



# Completion Report

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Project Number: 29472  
Loan Number: 1876  
August 2011

## Nepal: Road Network Development Project

Asian Development Bank

## CURRENCY EQUIVALENTS

Currency Unit		–	Nepalese rupee/s (NRe/NRs)
		<b>At Appraisal</b>	<b>At Project Completion</b>
		27 June 2001	29 June 2010
NRs1.00	=	\$0.0133	\$0.0135
\$1.00	=	NRs75.18	NRs73.93

## ABBREVIATIONS

ADB	–	Asian Development Bank
AADT	–	annual average daily traffic
ARMP	–	annual road maintenance plan
DOR	–	Department of Roads
DFID	–	Department for International Development of the United Kingdom
EIRR	–	economic internal rate of return
EWB	–	East–West Highway
ICB	–	international competitive bidding
ha	–	hectare
km	–	kilometer
MPPW	–	Ministry of Physical Planning and Works
NCB	–	national competitive bidding
NGO	–	nongovernment organization
PBM	–	performance-based maintenance
RAP	–	Rural Access Program
SCF	–	standard conversion factor
SDR	–	special drawing right
TA	–	technical assistance
VOC	–	vehicle operating cost

## NOTES

- (i) The fiscal year (FY) of the government ends on 15 July. FY before a calendar year denotes the year in which the fiscal year ends, e.g., FY2011 ends on 15 July 2011.
- (ii) In this report, "\$" refers to US dollars.

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## BASIC DATA

### A. Loan Identification

1.	Country	Nepal
2.	Loan number	1876
3.	Project title	Road Network Development Project
4.	Borrower	Nepal
5.	Executing agency	Ministry of Physical Planning and Works
6.	Amount of loan	SDR35,686,000.00
7.	Project completion report number	1252

### B. Loan Data

1.	Appraisal	
	– Date started	27 June 2001
	– Date completed	11 July 2001
2.	Loan negotiations	
	– Date started	9 October 2001
	– Date completed	11 October 2001
3.	Date of Board approval	13 December 2001
4.	Date of loan agreement	10 December 2002
5.	Date of loan effectiveness	
	– In loan agreement	8 March 2003
	– Actual	11 March 2003
	– Number of extensions	None
6.	Closing date	
	– In loan agreement	31 December 2007
	– Actual	11 January 2010
	– Number of extensions	2
7.	Terms of loan	
	– Interest rate	1% per annum during the grace period and 1.5% per annum thereafter
	– Maturity (number of years)	32
	– Grace period (number of years)	8
8.	Terms of relending (if any)	Not applicable
	– Interest rate	
	– Maturity (number of years)	
	– Grace period (number of years)	
	– Second-step borrower	

9. Disbursements  
a. Dates

Initial Disbursement	Final Disbursement	Time Interval
16 July 2003	3 December 2009	77 months
Effective Date	Original Closing Date	Time Interval
11 March 2003	31 December 2007	58 months

b. Amount (SDR'000)

Category or Subloan	Original Allocation	Partial Cancellation	Last Revised Allocation	Amount Disbursed	Undisbursed Balance
Civil works – A and E	11,481	3,034	8,447	6,881	1,566
Civil works – B (I), B (V), and G	9,542	(4,835)	14,377	13,460	917
Civil work – D	2,017	(445)	2,462	2,230	232
Equipment	233	115	118	118	0
Consulting services	4,421	(1,993)	6,414	6,305	109
Interest charge	1,164	0	1,164	685	479
Unallocated	6,828	6,814	14	0	14
<b>Total (SDR'000)</b>	<b>35,686</b>	<b>2,690</b>	<b>32,996</b>	<b>29,679</b>	<b>3,317</b>
<b>Total (\$'000)</b>	<b>46,000</b>	<b>4,003</b>		<b>45,062</b>	<b>5,186</b>

( ) = negative

10. Local costs (financed)	
- Amount (\$)	5,890.00
- Percent of local costs	62.29
- Percent of total cost	13.07

**C. Project Data**

1. Project cost (\$ '000)

Cost	Appraisal Estimate	Actual
Foreign exchange cost	38,000	39,172
Local currency cost	8,000	5,890
<b>Total</b>	<b>46,000</b>	<b>45,062</b>

## 2. Financing plan (\$'000)

<b>Cost</b>	<b>Appraisal Estimate</b>	<b>Actual</b>
Implementation costs		
Borrower financed	13,900	12,949
ADB financed	46,000	44,377
Other external financing	9,600	8,400
<b>Total</b>		
IDC costs		
Borrower financed		
ADB financed	0	685
Other external financing	<b>69,500</b>	<b>66,411</b>
<b>Total</b>		

ADB = Asian Development Bank, IDC = interest during construction.

