day	269.4	533.8	263.7	533.1
Km per loco p.a.(000)	98,331	194,837	96,251	194,582
Wagons				
Tonne-km per wagon day	2,046	675	1,715	
Wagons in use (annual daily average)	3,458		4,108	
Km per wagon day	102		87	
Average train capacity (tonne)	300		298	
Wagons per train	15.9		16.1	
Average tonnes / wagon	20.1		19.7	

As can be seen in Table 2.1, wagon loads average 20 tonnes. Load factors are approximately 65% (see below), giving a load per loaded wagon of 30.8 tonnes. Average train composition is 16 wagons.

VNR also provide data on the tonnage carried by section on the Hanoi to Lao Cai line. This shows that the traffic moving towards Hanoi is approximately 3 times greater than the *down* traffic (towards Lao Cai). If an allowance of 5% is made for empty running in the dominant direction, the ratio of loaded wagon-km to total wagon-km is estimated to be 65% (see Table 2.2)

Table 2.2: Freight Density and Empty Running

	2003		
Freight Density (tonnes/day)	Up	Down	Total
Hanoi - Gia Lam	2,087	2,057	4,144
Gia Lam - Yen Vien	3,385	3,327	6,712
Yen Vien - Dong Anh	3,333	3,344	6,677
Dong Anh - Viet Tri	3,571	2,035	5,606
Viet Tri - Yen Bai	4,492	1,214	5,706
Yen Bai - Lang Giang	3,854	964	4,818
Lang Giang - Lao Cai	1,820	881	2,701
Average	3,847	1,365	5,212
Equivalent wagons (@ 30.8 tonnes)	124	44	168
Empty running (%)	5		
Total Wagons	131	131	262
Percent loaded	95	34	64

Finally, VNR provide the following data for average haul for freight and for passengers on the Hanoi – Lao Cai line.

Table 2.3: Average Haul: Hanoi – Lao Cai Line

	2003			2004		
	Freight	Passenger	Luggage	Freight	Passenger	Luggage
Tonnes loaded (000)	2,595.0	2,890.0	18.9	2,740.1	3,361.2	21.4
Average km	244.1	150.0	143.2	244.1	140.9	145.1
Tonne-km (mn)	633.4	433.5	2.7	668.9	473.6	3.1

2.4 OPERATING COST ESTIMATES

Table 2.4 below gives the key unit cost inputs.

Table 2.4: Key Operating Unit Cost Inputs

	Locomotives			Wagons
	Chinese	N America	D20E	
Unit Capital Costs				
VND million	11,927	20,000	69,600	338
US\$ 000	750	1,258	4,377	21
Scrap (\$000)	75	126	438	2
Interest (% p.a.)	12	12	12	12
Unit Operation Cost Inputs				
Fuel				
kg/10,000 t-km	46	46	46	
\$/kg (current)	0.71	0.71	0.71	
\$ / 1,000 t-km	1.518	1.518	1.518	
Maintenance - Life (\$ per km)	1.88	1.88	3.75	0.0625
Crew (\$ per hour)	1.50	1.50	1.50	
Operating Parameters				
Life (years)	20			20
Hours operation p.a.	3,000			2,880
Kilometres p.a.	98,000			30,000

Note: Density of diesel is 0.844 kg/litre

Table 2.5 shows the train composition for the existing and improved (project) cases.

Table 2.5: Train Composition and Loads

	Existing			Improved		
	Locos	Wagon	Train	Locos	Wagon	Train
Composition	1		16	1		20
Loads (tonnes)						
Tare		19			19	
Gross (full load)	80	50	880	80	50	1080
Load per loaded wagon		31			31	400
Percent running loaded		65			65	
Pay Load (average)		20	320		20	400

Table 2.6 summarizes the average time, distance and total costs for each train composition and locomotive type.

