ASIAN DEVELOPMENT BANK

ENVIRONMENTAL IMPACT ASSESSMENT

FOR

SECOND ROAD IMPROVEMENT PROJECT

IN

VIET NAM

31 May 1996

I. Introduction

1. The Environmental Impact Assessment (EIA) for the Second Road Improvement Project in Viet Nam, of which this Report is a summary, was carried out between March and November 1995. The Project scope is improvement of Highway 1A between the border of the Peoples Republic of China (PRC), near Lang Son City, and Hanoi (km 168).

2. The EIA has been prepared by DMJM International, Inc. and Japan Overseas Consultants Co. Ltd., the consultants for TA No 1997-VIE: Second Road Improvement Project. The assignment was carried out in accordance with the Bank's Terms of Reference (TOR), Phase 2, by an environment specialist. It was done concurrently with the Resettlement Action Plan (RAP), undertaken by the same specialist.

3. The EIA is based on many site visits, meetings with local representatives from Provincial, District and Commune People's Committees, Ministry of Transport (MOT) and its Project Management Unit No 1 (PMU-1) and the Irrigation Company, review of available documentation including master plans of the urban areas through which the Project road passes, regulations and data concerning this project, analysis of old and recent aerial photos, analysis of dwelling units, agricultural survey data and inputs provided by DMJM-JOC's engineering team.

II. Description of the Project

A. Location

4. The Project Road originates at the PRC border crossing point in Lang Son Province. It crosses into Ha Bac Province at km 102, into Hanoi Province at km 161, and is joined by National Highway 5 at km 168. The Project road's southern terminus is just north of the junction with Highway 5. Hereinafter, the length of the road from km 0 to km 100 (the boundary between Ha Bac and Lang Son provinces) is referred to as N1, and the length from km 100 to km 168 is referred to as N2.

B. Design alternatives

5. It had originally been intended that the improvement works would be contained within the existing Right-of-Way (ROW) of the highway (the base case). During the feasibility study phase of the TA, however, alternatives involving substantial lengths of new alignment were investigated. This was because of the high volume of traffic in certain sections, particularly near Hanoi; the presence of a high proportion of non-motorized traffic within the traffic stream; the extensive involuntary resettlement that improvement on the existing alignment would necessitate; the requirements of local authorities; and the low standard geometric alignment of much of the existing road. During the detailed design phase, base case and realignment alternatives were investigated more thoroughly. Many meetings with the Provincial Peoples' Committees, with the Ministry of Transport, PMU-1 and the State Planning Committee were held. Comparisons of each alternative were carried out and discussed with these organizations in order to obtain local agreement to the alignment finally selected. Figure 1 presents a short description of the base case and the recommended alignment. Details of both are provided below.

1. Base Case

6. The base case provides for rehabilitation of the Project road to a two-lane undivided standard on the existing highway from the PRC border to Highway 5 and rehabilitation or replacement of all bridges (15 in total) along the route. Of these bridges, four major ones will be replaced, three of which three are combined road/rail bridges.

2. Base Case with Alternative Alignments to the Base Case (Recommended Alignment)

7. This alignment consists of the base case plus a number of substantial realignments. These will bypass most urban areas along the existing highway. There will also be two major re-alignments. The first will be around the Sai Ho Pass (between km 18 and km 70), to be constructed along the alignment of an abandoned railway. This alternative provides more favorable horizontal and, in particular, vertical geometrics and is 3 km shorter than the existing route. The second will be from north of Bac Giang (km 115) to Highway 5 (km 168). Here there will be a continuous realignment to the east of the existing alignment. This will avoid the almost continuous urban ribbon development that lines both sides of the existing highway through this corridor. The existing highway will continue in service and will accommodate short local trips by motor vehicles as well as the high volume of more local slower-moving traffic — bicycles, livestock and pedestrians, etc. The new highway, initially constructed to 2-lane standard but designed for expansion to six lanes when traffic demand requires this, will service longer distance trips.