## 3. Cost breakdown by project component (\$'000)

<b>Component</b>	<b>Appraisal Estimate</b>	<b>Actual</b>
Land acquisition and resettlement	500	0
East–West highway strengthening	17,000	13,185
Road improvement	17,700	25,445
Feeder road construction	9,200	10,500
Performance-based maintenance	4,000	5,342
Cross-border access road	1,500	0
Road safety and axle-load control	400	202
Community facilities or poverty intervention	500	0
Consulting services	5,700	10,695
Project management	1,000	0
Contingencies	10,500	0
Interest charge	1,500	1,042
<b>Total</b>	<b>69,500</b>	<b>66,411</b>

## 4. Project schedule

<b>Item</b>	<b>Appraisal Estimate</b>	<b>Actual</b>
Date of contract with consultants	31 March 2002	19 June 2003
Completion of engineering designs	31 March 2003	30 April 2006
Civil works contract		
Date of award	31 May 2003	16 February 2005
Completion of work	31 December 2007	30 June 2009
Equipment and supplies		
Dates		
First procurement		15 December 2005
Last procurement		16 May 2007
Completion of equipment installation		30 June 2009
Start of operations		
Completion of tests and commissioning		
Beginning of start-up		
Other milestones		
First partial loan cancellation		5 October 2006
Second partial loan cancellation		13 February 2009
Final loan cancellation		11 January 2010

## 5. Project performance report ratings

Implementation Period	Ratings	
	Development Objectives	Implementation Progress
From 30 December 2001 to 29 April 2002	Satisfactory	Satisfactory
From 30 April 2002 to 30 March 2003	Satisfactory	Unsatisfactory
From 1 April 2003 to 31 December 2003	Satisfactory	Highly Satisfactory
From 1 January 2004 to 31 December 2004	Satisfactory	Satisfactory
From 1 January 2005 to 31 December 2005	Satisfactory	Satisfactory
From 1 January 2006 to 31 December 2006	Satisfactory	Satisfactory
From 1 January 2007 to 31 December 2007	Satisfactory	Satisfactory
From 1 January 2008 to 31 December 2008	Satisfactory	Satisfactory
From 1 January 2009 to 30 June 2009	Satisfactory	Satisfactory

## D. Data on Asian Development Bank Missions

Name of Mission	Date	No. of Persons	No. of Person-Days	Specialization of Members
Fact-finding	19 March–7 April 2001	5	90	a, b, c, d, e
Appraisal	27 June–11 July 2001	5	70	a, b, d, f, g
Consultation	1–3 May 2003	2	3	a, h
Inception	22–26 September 2003	2	10	a, i
Review 1	13–17 December 2004	2	10	a, i
Review 2	1–9 May 2005	6	27	a, j, k, l, m, n
Review 3	8–21 November 2005	3	23	a, j, q
Review 4	23–31 January 2006	2	16	a, k
Midterm Review	26 May–13 June 2006	4		a, k, o, r
Review 5	19–28 September 2006	2	15	a, o
Review 6	9–20 April 2007	3	35	a, o, p
Review 7	26 September–11 October 2007	4	40	a, j, q, r
Review 8	2–13 June 2008	3	36	a, o, r
Review 9	13–24 October 2008	5	45	a, k, o, q, r
Review 10	1–18 June 2009	4	45	a, o, r, s
Project completion review	28 June–13 July 2010	2	30	a, o

a = mission leader, b = senior environment specialist, c = senior programs officer, d = resettlement specialist, e = senior project economist, f = transport specialist, g = counsel, h = project specialist, i = associate project analyst, j = country director, k = head, project administration unit, l = economics officer, m = program and project implementation officer, n = senior administrative assistant, o = assistant project analyst, p = procurement officer, q = senior country specialist, r = assistant disbursement analyst, s = project implementation officer.

## I. PROJECT DESCRIPTION

1. Efficient transport—and in particular improved access—is one of the keys to economic development and poverty reduction. Investment in roads is part of a continuous program of the Government of Nepal supporting the development of an integrated and reliable road network in the country. The government requested (i) the improvement of feeder roads to an all-weather maintainable standard to enable effective communications to serve major agricultural production centers and other socioeconomic facilities; (ii) the construction of a new access road connecting district headquarters to establish an effective connection between district communities and the national road network; (iii) strengthening of the East–West Highway (EWH) to support domestic trade and promote subregional activities in Nepal; and (iv) institutional capacity strengthening for preserving the existing road network through proper and timely maintenance in order to improve the road network's efficiency. In response to the government's request, the Asian Development Bank (ADB) approved technical assistance (TA) in 1997 to prepare an investment project.<sup>1</sup>

2. ADB approved a loan of SDR35.7 million (\$46 million equivalent) for the Road Network Development Project on 13 December 2001.<sup>2</sup> The project's main objective was promotion of economic growth in the project areas, with the anticipated outcomes of (i) increased efficiency in the movement of people and goods; (ii) improved access of the poor to social services and markets; and (iii) increased employment opportunities, leading to poverty reduction.

3. These objectives were to be achieved by (i) maintaining, improving, and developing the road network to induce more efficient movement of goods and passengers and to provide better access to income, employment opportunities, education, and health facilities; (ii) improving public sector implementation and maintenance capacity in the road sector; (iii) supporting development of private sector capabilities to carry out road improvement and maintenance by contract; (iv) improving road safety and axle load control; and (v) providing community access and complementary facilities through a participatory approach leading to poverty reduction.