Table 2.6: Rail Operation Costs – Summary

	Fuel Cost (US cents / kg) - 71.3			
	Current	Project		
		Low Cost	N.Am	D20E
Wagons / train	16	20	20	20
Tonnes / wagon	30.8	30.8	30.8	30.8
Percent running loaded	65	65	65	65
Time cost per train-hour	31.87	34.31	48.27	134.06
Average speed (km/h)	30	30	30	30
Time cost per train-km	1.06	1.14	1.61	4.47
<i>Fuel cost per train-km</i>	<i>2.28</i>	<i>2.78</i>	<i>2.78</i>	<i>2.78</i>
Distance cost per train-km	5.58	6.40	6.51	9.10
Payload	320	400	400	400
Time cost per tonne-km	0.0033	0.0029	0.0040	0.0112
Distance cost per tonne-km	0.0174	0.0160	0.0163	0.0227
Total cost per tonne-km	0.0207	0.0188	0.0203	0.0339

Table 2.7: Detailed Breakdown of Rail Operating Costs

	Current Operations			Improved Ops – Chinese Locos			Improved Ops – N. American Locos			Improved – D20E		
	Loco	Wagon	Train	Loco	Wagon	Train	Loco	Wagon	Train	Loco	Wagon	Train
Time Costs (\$)												
Depreciation (50%) p.a.	16,878	478		16,878	478		28,302	478		98,491	478	
Interest p.a.	45,008	1,275		45,008	1,275		75,472	1,275		262,642	1,275	
Crew												
per hour (\$)	1.50	~		1.50	~		1.50	~		1.50	~	
p.a. (\$)	4,500			4,500			4,500			4,500		
Subtotal (time) p.a.	66,385	1,754	94,445.75	66,385	1,754	101,461	108,274	1,754	143,349	365,632	1,754	400,708
Cost per hour (\$)	22.13	0.61	31.87	22.13	0.61	34.31	36.09	0.61	48.27	121.88	0.61	134.06
Average train speed (km/h)			30			30			30			30
Cost /hr / net tonne load			0.0995			0.0857			0.1206			0.3348
Time cost / tonne-km load			0.0033			0.0029			0.0040			0.0112
Distance Costs (\$)												
Depreciation (50%) p.a.	16,878	478	24,531	16,878	478	26,444	28,302	478	37,868	98,491	478	108,057
Maintenance p.a.	183,750	1,875	213,750	183,750	1,875	221,250	183,750	1,875	221,250	367,500	1,875	405,000
Depreciation costs / km	0.17	0.02	0.43	0.17	0.02	0.49	0.29	0.02	0.61	1.01	0.02	1.32
Maintenance / km	1.88	0.06	2.88	1.88	0.06	3.13	1.88	0.06	3.13	3.75	0.06	5.00
Fuel												
Current fuel prices			2.31			2.82			2.82			2.82
Distance Costs – current fuel prices												
Costs per km per train			5.61			6.44			6.55			9.15
Cost per net tonne-km load			0.0175			0.0161			0.164			0.0228
Total Average Costs per tonne-km (\$)												
Current fuel prices			0.0208			0.0189			0.0204			0.0340

TA No. 4050-VIE

**KUNMING – HAIPHONG TRANSPORT CORRIDOR PROJECT
UPGRADING HANOI – LAO CAI RAILWAY**

Feasibility Study and Preliminary Design

FINAL REPORT

Technical Appendix F.3

FINANCIAL ANALYSIS

August 2006

(Revised June 2007)

CURRENCY EQUIVALENTS

(21 August 2006)

Currency Unit	–	Vietnamese Dong (VND)
VND 1.00	=	\$ 0.00006245
\$1.00	=	VND 16,013
VND 1.00	=	€ 0.00004829
€1.00	=	VND 20,704
€1,00	=	\$ 1.293
\$1.00	=	€ 0.773