C. Summary of the Economic Analysis

8. As summary of the Project's economic analysis, in which the base and recommended alignment alternatives were considered, is provided below. The analysis took into account three types of economic benefits: vehicle operating cost savings, maintenance cost savings, and benefits from generated traffic. The project's economic costs were based upon an adjustment of the following financial costs, together totaling about $208 million: detailed engineering costs (estimated at 3 percent of the construction cost per kilometer), construction supervision costs (estimated at 6 percent of the construction cost), civil works costs, maintenance costs, and resettlement and land acquisition costs. To calculate economic costs, financial costs were reduced by four percent to reflect elimination of taxes. Maintenance costs without the project are based on MOT's estimate of the average cost of maintenance for National Highway 1A. The estimated economic useful life for each of the sections is twenty years with a single bituminous surface treatment in the fifth and fifteenth years and an asphaltic concrete overlay in the tenth year after opening.

9. On this basis, the Economic Internal Rates of Return (EIRRs) computed range from 13 percent for N2 (base case) to 32 percent for N2 (recommended alternative). The recommended alternative alignments have higher EIRRs than the base cases. This is because the existing alignments of the base cases pass through heavily populated areas with severe encroachment on the alignment. Rehabilitation of these alignments could thus incur heavy initial right-of-way and resettlement costs. By order of priority, the highway segments rank as follows:

N2 Recommended Alternative, 2-Lane Undivided	EIRR 32 percent
N1 Recommended Alternative	EIRR 31 percent
N1 Base Case	EIRR 22 percent
N2 Base Case	EIRR 13 percent.

10. The only section which did not demonstrate economic feasibility (EIRR greater than 12 percent) under all of the sensitivity tests applied was the N2 base case, because of the high cost of the right-of-way.

III. Environmental Study for New Alignment Selection

A. Corridor Selection

11. Corridor selection permits the identification of the main characteristics of an area and evaluates the possibility of improving or modifying the existing alignment. This mode of selection is called successive reduction of the territory; corridor analysis is the first step. To be effective, this analysis must first delimit the corridor according to certain parameters. After a rapid examination of the corridor, many alternatives can be determined and evaluated based on technical, economic and environmental factors. The best alternatives can be selected during the second step analysis, which is known as route selection.

B. Route Selection

12. Route selection was one of the most important activities undertaken during the design of the Project road. This activity not only allows many environmental impacts to be avoided, but also improves the technical characteristics of the road. For these reasons, the design consultant's technical and environmental teams have studied alternatives at the existing alignment where the improvement of highway was problematic for environmental (including resettlement and land acquisition) or technical reasons. The main advantages of the recommended alignment are: (i) greatly reduced requirement for involuntary resettlement; (ii) improved road safety; and (iii) a longer life for the road, in terms of capacity, through access control, right of way protection, and separation of local from through traffic.

IV. Description of the Environment

A. Physical Resources

13. The Project road passes through two distinct land forms. Its northern section, from km 0 to about km 100, traverses rolling to mountainous terrain. The road alignment generally follows river valleys, which are oriented north-south. Agricultural activity is largely limited to traditional slash-and-burn methods, practiced by the largely tribal population of the area. The southern section, from about km 100 to km 168, traverses the flat plains of the upper Red River Delta, passing through land that is intensively cultivated for irrigated rice production. Here the road alignment is generally perpendicular to the major rivers, which flow from west to east.

14. The climate of the Project area is tropical monsoon, influenced by the ocean. There are two distinct seasons: dry and rainy. The rainy season is from April to October with 80-100 rainy days providing 1,220-1,520 mm of rainfall. During the rainy season, the rainfall is unevenly distributed, with large storms depositing 200 mm/day (maximum annual) to 700 mm/day (maximum record), and causing floods along the rivers.

15. The following major rivers, all within the plain section, are crossed by the road: Ky Cung, Thuong, Cau and Duong. The months of May, June, July, August, September and October present a high risk of flooding for each of these rivers.