4. The seven following components were envisaged during appraisal:

- (i) **Part A: East–West Highway strengthening.** This included strengthening of pavement on an approximately 140 kilometer (km) section of EWH, from Belbari to Chuharwa.
- (ii) **Part B: Roads improvement.** This included improvement of approximately 165 km of feeder roads and important district roads in the hills, namely, (a) Dolalghat–Chautara, 25 km; (b) Pouwa Bhanjyang–Phidim, 24 km; (c) Hile–Basantpur, 26 km, in the Terai regions; (d) Biratnagar–Bardanga, 39 km; (e) Urlabari–Bardanga, 28 km; and (f) Damak–Gauriganj, 22 km, to an all-weather paved surface.
- (iii) **Part C: Feeder road construction.** This included construction of about 96 km of feeder road to connect Basantpur and Khandbari<sup>3</sup> (the district headquarters of Sankhuwasabha District).
- (iv) **Part D: Performance-based maintenance.** This included development of a 3-year road maintenance program in EWH, and provision of finance for the first year of maintenance of an approximately 200–300 km-long section of EWH

<sup>1</sup> ADB. 1997. *Technical Assistance to the Kingdom of Nepal for the Fourth Road Improvement Project*. Manila.

<sup>2</sup> ADB. 2001. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the Road Network Development Project*. Manila.

<sup>3</sup> This section was funded by Department for International Development of the United Kingdom (DFID).

- through performance-based maintenance (PBM) contracts; the roads to be maintained were to be selected from the annual road maintenance plan (ARMP).
- (v) **Part E: Cross-border access road improvement.** This was to improve an access road of about 10 km to the border crossing at Kakarbhitta.
  - (vi) **Part F: Road safety and axle-load control.** This included (a) road safety civil works at selected accident-prone areas or black spots, and axle-load measurement along the project roads and at selected cross-border locations in accordance with ADB's Road Safety Guidelines for the Asian and Pacific Region; and (b) training for public awareness on road safety improvement.
  - (vii) **Part G: Poverty intervention.** This included support of physical interventions to improve rural accessibility for poor and socially excluded people by constructing tracks, trails, footpaths, pedestrian bridges, slope protection, bus station or stops, and markets at community-selected locations to meet their domestic, economic, and social needs; and social development interventions to ensure that the poorest and socially excluded people could benefit from the longer-term socioeconomic opportunities associated with the road.

5. The Ministry of Physical Planning and Works (MPPW) was the executing agency and the Department of Roads (DOR) was the implementing agency. The project was originally envisaged to be implemented over 5 years, with an original loan closing date of 31 December 2007. At the request of the government, ADB extended the loan closing date by 18 months from 31 December 2007 to 30 June 2009 due to (i) the delayed recruitment of consultants, (ii) frequent unrest in Terai region, and (iii) the Koshi flood in August 2008.

## II. EVALUATION OF DESIGN AND IMPLEMENTATION

### A. Relevance of Design and Formulation

6. The project's overall design and formulation was consistent with the government's strategy outlined in Priority Investment Plan 1997–2006, the Ninth Five Year Plan (1997–2001), the Tenth Five Year Plan (2002–2007),<sup>4</sup> and the Three Year Interim Plan (2008–2010). Since the 1970s, the government's main objective within the road sector has been the completion of a strategic road network. Major elements of these plans and programs include (i) repair, maintenance, and rehabilitation of highways and feeder roads; (ii) low-cost construction of the roads to district headquarters yet to be connected to a road network; and (iii) labor-oriented construction methods geared to maximize local participation and address poverty reduction.

7. The project was consistent with ADB's country operational strategy, 1999–2002 for Nepal at the time of approval.<sup>5</sup> The overall objective of the strategy was poverty reduction through broad-based economic growth. Overall, project preparation and formulation were adequate. The relevance of the project design is adequately established by better access to the district headquarters of Sankhuwasabha district (Khandbari), a decrease in vehicle operating cost (VOC), reduction in travel time cost, better access to market and service centers, and increased employment opportunities in areas with project road sections. The project scope and components were relevant to achieving the intended project outcome of increased efficiency in the movement of people and goods, improved access of the poor to social services and markets, and increased employment opportunities.

<sup>4</sup> The Tenth Five Year Plan was also the poverty reduction strategy paper of the government.

<sup>5</sup> ADB. 2000. *Country Operational Strategy: Nepal, 1999–2002*. Manila.

8. MPPW and DOR were fully involved in the project design and formulation, and the roles and responsibilities of MPPW and DOR during project implementation were defined through extensive dialogue between ADB and the government. The project implemented all the components as envisaged during appraisal except Part E (cross-border access road improvement); the following modifications were made to the other components during implementation:

- (i) The Basantapur–Mudhe road section was removed from Part C and added to Part B.
- (ii) Construction of the Piluwa Khola Bridge on the Basantpur-Khandbari road section was also added to Part B (the project originally includes no funding for the construction of the bridge required on the Basantpur–Khandbari road section).
- (iii) The length of Part C was reduced from 94 km (from the survey and final design) to 62.5 km, commencing at Mudhe Sanischare and ending at Sabha Khola.
- (iv) The scope of work in Part A was modified, as the progress of work was adversely affected by frequent unrest in the Terai region.