ABBREVIATIONS

ADB	-	Asian Development Bank
AFD	-	Agence Française de Développement
AP	-	Affected People
BCR	-	Benefit cost ratio
CAD	-	Computed Aided Design
CARB	-	Compensation and Resettlement Board
CPC	-	Commune People's Committee
CPI	-	Consumer Price Index
DFR	-	Draft Final Report
DGTPE	-	Direction Générale du Trésor et de la Politique Economique
DMC	-	Developing Country Member (of ADB)
DPC	-	District People's Committee
EA	-	Executing Agency
EIRR	-	Economic internal rate of return
EMSA	-	Ethnic Minority Special Actions
EPMD	-	Environmental Protection and Management Division
FIRR	-	Financial Internal Rate of Return
FYRR	-	First Year Rate of Return
GDP	-	Gross Domestic Product
GOV	-	Government of Vietnam
GSO	-	General Statistical Office
GTZ	-	Gesellschaft für Technische Zusammenarbeit
IBRD	-	International Bank for Reconstruction and Development (World Bank)
ICB	-	International competitive bidding
IEE	-	Initial Environmental Examination
IoL	-	Inventory of Loss
IP	-	Indigenous People
IPDP	-	Indigenous Peoples' Development Plan
IMO	-	Independent Monitoring Organization
IPSA	-	Initial Poverty and Social Analysis
IRR	-	Internal rate of return
ISA	-	Initial Social Assessment
LURC	-	Land Use Rights Certificate
MOF	-	Ministry of Finance
MONRE	-	Ministry of Natural Resources and Environment
MOT	-	Ministry of Transport
MPI	-	Ministry of Planning and Investment
NGO	-	Non Government Organization
NPV	-	Net present value
OCR	-	Ordinary Capital Resources (of ADB)
O-D	-	Origin Destination

ABBREVIATIONS

ODA	-	Official Development Assistance
OSPF	-	Office of the Special Project Facilitator
PIB	-	Project Information Booklet
PPTA	-	Project Preparatory Technical Assistance
PRC	-	People's Republic of China
PSA	-	Participatory Social Appraisal
RALC	-	(Department of) Resettlement and Land Clearance
RoW	-	Right of way
RP	-	Resettlement Plan
RPI	-	Retail Price Index
RPUC	-	Railway Public Utility Company
RPMU	-	Railway Projects Management Unit
RRP	-	Report and Recommendation of the President (to ADB Board of Directors)
RRP	-	Report and Recommendation of the President (to ADB Board of Directors)
SAP	-	Severely Affected People
SES	-	Socio-Economic Survey
SIEE	-	Summary Initial Environmental Examination
TA	-	Technical Assistance
VNR	-	Vietnam Railways
VOC	-	Vehicle operating costs
vpd	-	Vehicles per day
VRA	-	Vietnam Roads Authority

WEIGHTS AND MEASURES

Metric system

NOTES

1. In this report, "\$" refers to US dollars.

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Table 1 : Financial Analysis - Normal Revenue per unit USD 2.13 cents / unit-km – Cash Flow Analysis

Year	With Project		
	Incremental		Net Cash Flow
	Investing Cash Flow	Operating Cash Flow	
2006	0	0	0
2007	0	0	0
2008	50.4	0.0	-50.4
2009	50.4	0.0	-50.4
2010	50.4	0.0	-50.4
2011		7.0	7.0
2012		7.4	7.4
2013		7.8	7.8
2014		8.0	8.0
2015		8.1	8.1
2016		8.8	8.8
2017		9.4	9.4
2018		9.9	9.9
2019		10.2	10.2
2020		10.4	10.4
2021		8.7	8.7
2022		7.5	7.5
2023		6.7	6.7
2024		6.3	6.3
2025		6.1	6.1
2026		6.2	6.2
2027		6.5	6.5
2028		6.9	6.9
2029		7.6	7.6
2030	-66.2	8.3	74.4
2031		0.0	
2032	44%	0.0	
2033		0.0	
2034		0.0	
FIRR	3.0%		

Table 2: Project Investment Costs (USD)