B. Ecological Resources

16. Existing vegetation within the Project road corridor originated with human activities and is not indigenous to the area. About 29 km out of 160.7 km of the length of the corridor are lined with forests and/or brush. The term "forest" as used in this report refers to degraded or secondary forest, most of which consists of low, dry scrub, the aftermath of many years of slash-and-burn agriculture as practiced by the indigenous tribal people. This land is located principally in Lang Son Province.

17. Based on field observations, four rivers present a high level of flow discharge (suspended matter) in the water and important human activity (navigation, harbor activities, borrow pits, dredging, etc.) which are not conducive to good development of aquatic life. Again, much of the sediment discharge is a direct result of the slash-and-burn induced deforestation.

18. Wildlife along the route is limited due to the intense human activity. Except for some small areas near Ban Thy railway station, which also appear to be under severe pressure, no wildlife was observed during the field surveys.

19. According to the Government's statistical publication, the Red Data Book of Vietnam (Hanoi, 1992), there is one rare or endangered species of fish that could be present in the study area of the Project. This is the Ca Mang Gia which has been seen in the Ky Cung River. However, a survey carried out with local people found no trace of this fish species in the study area.

C. Human and Economic Development

20. The district of Gia Lam is the only section of Hanoi City that lies within the Project's study area. This district is divided into 31 communes and 4 small towns, of which only **six** communes (Gia Thuy, Viet Hung, Hoi Xa, Giang Bien, Duong Ha and Ninh Hiep) are affected by the Project. The Project's study area in Ha Bac Province includes Yen Dung and Lang Giang districts, as well as these two towns. In Lang Son Province, the districts of Huu Lung, Chi Lang and Cao Loc, as well as the town of Lang Son and 19 communes are within the Project's study area. The existing road alignment passes through a number of small towns located in each of these districts: Met in Huu Lung, Chi Lang and Dong Mo in Chi Lang, and Dong Dang in Cao Loc. Details of population, land use, and agricultural activities follow.

1. Population

21. The population of Hanoi was estimated to be 2,155,000 in 1993. Within the study area, Ha Bac province has the largest population, with an estimated 2,300,000 people in 1993. Ha Bac is overwhelmingly rural, with approximately 95 percent of the population residing in the countryside and 5 percent in urban centers. Lang Son province had an estimated population of 672,000 in 1993. The urban population was estimated at 85,600, or 12.7 percent. Lang Son Town, with an estimated population of 58,064, comprised almost 70 percent of this figure.

22. Lang Son province, like other highland areas of Vietnam, is dominated by non-Kinh (the dominant Vietnamese ethnic group) ethnic groups. Based on 1987 data, the two largest groups are the Nung (43.7 percent of the population) and the Tay (35.7 percent of the population), with the Kinh comprising a minority population of 14.8 percent.

2. Land use

23. Land use along the Project road's recommended alignment is mainly agricultural, with 105 km of the alignment, out of 161 km, passing through agricultural areas. The area of agricultural land area inside the ROW of the recommended alignment is about 3,500,000 m^2 (350 hectare (ha)), most of which is used for rice cultivation. This is around 75 percent of the land required for the Project.

24. Forest or scrub land comprises 29.0 km, or 677,500 m^2 (68 ha). This is about 15 percent of the land required for the Project. This is all located in Lang Son province.

25. Residential and industrial land comprises 19.7 km of the total and is mainly located in Lang Son province (11.4 km) and Ha Bac province (8.1 km). Urban residential land (Lang Son town, Chi Lang town, Kep town and Dap Cau town) represents 64,500 m^2; residential rural land is 279,800 m^2; and industrial land is 31,000 m^2, together equivalent to about 370,000m^2 (37 ha) or 8 percent of the land required for the Project.