## **B. Project Outputs**

9. The outputs anticipated during appraisal were improved road infrastructure and maintenance, including (i) pavement strengthening on about 140 km of the EWH, (ii) upgrading of about 165 km of feeder and district roads to an all-weather paved surface, (iii) constructing a district headquarters access road of about 96 km, and (iv) maintaining 200–300 km of EWH road sections through PBM contracts. Actual project outputs are described in Appendixes 1 and 2.

### **1. Part A: East–West Highway Strengthening**

10. The project intended to strengthen the pavement on 140 km of the EWH (from Belbari to Chuharwa). At appraisal, it was envisaged the work on EWH would be implemented under two international competitive bidding (ICB) contracts, but during implementation a decision was made to implement this as a single ICB contract. The overall implementation of this component was generally satisfactory. However, the scope of the work had to be modified, because (i) work progress was adversely affected by the unrest in Terai region; (ii) variations were issued that (a) modified the methodology in the two reconstruction areas from complete reconstruction to composite overlay; and (b) omitted the scheduled bituminous overlay in two stretches, totaling approximately 37 km, which instead were to be patched and provided with a single bituminous surface treatment; and (iii) damage done to the road by the Koshi flood in August 2008. Of the 140 km road section, 93 km were fully strengthened with an asphalt overlay, but the remaining 47 km will be maintained with patch works by the government through its own resources, as the ADB-financed contract was terminated on mutual agreement between DOR and the contractor. The unrest in Terai and additional demands by local groups hindered part A progress and led to termination of the contract by mutual agreement. At the request of the government, and given the strategic importance of the EWH, the remaining 47 km of the road section have been included under ADB's Subregional Transport Enhancement Project.<sup>6</sup>

<sup>6</sup> ADB. 2010. *Report and Recommendation of the President to the Board of Directors: Proposed Loan and Grant to Nepal for the Subregional Transport Enhancement Project*. Manila (Loan 2685-NEP and Grant 0225-NEP).

## 2. Part B: Roads Improvement

11. The project was designed to upgrade about 165 km of feeder and important district roads in the Hill<sup>7</sup> and Terai regions to all-weather paved roads. Twelve national competitive bidding (NCB) packages and one ICB package were awarded for the improvement of feeder roads. The three Terai roads<sup>8</sup> were constructed using DOR feeder road design standards, which involved improvement of existing roads. In the Biratnagar–Bardanga and Urlabari–Bardanga road sections, land acquisition and compensation affected the ability to meet the required minimum radius for horizontal curves in a number of places,<sup>9</sup> while in the Damak–Gauriganj road section the design standards were completely met. However, the design of the roads in the Hill region could not conform to DOR's standard. In many instances the work involved improvement of existing roads rather than construction of new roads, and many of the standards either could not be achieved, or could be achieved only at huge extra financial and environmental cost. Modified standards were adopted in several locations as a result.

12. The Hile–Basantapur (26 km) and Basantapur–Mudhe (13 km) road sections were also constructed as part of this component, with financing from ADB instead of the Department for International Development of the United Kingdom (DFID), as this road section had to be constructed as black top surface through the contractor based approach and was not appropriate for DFID's RAP approach (labor based). A total of 177 km of feeder and district roads were upgraded in the Hill and Terai regions.

## 3. Part C: Feeder Road Construction

13. The Government of the United Kingdom, acting through DFID, made available to ADB a grant (TA for Road Network Development Project)<sup>10</sup> from the technical cooperation funds of the Nepal Rural Access Program (RAP); the grant was for a sum not exceeding £7,064,000.00 (equivalent to \$9.6 million) to assist in the implementation of the Hile–Basantapur–Khandbari feeder road as set out in the RAP project document<sup>11</sup> and ADB project document for Road Network Development Project. A tripartite memorandum of understanding was signed between ADB, DFID, and the Nepal's Ministry of Finance on 17 November 2003, with a TA closing date of 31 December 2007. This component included construction of about 96 km of feeder road to connect the district headquarters of Sankhuwasabha district (Khandbari) to the road network.

14. In 2004, it was agreed that the Hile–Basantapur–Mudhe road section should be changed from labor-based construction to contractor construction, and the Mudhe–Sabha Khola road section should be built to a sealed gravel (otta-seal) instead of labor-based construction standard. DFID requested that ADB finance the Hile–Basantapur (26 km) and Basantapur–Mudhe (13 km) road sections. This change was approved by ADB on 10 March 2005 and the construction of the Hile–Basantapur and Basantapur–Mudhe road sections undertaken through Part B.

15. In 2005, DFID reduced \$1.2 million under the TA. An amendment to the memorandum of understanding was signed on 13 July 2005, which included (i) the reduction in the total cost, (ii)

<sup>7</sup> Pouwa Bhanjyang–Phidim (24 km) and Dolalghat–Chautara (25 km).

<sup>8</sup> Biratnagar–Bardanga (39 km), Urlabari–Bardanga (28 km), and Damak–Gauriganj (22 km).

<sup>9</sup> Ten out of 300 curves (3.3%) have a radius less than 70 meters in the Biratnagar–Bardanga road section, and 14 of 213 curves (6.6%) have a radius below 70 meters radius in the Urlabari–Bardanga road section.

<sup>10</sup> ADB. 2001. *Technical Assistance to the Kingdom of Nepal for Road Network Development Project*. Manila (TA 3785-NEP).