	Local Costs	% of Total	Foreign Costs	% of Total	Total Costs	% of Total	Annual Depr.
Track Works	3.099.262	10,77	75.596.254	66,33	78.695.515	55,14	3.147.821
Earthworks & Embankments	5.967.981	20,75			5.967.981	4,18	119.360
Bridges & Culverts Component			13.041.598	11,44	13.041.598	9,14	260.832
Stations	9.131.302	31,74			9.131.302	6,40	365.252
Level Crossings		0,00			0	0,00	
Basic Construction Costs	18.198.545	63,26	88.637.852	77,78	106.836.396	74,85	
Environmental Costs	1.602.546	5,57			1.602.546	1,12	64.102
Resettlement Costs	5.164.673	17,95			5.164.673	3,62	206.587
Detailed Design & Supervision			8.546.912	7,50	8.546.912	5,99	341.876
VAT	1.980.109	6,88	9.718.476	8,53	11.698.585	8,20	450.583
Total Construction Costs	26.945.873	93,67	106.903.240	93,80	133.849.112	93,78	
Physical Contingencies (5%)	1.000.920	3,48	4.875.082	4,28	5.876.002	4,12	247.821
Total Estimated Costruction Costs	27.946.792	97,15	111.778.322	98,08	139.725.114	97,89	
Price Contingency	818.935	2,85	2.186.400	1,92	3.005.335	2,11	120.213
Total	28.765.727	100,00	113.964.722	100,00	142.730.449	100,00	5.324.446

Price Contingency	
Local Costs (4.5% p.a.)	818.935
Foreign Costs 2006 (3,1%)	915.924
2007(2.1%)	620.465
2008 (2.2%)	650.011
Total	3.005.335

Foreign Cost (\$) inflation figures from Oregon State University forecasts based on December 2005 CPI.

Table 3 : Weighted Average Cost of Capital

		Financing Components					
		ADB	AFD	DGTPE	Gov't	Total	
A.	Amount (\$mns)	60	40	37.5	22.5	160	VCT: 32 year, inclusive of 8 year grace period. 1.0% during grace period, 1.5% thereafter. Interest during grace period capitalized.
B.	Weighting	38%	25%	23%	14%	100%	VCT: variable at 6-months euribor, less 2%. On average 18 years maturity with 6 years grace. Interest not capitalized during grace period.
C.	Nominal Cost	1.5%	1.5%	1.25%	9.0%		VCT: 1.25%, 20 years maturity with 5 year grace. Interest not capitalized during grace period. Tied credits.
D.	Tax Rate (assuming that interest costs are deductible for tax purposes)	25%	25%	25%			VCT: proxy for Gov't cost of funds -
E.	Tax-adjusted nominal rate [C x (1-D)]	1.1%	1.1%	0.9%	9.0%		
F.	Inflation Rate	2%	2%	2%	5%		
G.	Real Cost [(1+E) / (1+F) -1]	-0.9%	-0.9%	-1.0%	3.8%		
H.	Weighted component of WACC (G x B), if negative, then Zero.	0%	0%	0.00%	0.54%	0.54%	

The Weighted Average Cost of Capital (WACC) is calculated based on the revised estimated share of each lender.

The nominal cost for the ADB portion of the loan is based on the request of the Viet Nam Government for funding out of the ADB Special Funds resources. The nominal costs for the other lenders are based on current rates in accordance with ADB guidelines.

The inflation rate calculated is in accordance with ADB's inflation rates of 2% for international lending and 5% for local lending.

The Real WACC as calculated is positive for the project

Table 4 : Proforma Financial Statements - Forecast Income Statement (Without Project) (million USD)