3. Agriculture

26. The Vietnamese economy is solidly based on agriculture, with over 72 percent of its workforce engaged in this form of production. Despite its vast labor supply, however, agriculture remains one of the least developed sectors of the economy, contributing only 29.3 percent of GDP in 1993. Vietnamese agriculture is centered on cereal crop production, with almost 80 percent of cultivated land planted to cereals. Of this land, approximately 85 percent is planted to rice, the country's staple food.

27. Lang Son province, with only 5 percent of its land cultivated to rice, has one of the lowest rates of productivity in the Project area, achieving less than 2.3 tonnes/hectare (t/ha). Ha Bac province has the largest amount of rice lands in the region, at 23 percent of the mountains and midlands total. Productivity is also the highest in the area, at 2.8 t/ha, contributing 26 percent of the area's production. Hanoi has a higher rate of productivity, at 3.1 t/ha, than the primarily agricultural northern provinces due to its location within the Red River delta.

28. Rice production in Vietnam is divided into three different seasonal varieties: spring rice, summer-autumn rice and seasonal rice, planted in the winter. Each of these crops has different natural potential and responds to different environmental factors. Different regions plant these crops in different proportions, depending on their geographical conditions. In the whole of Vietnam, two crops - spring and seasonal rice - are equally important, the former contributing 40 percent to the harvest, and the latter 36 percent. In most areas of Vietnam, these two crops form the basis of the agricultural year. The summer-autumn crop contributes an additional 25 percent.

29. There is a considerable fragmentation of holdings in agricultural land. In the Red River Delta, a typical household farms six separate plots, with the number of plots per household ranging from 1 to 9. This fragmentation permits a high level of inter-household equality. Individual plots range from 24 m^2 to 1,500 m^2. The median field is less than 400 m^2, with 90 percent of plots less than 1,000 m^2. In the study area, in Cao Loc District, one household may have 15-20 plots, some of which are very small (20 m^2), others larger (2,000-3,000 m^2). The average area cultivated per person is 500 to 550 m^2.

V. Anticipated Environmental Impacts and Mitigation Measures

A. Environmental Impacts associated with the Location

1. Encroachment on agricultural land

30. The Project will require 3,500,000 m^2 (350 ha) of agricultural land, mostly located between Bac Giang and Highway 5 (2,400,000 m^2). The number of affected farmers will be very high because one family can have between 6 to 12 plots of land distributed inside a local administrative area. The environmental impact due to the location of the Project will be major negative because the number of affected people will be high. The loss of income will be low for each farmer (estimated at around US$20/year), but this amount of money is considered high for a family with a low income (US$300/year). Mitigation measures to affected people are elaborated in the Resettlement Action Plan (RAP) prepared under the TA.

2. Severance of residential areas

31. Severance of residential areas will affect 24 rural and 4 urban residential areas. The highway will sever urban residential urban areas over a total length of 800m and residential rural areas over a total length of 4,390m. These environmental impacts are considered minor negative because they affect an important population and increase to some extent the risk of accidents on the highway.

3. Disruption of agricultural activities

32. According to the TA's agricultural survey, the 6 to 12 plots of land belonging to the farmer are located within 600 m of his house. Thus, the environmental impact could affect the population located on a 600 m band on each side of the new highway. This is a major negative environmental impact particularly in the section between Bac Giang and Highway 5, where the new highway will have access control (no access for population, animals and slow-moving vehicles for 52 km). Mitigation measures included in the Project design, to decrease the disruption of agricultural activities, to prevent accidents along the highway and to assure a high level of service for this road, include 39 rural road farm crossings under the new highway (subways), between Bac Giang and Highway 5. As the new highway is relatively close to the existing one, this solution will separate slow-moving from fast-moving vehicles. The total cost of this mitigation measure will be about US$1,500,000. The residual impact will be minor negative.

4. Economic Impacts

33. The economic impact of this new highway will be major positive (see para 8). Presently, the traffic at the border is increasing rapidly. Indicative of the Lang Son area's growth are the provincial revenues. These have increased from VND 25 billion in 1991 to VND 251 billion in 1994 and are estimated to have been VND 400 billion in 1995. Improvement of the highway and the border area will facilitate more exchange and economic activity with China.