<sup>11</sup> DFID Nepal. 2000. *Nepal Rural Access Programme – Program Document PRC (00 – 38)*. Kathmandu.

change in scope for the road construction method, and (iii) extension of the closing date from 31 December 2007 to 31 December 2008. The construction of the road was initially implemented through road building groups, following procedures adopted by RAP. The road building groups were formed with the help of the partner nongovernment organizations (NGOs) under RAP. An operations manual was prepared and used for project implementation to ensure the approach was consistent with existing DOR procedures.

16. The alignment of the Mudhe–Khadbari road section necessitated the construction of two large bridges—at Piluwa Khola and Sabha Khola—to connect district headquarters (Khandbari) to the road network. The project originally did not allocate any funds for construction of the two bridges required on the Basantpur–Khandbari road section. However, the Piluwa Khola Bridge was constructed under Part B. The length was reduced from 96 km (Mudhe–Khandbari) to approximately 62.5 km (Mudhe–Sabha Khola) following revised survey and design of the road section and a reduction in DFID funding (from \$9.2 million to \$8.4 million). DOR gave assurance that the Sabha Khola Bridge would be constructed with new funds from DFID and the Sabha Khola–Khandbari road section would be upgraded under DOR’s national program.

#### **4. Part D: Performance-Based Maintenance**

17. The project envisaged a 3-year road maintenance program, and ADB financing for 1 year for about 200–300 km of road through PBM contracts<sup>12</sup> tendered to domestic private contractors. However, this component was later designed and implemented for a 5-year road maintenance program with ADB financing for 2 years. Roads to be maintained were selected from the ARMP and PBM works were implemented in two sections (i) Kohalpur–Gadda Chauki (204 km) of EWH, and (ii) Hetauda–Narayani Bridge (77 km) along EWH. At appraisal, it was envisaged that all the PBM work would be undertaken through NCB; the road section between Kohalpur and Gadda Chauki was identified and considered consistent with the \$1.0 million threshold for NCB, and the work was implemented through four NCB packages. However, the PBM work on the Hetauda–Narayani Bridge section was undertaken as an ICB contract, because it required more extensive and costlier work that exceeded the \$1.0 million NCB limit. The PBM contract conditions were based on PBM contract documents used by the World Bank, with modifications from the first PBM contract in Nepal (EWH, Narayani Bridge–Butwal). Special conditions were amended to ensure consistency with DOR standard specifications for road and bridge works. The special specifications included an entirely new section covering PBM, for which the PBM contract for Narayani Bridge–Butwal was used as a guide.

#### **5. Part E: Cross-Border Access Road Improvement**

18. As per appraisal, the proposed road improvement under this component was subject to the findings of ADB’s TA for Identification and Prioritization of Subregional Projects in South Asia<sup>13</sup> and ADB’s TA for Preparing the Subregional Transport Facilitation Project;<sup>14</sup> the latter TA concluded that no significant road works were required at Kakarbhitta. Hence, during the project

<sup>12</sup> A PBM contract is an agreement between a government department or state enterprise and a private contractor whereby the private contractor maintains the road to achieve specified condition standards for a certain period of time in return for a fixed payment stream. Under the contract the existing road would be maintained on the basis of customer-based performance indicators, such as riding and strength quality, safety features, and roadside aesthetics.

<sup>13</sup> ADB. 2000. *Technical Assistance for Identification and Prioritization of Subregional Projects in South Asia*. Manila (TA 5636-REG).

<sup>14</sup> ADB. 2003. *Technical Assistance for Preparing the Subregional Transport Facilitation Project*. Manila (TA 6139-REG).

review mission from 13 to 17 December 2004, it was proposed that this component be cancelled. Further, the back-to-office report of the midterm review (fielded 26 May to 13 June 2006) noted that this component could be cancelled. This component was ultimately cancelled in accordance with one of the midterm review recommendations, but ADB approval for the cancellation (as a change in scope) should have been obtained.

## **6. Part F: Road Safety and Axle-Load Control**

19. The project undertook road safety civil works at selected accident-prone areas or black spots, and axle-load measurement along the project roads and at selected cross-border locations. Improving road safety was undertaken in accordance with ADB's Road Safety Guidelines. DOR provided training for public awareness on road safety improvement during and after completion of construction of the road sections. A public awareness program was also conducted targeting school children, local communities, and drivers using these road sections. Road design was improved by (i) installing delineation post and edge marking on Hill roads, including the use of reflective marker posts; (ii) installing traffic sign (chevron) boards in critical locations; (iii) widening the pavement sections of main roads with high numbers of pedestrians, bicycles, and animal-drawn vehicles; (iv) providing off-road facilities for pedestrians in settlements, including facilities for buses and bus passengers; and (v) providing adequate reflective warning signs, setting realistic speed limits, and building speed bumps on roads through settlements. A safety audit was conducted after the design phase but prior to procurement to ensure compliance with safety requirements.

20. The government approved the Heavy Vehicle Management Policy on 26 June 2007. The project procured and provided 10 portable axle-load weigh bridges for DOR's division road offices<sup>15</sup> to control overloaded vehicles. The government has started consultation with Ministry of Labour and Transport Management to initiate enforcement of the new policy. However, the government has yet to initiate a process for amendment of the Vehicle and Transport Management Act, in order to increase the policy's effectiveness.