Year	2001 Actual	2002 Actual	2003 Actual	2004 Actual	2005 Estimated	2006 Estimated	2007 Estimated	2008 Estimated	2009 Estimated	2010 Estimated	2011 Estimated	2012 Estimated	2013 Estimated	2014 Estimated	2015 Estimated	2016 Estimated
Revenues																
Transport	89,06	98,38	111,83	112,46	120,14	120,14	120,14	120,14	120,14	120,14	120,54	120,94	121,34	121,64	122,04	122,24
Other	144,72	170,72	191,25	197,74	229,16	229,16	229,16	229,16	229,16	229,16	229,16	229,16	229,16	229,16	229,16	229,16
Total Revenues	233,79	269,09	303,08	310,20	349,30	349,30	349,30	349,30	349,30	349,30	349,70	350,10	350,50	350,80	351,20	351,40
Costs:																
Transport	88,98	98,29	111,74	112,38	120,05	120,05	120,05	120,05	120,05	120,05	120,35	120,75	121,15	121,55	121,85	122,25
Other	140,92	166,10	187,54	194,41	224,84	224,84	224,84	224,84	224,84	224,84	224,84	224,84	224,84	224,84	224,84	224,84
Total Costs	229,90	264,38	299,29	306,80	344,90	344,90	344,90	344,90	344,90	344,90	345,20	345,60	346,00	346,40	346,70	347,10
Net Profit/Loss Transport	0,08	0,09	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,18	0,18	0,18	0,08	0,18	-0,02
Other	3,80	4,62	3,71	3,33	4,32	4,32	4,32	4,32	4,32	4,32	4,32	4,32	4,32	4,32	4,32	4,32
Net Profit before Taxes	3,89	4,71	3,79	3,41	4,40	4,40	4,40	4,40	4,40	4,40	4,50	4,50	4,50	4,40	4,50	4,30
Taxes	0,97	1,18	0,95	0,85	1,10	1,10	1,10	1,10	1,10	1,10	1,13	1,13	1,13	1,10	1,13	1,08
Net Profit after Taxes	2,91	3,53	2,84	2,56	3,30	3,30	3,30	3,30	3,30	3,30	3,38	3,38	3,38	3,30	3,38	3,23

Table 5 : Proforma Financial Statements - Forecast Income Statement (With Project) (million USD)

Year	2001 Actual	2002 Actual	2003 Actual	2004 Actual	2005 Estimated	2006 Estimated	2007 Estimated	2008 Estimated	2009 Estimated	2010 Estimated	2011 Estimated	2012 Estimated	2013 Estimated	2014 Estimated	2015 Estimated	2016 Estimated
Revenues																
Transport	89,06	98,38	111,83	112,46	120,14	120,14	120,14	120,14	120,14	120,14	121,84	123,44	125,14	126,74	128,44	130,74
Other	144,72	170,72	191,25	197,74	229,16	229,16	229,16	229,16	229,16	229,16	229,16	229,16	229,16	229,16	229,16	229,16
Total Revenues	233,79	269,09	303,08	310,20	349,30	349,30	349,30	349,30	349,30	349,30	351,00	352,60	354,30	355,90	357,60	359,90
Operating Costs:																
Transport	88,98	98,29	111,74	112,38	120,05	120,05	120,05	120,05	120,05	120,05	121,15	122,35	123,75	125,15	126,65	128,25
Other	140,92	166,10	187,54	194,41	224,84	224,84	224,84	224,84	224,84	224,84	224,84	224,84	224,84	224,84	224,84	224,84
Total Operating Costs	229,90	264,38	299,29	306,80	344,90	344,90	344,90	344,90	344,90	344,90	346,00	347,20	348,60	350,00	351,50	353,10
Operating Profit/Loss Transport	0,08	0,09	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,68	1,08	1,38	1,58	1,78	2,48
Depreciation of Project Costs											5,32	5,32	5,32	5,32	5,32	5,32
Net Profit/Loss Transport	0,08	0,09	0,08	0,08	0,08	0,08	0,08	0,08	0,08	0,08	-4,64	-4,24	-3,94	-3,74	-3,54	-2,84
Other	3,80	4,62	3,71	3,33	4,32	4,32	4,32	4,32	4,32	4,32	4,32	4,32	4,32	4,32	4,32	4,32
Net Profit before Taxes	3,89	4,71	3,79	3,41	4,40	4,40	4,40	4,40	4,40	4,40	-0,32	0,08	0,38	0,58	0,78	1,48
Taxes (25%)	0,97	1,18	0,95	0,85	1,10	1,10	1,10	1,10	1,10	1,10	0,00	0,00	0,00	0,00	0,00	0,00
Net Profit after Taxes	2,91	3,53	2,84	2,56	3,30	3,30	3,30	3,30	3,30	3,30	-0,32	0,08	0,38	0,58	0,78	1,48