B. Environmental Impacts associated with the Design

1. Slope erosion

34. Cau Bridge (km 132.25) and Duong Bridge (km 156.4) will be located in the plain portion of the Project area, and will be subject to annual flooding of varying severity. To control erosion and to prevent any environmental impacts as a result of the modification of the river sections at the bridge sites, the Project designs include appropriate river bank protection and river training works.

35. Along the Thuong river, located in the mountainous northern section of the Project road, the old railway embankment that will form the formation of the new Project road alignment is located close to the river (from km 29.7 to km 50). The steepness of the embankment is very important in many places where slope erosion is active. With the Project, the existing embankment must be enlarged and encroachment on the river will be necessary in some locations. Potential erosion will be more important after the Project because the section of the river will be reduced. Around 600m in the area in contact with the river will require slope protection. These impacts are assessed as major negative or intermediate negative depending on the location. Mitigation measures, principally gabion retaining walls, have been integrated into the Project design. Once these have been constructed, the residual impact will be minor negative. However, where erosion is presently occurring, and will be arrested by the Project's mitigation measures, the residual impact will be minor positive.

2. Road Safety

36. To ensure the new highway conforms to acceptable international road safety standards, appropriate intersections with national, provincial and local roads have been designed. Maps included in the detailed EIA report provide recommendations for more than 100 existing or future intersections with the Project road.

C. Environmental Impacts associated with the Pre-construction stage

37. During the pre-construction stage, the main impacts will concern land acquisition the road itself, and for dwelling units, for modified irrigation infrastructure, and for drainage infrastructure. These activities must be well-advanced, for the section inside the Project road's ROW, before construction commences.

1. Land Acquisition (Resettlement)

38. The impact of resettlement is major and has been detailed in the RAP (Resettlement Action Plan). Presently, the number of PAP's (Project Affected People) is estimated at 3,420 (960 households). The relocation of PAP's within a specific area must have been completed before construction works commence in that area.

2. Land Acquisition (Land)

39. Land acquisition compensation costs including residential, agricultural and forest land is estimated at US$11,600,000. The mitigation measures for this major negative impact are described in detail in the RAP Report.

40. Land Acquisition will also affect agricultural activities. Farmers will have to change their activities on the plots impacted before construction commences. Considering the number of affected farmers, this impact on agricultural activities is considered as major negative. Land acquisition in a particular section of the Project road must have been completed before construction commences. The RAP report established appropriate ways to compensate the affected farmers. Provided that the RAP is implemented as agreed, there should be no residual impact.

3. Land Acquisition (Irrigation and drainage)

41. On agricultural land, the Project will affect indirectly a large number of farmers outside of the ROW due to the modification of the irrigation and drainage system. The affected irrigation canals and structures are shown on the contract drawings, as are the details of the necessary modifications, and realignments. The local authorities will be required to coordinate closely with the supervising consultant and construction contractors to assure a continuous supply of water to the affected farmers during irrigation seasons through the construction of new or temporary canals, temporary pumps, and modification of the gradient of residual plots of land. The necessary relocation of canals is included in the scope of its relevant civil work contracts. In order to mitigate the effects of these modifications on the irrigation/drainage system, whenever possible this work will be carried out during the months when the irrigation system is closed for maintenance. The impact on population and agricultural activities is potentially major negative due to the high number of affected people, the low income of the farmers and their high level of dependence on agricultural production. However, provided that the measures incorporated in the contract documents are implemented correctly, there will be no residual impact.

D. Environmental Impacts associated with the Construction stage

42. As is typical for contracts of this nature, only preliminary information is available at this time as to location of borrow pits, location of temporary roads, periods of the year for construction, traffic control requirements, etc. There will be environmental impacts associated with each of these. However, the contract documentation is clear in regard to the measures to be taken to mitigate the resulting environmental impacts. For more information in this regard, the readers' attention is drawn to the following portions of the documentation. The remainder of this section describes a range of construction period impacts and the mitigation methods to be adopted for each.