## **7. Part G: Poverty Intervention**

21. The primary objective of this component was to reduce poverty by (i) physical interventions to improve rural accessibility for poor and socially excluded people by constructing tracks, trails, footpaths, pedestrian bridges, slope protection, bus station or stops, and markets at community-selected locations to meet their domestic, economic, and social needs; and (ii) social development interventions to ensure that the poorest and socially excluded people can benefit from the longer-term socioeconomic opportunities the road may bring. This included (i) community-based construction of facilities to improve community access; (ii) formation of a revolving fund and capacity building and training for community groups on how to use the income and invest in income-generating activities, and (iii) enhancement and development of protective interventions.

22. The social development intervention was financed and implemented by DFID following the RAP approach along two road sections, Mudhe–Piluwa Khola and Piluwa Khola–Sabha Khola (Part C), in addition to the cofinancing program under the project. Local NGOs were recruited under the project to (i) carry out needs assessments; (ii) undertake social mobilization; (iii) conduct a savings and credit program by forming a user's group; (iv) identify and prepare infrastructure design; and (v) provide enhanced skill training. Four hundred households (200

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<sup>15</sup> Butal, Chitwan, Hetauda, Mahendranagar and Nepalgunj division road offices.

from each road section)—including the poorest of the poor, socially disadvantaged families and people affected by the project’s activities—were selected and supported under this component. Beneficiaries were provided training on (i) increased agricultural production; (ii) animal husbandry; (iii) planting along road corridors; and (vi) pig farming. After DFID conclusion of RAP1 in 2006, the NGOs were directly recruited by DOR to implement the poverty intervention activities of the project.

23. A separate poverty intervention for the other project areas<sup>16</sup> was implemented through ADB’s TA for Enhancing Poverty Reduction Impact of Road Projects.<sup>17</sup> The TA used local NGOs to provide skills training, establish savings and credit schemes, and conduct income-generating activities for poor labors, persons affected by the project, and very poor households.

### **C. Project Costs**

24. The project cost estimate at appraisal was \$46.0 million, including a foreign exchange component of \$38.0 million and a local cost component of \$8.0 million. The actual total project cost amounted to \$45.06 million, including \$0.68 million for interest during construction. ADB financed the entire foreign exchange cost of \$39.16 million and a part of the local currency cost of \$5.9 million. The total loan cancellation was \$9.19 million. The appreciation of special drawing rights against the US dollar between the date of the loan agreement and loan closing, low price bids for civil works contracts, and termination of the part A component contract between DOR and the contractor contributed to the cancellation.

### **D. Disbursements**

25. Disbursement was slow during the first 2 years of project implementation (Appendix 3), but began to pick up in the third year of implementation. Although the loan closing date was 30 June 2009, the loan account remained open until 11 January 2010 to process payments for construction works completed late in the implementation period. The total loan disbursement was \$45.06 million, including \$0.68 million for interest during construction.

26. As per the loan agreement, DOR established an imprest account in Nepal Rastra Bank. The initial imprest account ceiling of \$1.0 million was later increased to \$2.0 million. The imprest account was fully liquidated before the loan closing date. DOR maintained a separate account to facilitate payments for ADB’s TA for Road Network Development Project (footnote 10), which was financed by DFID. The original amount was \$9.6 million. However, in 2005, DFID reduced their contribution from \$9.6 million to \$8.5 million due to the appreciation of the US dollar. The total disbursement under the TA was \$8.4 million.

### **E. Project Schedule**

27. The project was originally envisaged to be implemented over 5 years, with a loan closing date of 31 December 2007. Appendix 4 shows the implementation schedule (both at appraisal and actual). Implementation progress was affected by (i) the delayed recruitment of consultants, which resulted in delayed submission of the detailed project survey and design; (ii) frequent unrest in the Terai region; (iii) onsite absence of the lead firm; and (iv) the Koshi flood in August 2008. The first civil works contract was awarded 37 months after loan approval. Project

<sup>16</sup> Biratnagar–Bardanga, Urlabari–Bardanga, Damak–Gauriganj, and Pouwa Bhanjyang–Phidim road sections.

<sup>17</sup> ADB. 2006. *Technical Assistance to the Kingdom of Nepal for Enhancing Poverty Reduction Impact of Road Projects*. Manila (TA 4760-NEP).

implementation was also affected by the conflict in Nepal during 2001–2006. At the request of the government, ADB extended the loan closing date by 18 months from 31 December 2007 to 30 June 2009.

## **F. Implementation Arrangements**

28. Overall, implementation arrangements were reported to be satisfactory in delivering project outputs and achieving the project outcome. A minor change in implementation arrangements was approved on 6 June 2005 to finance the cost of the Piluwa Khola Bridge, which was not envisaged earlier in the project. MPPW was the executing agency and DOR the implementing agency for the project. Both MPPW and DOR had substantial experience with the implementation of ADB-financed projects. A project directorate (established under earlier ADB-financed road projects and fully functional) was maintained within DOR and given responsibility for overall project coordination, monitoring, and implementation. DOR assigned a full-time project director, and ensured that the director was (i) a senior officer with adequate technical and administrative experience and qualifications acceptable to ADB, and (ii) assisted by appropriate and adequate technical and administrative staff. DOR promptly informed ADB of any change in the project director.