Table 6 : Proforma Financial Statements - Balance Sheet (Without Project) (million USD)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	Actual	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate
Current Assets														
Cash & Short-term Investments	24,0	34,2	34,2	34,2	34,2	34,2	34,2	34,2	34,3	34,5	34,7	34,8	35,0	35,0
Accounts Receivable	153,3	180,9	180,9	180,9	180,9	180,9	180,9	180,9	180,9	180,9	180,9	180,9	180,9	180,9
Inventories	38,8	38,8	38,8	38,8	38,8	38,8	38,8	38,8	38,8	38,8	38,8	38,8	38,8	38,8
Administrative Subsidies	31,0	29,7	29,7	29,7	29,7	29,7	29,7	29,7	29,7	29,7	29,7	29,7	29,7	29,7
Other	4,2	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4
	251,2	286,9	286,9	286,9	286,9	286,9	286,9	286,9	287,1	287,3	287,5	287,5	287,7	287,7
Long-Term Investments	2,4	3,6	3,6	3,6	3,6	3,6	3,6	3,6	3,6	3,6	3,6	3,6	3,6	3,6
Fixed Assets	794,3	823,3	823,3	823,3	823,3	823,3	823,3	823,3	823,3	823,3	823,3	823,3	823,3	823,3
Work in Progress														
Total Assets	1.048,0	1.113,8	1.113,8	1.113,8	1.113,8	1.113,8	1.113,8	1.113,8	1.114,0	1.114,2	1.114,4	1.114,5	1.114,7	1.114,6
Current Liabilities														
Accounts Payable & Short-Term Loans	62,3	71,7	71,7	71,7	71,7	71,7	71,7	71,7	71,7	71,7	71,7	71,7	71,7	71,7
Current Portion of Long-Term Loan	7,5	10,4	10,4	10,4	10,4	10,4	10,4	10,4	10,4	10,4	10,4	10,4	10,4	10,4
Taxes Payable	16,1	16,5	16,5	16,5	16,5	16,5	16,5	16,5	16,5	16,5	16,5	16,5	16,5	16,5
Liabilities to Related Companies	73,9	112,5	112,5	112,5	112,5	112,5	112,5	112,5	112,5	112,5	112,5	112,5	112,5	112,5
Other Current Liabilities	39,8	23,5	23,5	23,5	23,5	23,5	23,5	23,5	23,5	23,5	23,5	23,5	23,5	23,5
	199,6	234,5	234,5	234,5	234,5	234,5	234,5	234,5	234,5	234,5	234,5	234,5	234,5	234,5
Long Term Loans & Other Liabilities	97,4	128,9	128,9	128,9	128,9	128,9	128,9	128,9	128,9	128,9	128,9	128,9	128,9	128,9
Total Liabilities	297,1	363,4	363,4	363,4	363,4	363,4	363,4	363,4	363,4	363,4	363,4	363,4	363,4	363,4
Equity														
Capital	111,7	102,7	102,7	102,7	102,7	102,7	102,7	102,7	102,7	102,7	102,7	102,7	102,7	102,7
Reserves for Fixed Assets	413,3	391,3	391,3	391,3	391,3	391,3	391,3	391,3	391,3	391,3	391,3	391,3	391,3	391,3
Reserves	226,5	259,5	259,5	259,5	259,5	259,5	259,5	259,5	259,6	259,8	260,0	260,1	260,3	260,2
Other	-0,5	-3,0	-3,0	-3,0	-3,0	-3,0	-3,0	-3,0	-3,0	-3,0	-3,0	-3,0	-3,0	-3,0
	751,0	750,4	750,4	750,4	750,4	750,4	750,4	750,4	750,6	750,8	751,0	751,1	751,2	751,2
Total Liabilities and Equity	1.048,0	1.113,8	1.113,8	1.113,8	1.113,8	1.113,8	1.113,8	1.113,8	1.114,0	1.114,2	1.114,4	1.114,5	1.114,7	1.114,6