Technical Specifications

- Section 113 - Occupational Safety and Health
- Section 108 - Control of Traffic
- Section 116 - Cleaning
- Section 203 - Excavation and Embankment
- Section 615 - Routine Maintenance of Adjacent Roads and Bridges

Conditions of Contract

- Clause 45.1 - Restriction on Working Hours
- Clause 32.1 - Contractor to Keep Site Clear

1. Air quality (dust)

43. Construction works include all activities inside the ROW, at borrow pits, and asphalt plants. Dust will be a nuisance created by all of these to a greater or lesser extent, and will affect air quality. Moreover, warm temperatures and the presence of heavy traffic on the roads supply excellent conditions to create a high level of dust in the atmosphere. To mitigate this intermediate impact, measures have been proposed, including frequent watering of permanent and temporary roads, and appropriate construction scheduling techniques.

2. Noise

44. Although for most of its length the Project road passes through open or relatively sparsely populated country, there are some areas where population densities are higher and where, as a consequence, noise impacts during construction could be a problem. To attenuate these intermediate impacts, two mitigation measures have been included in the contract documentation: a limit on night time work in populated areas, and the requirement that equipment be fitted with functioning mufflers.

3. Soil quality

45. Topsoil material resulting from stripping or associated operations will be stockpiled in areas approved by the supervision consultant and reused for slopes according to the technical specifications. In case of a surplus, topsoil should be offered to the local authorities to fill and restore ponds along irrigation and drainage channels or on other communal areas. This mitigation measure will be coordinated so that it will assist in the relocation of affected farmers.

4. Irrigation and/or drainage channels

46. The Project road crosses more than 100 irrigation and/or drainage channels and 46 rivers or streams all of which are essential for agricultural activities. Construction activities risk causing a major modification of surface water hydrology and water quality. Considering the number of potentially affected people, this modification will generate a major negative environmental impact on agricultural activities and population. Mitigation measures, concerning irrigation and/or drainage channels elaborated in this report must be implemented by the contractor to decrease the magnitude of this impact. The residual environmental impact will be minor with respect to the mitigation measures. Environmental monitoring will be necessary to minimize the impacts of construction works. This is included in the scope of the construction supervisor consultant.

5. Traffic disturbance

47. Traffic disturbance will be important during construction works all along the section of the existing highway being rehabilitated. In some locations disturbance of traffic will be great. Traffic control by local authorities, and by the contractor where appropriate, will be essential in order to decrease the impact of construction works on the population. The contract documentation provides for this.

E. Specific Impacts associated with Bridge Construction

48. The construction of the Project's bridges may create an intermediate negative environmental impact. Bridge construction can affect river navigation, population (noise, dust, agricultural activities, etc.), aquatic biology (erosion and siltation, etc.) and infrastructure. General mitigation measures for the bridges are elaborated in the EIA report. Moreover, specific mitigation measures will be applied according to the location of a particular bridge. These mitigation measures will reduce the general residual environmental impact to minor negative.

49. In the Thuong valley (about km 30 to km 50), through which the Sai Ho pass realignment passes, a number of small bridges will be constructed over the river. The water quality is good in this section and the potential for aquatic life is high. Moreover, this water is used all along the river for irrigation and, in some locations, for electricity supply. As this river has many meanders, the Project must build 8 permanent bridges. In addition, it may be necessary to construct up to three temporary bridges for the contractor's access, and to avoid fording the river. Specific mitigation measures are included in the contract documents. The contract must be administered so that they are implemented during the construction stage. These mitigation measures will reduce the residual environmental impact created by the construction of these bridges to minor negative.