29. To ensure proper implementation of the project, DOR appointed four full-time project managers and placed one each in Basantapur, Chautara, Damak and Dharan. The project managers reported directly to the project director and were responsible for day-to-day project implementation. The project director had overall responsibility for PBM, including subproject selection under the ARMP, procurement, monitoring, and reporting. The project director also acted as project coordinator for the PBM component. However, contract administration and other aspects of day-to-day implementation of the PBM component were delegated to DOR's maintenance division. The project director also coordinated with the DFID-financed RAP regarding feeder-road construction, and the project's detailed design and supervision consultants coordinated with the DFID consultants. The PBM contract was designed and implemented for a 5-year road maintenance program, with ADB financing for the first 2 years; the Roads Board of Nepal provided funds to the DOR road offices for implementation of PBM contracts for the remaining 3 years.

30. The design and supervision consultant recruited by DOR submitted monthly progress reports to DOR, MPPW, and ADB. DOR ensured that the consultant report included information on progress towards land acquisition, resettlement, environmental management, training, the public campaign, and other activities critical for project implementation, in addition to progress on the engineering services. DOR also monitored project preparation and implementation in accordance with the implementation schedule, and kept ADB informed of any significant deviations that could result in the schedule not being met.

## **G. Conditions and Covenants**

31. The condition for loan effectiveness was complied with on time, and the loan was declared effective on 11 March 2003, 3 months after loan signing.

32. The major loan covenants were complied with. However, one loan covenant was partly complied with, as the government approved the Heavy Vehicle Management Policy on 26 June 2007 but the amendment to the Vehicle and Transport Management Act could not be achieved under the project (Appendix 5). However, this covenant is also a covenant of ADB's Road

Connectivity Sector 1 Project,<sup>18</sup> which was delegated to the Nepal Resident Mission on 1 October 2010. The resident mission will closely monitor and follow up with DOR and MPPW on the progress and compliance of this covenant through regular meetings and review missions. None of the project's major covenants were modified, suspended, or waived, as most were relevant and realistic.

## **H. Consultant Recruitment and Procurement**

33. Consultants were recruited in accordance with ADB's Guidelines on the Use of Consultants (1999, as amended from time to time), and procurement was made, following ADB's Procurement Guidelines (1999, as amended from time to time). Consulting services were used for (i) detailed design and construction supervision for the civil works to strengthen EWH, and road improvement, feeder-road construction, cross-border access road improvement, and road safety and axle-load control; (ii) program design and implementation supervision for PBM; and (iii) monitoring poverty reduction impact. The consultants were also responsible for ensuring community participation, identifying community needs, and monitoring gender and child labor issues. Although advance action for recruitment of consultants was allowed, the mobilization of consulting services was delayed by 14.5 months due to controversies regarding the consultant selection process.

34. The project used the services of international (195 person-months) and national (1,338 person-months) consultants; the consultant provision at appraisal was for 153.5 person-months of international and 875 person-months of national consultants.

35. The civil works contracts were conducted in accordance with ADB's Procurement Guidelines. DOR procured 10 portable axle-load weigh bridges, following NCB procedures acceptable to ADB.

## **I. Performance of Consultants, Contractors, and Suppliers**

36. The consultants' performance was rated *satisfactory*, as most of the consultants delivered their services to the expected standard as per the requirements of the project. However, supervision lapses were seen in a few cases.

37. Contractors' performance in completing civil works varied for various packages. The contractors generally lacked resource planning capacity, and most of the contractors experienced time overruns. The contractors' international joint venture partners were observed to be absent during contract implementation, despite the fact that the actual presence of international partners is an essential contractual requirement.

38. The performance of equipment suppliers was *satisfactory* (delivery was on time and the quality of the supplied items was as specified in the supply contracts).

## **J. Performance of the Borrower and the Executing Agency**

39. The overall performance of the borrower and MPPW as executing agency, and DOR as implementing agency was *satisfactory*. The project received the "best project management team" award from the Resident Mission for 3 consecutive years. The appraisal assessment of

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<sup>18</sup> ADB. (Year). *Report and Recommendation of the President to the Board of Directors: Proposed Grant to Nepal for the Road Connectivity Sector 1 Project*. Manila (Grant 0051-NEP).

MPPW's capabilities was reasonably accurate. Throughout project implementation, the government categorized the project as core to its annual program and this ensured that budgetary provisions for the project were adequate. Key project staffs were also retained during implementation. DOR demonstrated very strong procurement management capacity. However, their contract administration capacity could have been further strengthened to ensure timely completion of the contract packages.

## **K. Performance of the Asian Development Bank**

40. The performance of ADB was *satisfactory*. From project preparation to implementation, ADB provided significant staff and financial resources. ADB fielded 16 missions, including one project inception mission, one midterm review mission, and one project completion review mission. ADB missions focused mostly on project inputs; the physical progress of the project, including contract awards and disbursements; and implementation delays. Each mission provided a time-bound action plan that could be readily monitored. ADB organized monthly meetings with the project management team to monitor contract award, disbursement, counterpart funding, and other project implementation issues, which improved project performance. ADB processed withdrawal claims on time.