Table 7 : Proforma Financial Statements - Balance Sheet (With Project) (million USD)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	Actual	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate
Current Assets														
Cash & Short-term Investments	24,0	34,2	34,2	34,2	34,2	34,2	34,2	34,2	39,2	44,6	50,3	56,2	62,3	69,1
Accounts Receivable	153,3	180,9	180,9	180,9	180,9	180,9	180,9	180,9	180,9	180,9	180,9	180,9	180,9	180,9
Inventories	38,8	38,8	38,8	38,8	38,8	38,8	38,8	38,8	38,8	38,8	38,8	38,8	38,8	38,8
Administrative Subsidies	31,0	29,7	29,7	29,7	29,7	29,7	29,7	29,7	29,7	29,7	29,7	29,7	29,7	29,7
Other	4,2	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4	3,4
	251,2	286,9	286,9	286,9	286,9	286,9	286,9	286,9	291,9	297,3	303,0	308,9	315,0	321,8
Long-Term Investments	2,4	3,6	3,6	3,6	3,6	3,6	3,6	3,6	3,6	3,6	3,6	3,6	3,6	3,6
Fixed Assets (Net)	794,3	823,3	823,3	823,3	823,3	823,3	823,3	823,3	960,7	955,4	950,0	944,7	939,4	934,1
Work in Progress						47,6	95,2	142,7						
Total Assets	1.048,0	1.113,8	1.113,8	1.113,8	1.113,8	1.161,4	1.209,0	1.256,6	1.256,3	1.256,3	1.256,7	1.257,3	1.258,1	1.259,6
Current Liabilities														
Accounts Payable & Short-Term Loans	62,3	71,7	71,7	71,7	71,7	71,7	71,7	71,7	71,7	71,7	71,7	71,7	71,7	71,7
Current Portion of Long-Term Loan	7,5	10,4	10,4	10,4	10,4	10,4	10,4	10,4	10,4	10,4	10,4	10,4	10,4	10,4
Taxes Payable	16,1	16,5	16,5	16,5	16,5	16,5	16,5	16,5	16,5	16,5	16,5	16,5	16,5	16,5
Liabilities to Related Companies	73,9	112,5	112,5	112,5	112,5	112,5	112,5	112,5	112,5	112,5	112,5	112,5	112,5	112,5
Other Current Liabilities	39,8	23,5	23,5	23,5	23,5	23,5	23,5	23,5	23,5	23,5	23,5	23,5	23,5	23,5
	199,6	234,5	234,5	234,5	234,5	234,5	234,5	234,5	234,5	234,5	234,5	234,5	234,5	234,5
Long Term Loans & Other Liabilities	97,4	128,9	128,9	128,9	128,9	176,4	224,0	271,6	271,6	271,6	271,6	271,6	271,6	271,6
Total Liabilities	297,1	363,4	363,4	363,4	363,4	411,0	458,6	506,1	506,1	506,1	506,1	506,1	506,1	506,1
Equity														
Capital	111,7	102,7	102,7	102,7	102,7	102,7	102,7	102,7	102,7	102,7	102,7	102,7	102,7	102,7
Reserves for Fixed Assets	413,3	391,3	391,3	391,3	391,3	391,3	391,3	391,3	391,3	391,3	391,3	391,3	391,3	391,3
Reserves	226,5	259,5	259,5	259,5	259,5	259,5	259,5	259,5	259,1	259,2	259,6	260,2	261,0	262,4
Other	-0,5	-3,0	-3,0	-3,0	-3,0	-3,0	-3,0	-3,0	-3,0	-3,0	-3,0	-3,0	-3,0	-3,0
	751,0	750,4	750,4	750,4	750,4	750,4	750,4	750,4	750,1	750,2	750,6	751,2	751,9	753,4
Total Liabilities and Equity	1.048,0	1.113,8	1.113,8	1.113,8	1.113,8	1.161,4	1.209,0	1.256,6	1.256,3	1.256,3	1.256,7	1.257,3	1.258,1	1.259,6