F. Environmental Impacts associated with Temporary Infrastructure

50. Specific environmental impacts associated with temporary works, such as temporary roads, quarries, borrow pits, asphalt plants, stockpiles, etc., cannot be assessed at this stage of the study, since the locations of most these will be known only when the contractor submits his work program and method statement. These temporary construction works could create more negative impacts than the other activities if they are not properly controlled. They are dealt with in detail in the contract documentation. Judicious selection for any temporary infrastructure will be carried out in collaboration with the environmental monitoring specialist who will be part of the supervision consultant's organization.

G. Environmental Impacts associated with the Operation stage

1. Maintenance

51. Maintenance work generates positive impacts, eliminating or reducing environmental problems caused by the deterioration of road surfaces, drains, and roadsides. The most important mitigation measure related to this activity is to make sure that maintenance is done, so that the environmental features built into the road design operate effectively.

2. Traffic

52. Traffic flow will be greatly improved with the Project. This modification of the traffic will generate a major positive economic impact throughout the Project area. To maintain and to improve this impact, the Government will have to keep a strict control on the access to the new highway, particularly in the southern plain section, where the growth of Hanoi city will result in ribbon development unless there is adequate urban planning.

3. Road safety

53. Road safety will be improved with the Project, in particular for the section of the road located along the Bac Giang - Highway 5 bypass and the Sai Ho Pass bypass. The environmental impacts will be positive and major. The main characteristic of this project is the separation of slow-moving from fast-moving vehicles, without creating a negative impact on the traffic. By banning the slow-moving vehicles on the new highway through establishing a minimum speed limit (40 km/hr), the safety of this section of the road will be greatly increased. The Project will also have a positive impact on the old, existing highway, by moving the fast-moving vehicles to the new highway. To maintain this improvement in the long term, the Government will control access of the new highway.

VI. Alternatives

54. Subsequent to completion of the field surveys and topographical work, new aerial photography was made available to the design team. Upon study of these photos, and comparison with ground observations, several locations were identified where it was felt that potential improvements in the environmental impacts as well as the final design alignment could be achieved. This section will be further studied by the supervising consultant, to “fine-tune” the final alignment, immediately prior to construction. The contract documentation includes this provision. The total length of alignment involved is not significant and will not seriously affect the cost of the project. The locations suggested for further study are as follows:

- From km 47.7 to 49.5, study the possibility of bypassing the area close to the Thuong River, an irrigation channel and a hill. A bypass is possible on the east side of the hill in a valley. This bypass could decrease the potential negative environmental impact on the irrigation channel, if it cannot be otherwise controlled by appropriate measures included in the present design.

- From km 75.9 to 77.6, study the possibility of bypassing the small urban area. This bypass will help to avoid the resettlement of 20 households and will decrease the risk of accidents in this section of the road. In this area, particular attention should be given to a small river adjacent to the alignment. The water quality of this stream appear to be particularly good.

- From km 85.0 to 86.5, study another location of a bypass to the south of the recommended alignment. The presently imposed alignment will create some severance in a small residential area. It also passes close to an existing school and affects a number of households along the existing highway. For these reasons, a new location south of the recommended alignment, that would avoid these problems and also improve the geometry of the road, should be examined.

- From km 102.8 to 104.2, investigate whether the recommended alignment could be closer to the existing highway than the present design. This mitigation measure will avoid severing a small village which is located more than 30m from the existing highway, and will also avoid disrupting agricultural activities. In order to improve the security on the new highway, a small road should be built very close to the west side of the railway and joined with only two accesses to the new highway. A barrier between the new highway and the railway would control access through this residential area.

- From km 150.5 to 150.6, modify the recommended alignment to avoid resettlement of a section of a small village. The location of the new highway should be better on the west side of the irrigation channel through this section of the highway (between km 149.9 and 150.9).

VII. Institutional Requirements and Environmental Monitoring Program

55. During the environmental monitoring for the construction stage, a domestic team will be selected and trained by the environmental specialist. This team, directed by the consultant, will monitor all the construction activities. These team members will have a background in engineering and environmental studies and will become the core MOT's EIA monitoring capability, something which it does not possess at present.

56. The environmental monitoring activities will be included in the Project's monthly progress reports.

57. The Terms of Reference for the supervision consultant provide for 16 months of international specialist input over the 36 month construction period. In addition it will be necessary to provide preconstruction monitoring for the resettlement activities for an additional 12 months for a total of 28 months. The estimated cost of these services will be about US$572,000. This estimate includes the presence of an environmental expert during this period, 2 domestic counterparts, and allowances and vehicles for this period of time.

VIII. Public Involvement

58. During this study, many meetings with Province, District, Commune People's Committees were held. These meetings, particularly with the Commune People's Committees, were very helpful. Authorities of these local committees are close to their people and usually understand their needs.

IX. Conclusion

59. This Environmental Impact Assessment was carried out in conjunction with the detailed design phase of the TA. Route selection and detailed alignment was a joint effort by engineering and environmental specialists. For this reason, route selection has integrated environmental criteria.

60. The major positive environmental impact anticipated by the Project will be economic. Improvement of the highway and the border area will facilitate more trade and economic activity with China. In Lang Son Province, the influence of the exchange with China has resulted in increased provincial growth in the period 1994-1995. Travel time between the border and Hanoi will be reduced by more than two hours.

61. Improvement of road safety will be another major positive environmental impact of the Project. This concept used for the first section of Highway 1, between North Bac Giang and Highway 5 (52 km), controls access to the highway and separates slow-moving from fast-moving vehicles. By banning the slow-moving vehicles on the freeway through establishing a minimum speed limit (40 km/hr), the safety of this section of the road will be greatly increased. The Project will also have a positive impact on the old existing highway by moving fast-moving vehicles to the

new highway. To maintain this improvement on a long term, MOT must control the access to this new highway.

62. Resettlement and land acquisition (including encroachment on agricultural land) are the most important major negative environmental impacts of the Project, followed by disruption of agricultural activities (see next para). The number of PAPs is estimated at 3,420 (960 households). The Project will require a total of 3,500,000 m^2 of agricultural land, mainly located in the plains area (2,400,000m^2). The RAP report has proposed a range of mitigation measures and policies to relocate and compensate these PAPs. The estimated cost for resettlement and land acquisition is US$15,000,000.

63. Disruption of agricultural activities will affect a large portion of the Project area's population. The agricultural survey carried out during the study indicated that the land belonging to the farmer (more correctly, the land to which he holds right of use) is divided into 6 to 12 plots located within 600 m of his house. This environmental impact could affect the population located on a 600 m band on each side of the new highway. This is a major negative environmental impact, particularly in the section between Bac Giang and Highway 5 where the new highway will have full access control (no access for pedestrians, animals and slow-moving vehicles for 52 km). To minimize the disturbance for the population of the area through which this length of the road passes, in particular to reduce the severance impact, and to prevent accidents, the Project designs provide for 39 rural road farm crossings under the new highway. In addition, there will be road underpasses constructed as part of the new bridges provided through this length of the Project road. The cost of this mitigation measure will be about US$1,500,000. The residual impact will be minor negative.

64. Potential erosion will create a major or intermediate negative environmental impact depending on the location. The Thuong River will be particularly affected by the construction works. Potential erosion will be more important after the Project because the section of the river will be reduced. Around 600m of the area in contact with the river will require slope protection, for which provision has been made in the Project designs. Residual environmental impact will be minor negative and in some cases minor positive where erosion is already active.

65. Construction works, including bridge construction, will generate a number of negative environmental impacts. Many environmental impacts that will be generated during this period cannot be assessed at this moment, because these sites have not been identified and/or information concerning the period and the duration of these activities is not available. The temporary construction works could create more impacts than the other activities related to the Project. For this reason, environmental monitoring will be required. The duration of this activity will be 28 months including pre-construction and construction stages and is estimated to cost US$ 572,000.

66. Based on aerial photography acquired late in the design period, there appears to scope for improving the recommended alignment over some short lengths. This will be studied further by the design consultant.