## **III. EVALUATION OF PERFORMANCE**

### **A. Relevance**

41. At both appraisal and completion, the project was *highly relevant* to the government's and ADB's policies and priorities seeking to promote economic growth, with the anticipated outcomes of increased efficiency in movement of people and goods, improved access of the poor to social services and markets, and increased employment opportunities, thereby leading to poverty reduction. The project's design, rationale, and strategies were relevant, as the project contributed to improving the quality of life of the people residing in the project areas. ADB's support for the project, which coincided with a period of conflict in Nepal, was also instrumental in addressing rural–urban migration problems and mitigating conflict impact.

42. Institutional and management arrangements were well designed at executing agency, implementing agency, and beneficiary levels. The capacity of consultants, contractors, and partner NGOs was developed and linkages between consultants, contractors, and local people maximized the benefits of available services in terms of access to economic development.

### **B. Effectiveness in Achieving Outcome**

43. The project was *effective* in achieving its outcome. The project has (i) improved 613.5 km of roads; (ii) reduced vehicle operation cost by 30.7% and passenger fare and freight rates by 48.6% and 30.7% respectively in the project road sections; (iii) reduced average travel time of different types of vehicles by 138.9%; (iv) increased annual average daily traffic by 38.6%; (v) increased the volume of marketed agricultural products by 6.5% in the project areas; (vi) increased ownership of motorized vehicles in the project areas by 88.9%; and (vii) decreased the average travel time to the nearest health services and schools in the project areas by 24.1% (Appendix 6). There were instances of growth in rural enterprises such as tea stalls, handlooms, tailoring, restaurants and agricultural product collection centres. The increase in off-farm employment generation included activities related to vehicle repair and maintenance. The road improved and increased labour mobility and marketing of agricultural products.

44. The project's performance monitoring study report<sup>19</sup> emphasized that changes were observed in agricultural production, with an increase per average area (in hectares [ha]) and yield per area (ton/ha) in the production of cereal crops such as paddy, wheat and maize and a decrease in the average area and yield per area under millet cultivation after project implementation in the areas influenced by the project road sections. The same study findings indicated that the average volume of marketed agricultural productions of cash crops such as green leafy vegetables, tomato and cauliflower increased whereas production of sugarcane and cardamom decreased. Overall the average production of marketed agricultural products per area (cash crop) increased by 6.5% in the areas influenced by the project road sections (Appendix 6, Table 6.5).

### C. Efficiency in Achieving Outcome and Outputs

45. The project is rated *efficient* in achieving its outcomes and outputs, based on economic analyses using the same methodology as at appraisal, and in accordance with ADB's Guidelines for the Economic Analysis of Projects<sup>20</sup> (Appendix 7). The economic internal rate of return for all project road sections is significantly higher than 12%, indicating the project is justified from an economic perspective.

46. Some project activities were delayed due to a lack of resources and proper time management by contractors, frequent unrest in Terai regions and the Koshi flood in August 2008. A few civil works<sup>21</sup> were not completed by the loan closing date of 30 June 2009; they were carried out by the government with its own funds and were completed by 30 May 2010.

47. The sensitivity analysis of the project was conducted under the four following scenarios: (i) 20% increase in construction cost, (ii) 20% decrease in savings on VOC, (iii) exclusion of the travel time savings benefits, and (iv) 50% reduction in the traffic growth rate. The project roads are most sensitive to a reduction in traffic growth rate, followed by the exclusion of travel time savings benefits and an increase in construction cost. The project roads are less sensitive to a decrease in VOC savings.

48. There has been a significant reduction in travel time across all kinds of vehicles and for all kinds of road sections. A quick community assessment survey during project completion review mission estimates the time savings as: Biratnagar–Bardanga, 25%; Damak–Gaurigunj, 35%; Urlabari–Bardanga, 36%; Pouwa Bhanjyang–Phidim, 45%; Hile–Basantpur, 25%; Dolalghat–Chautara, 50%; Basantpur–Mude, 60%; and Mudhe–Khandbari, 75%. A new track has been opened up to Sabhakhola, reducing walking time by one day. There has been at least 25% transport time savings in the Hetauda–Narayani Bridge and Kohalpur–Gadda Chauk road sections due to the PBM system introduced in these road sections. Further time savings of 30% has been estimated for the Belberi–Chuharwa road section due to upgrading of that section.

### D. Preliminary Assessment of Sustainability

49. The project is assessed *sustainable*, as the project has built the capacity of government institutions, consultants, and contractors to handle the construction, operation, and management of the road projects. Since project completion, all project road sections have been functional and had access to follow-up services from consultants and contractors. The

<sup>19</sup> DOR. 2009. *Project Performance Monitoring Study Report*. Kathmandu.

<sup>20</sup> ADB. 1997. *Guidelines for the Economic Analysis of Projects*. Manila.

<sup>21</sup> Piluwa Khola Bridge, Hile–Basantapur, and Basantpur–Mudhe road sections.

government has allocated sufficient funds for the operation and maintenance costs of the road sections constructed, repaired, or upgraded under the project.

## **E. Impact**

### **1. Income and Employment**

50. The economic impacts of the project include an increase in average cash income of the household in the project areas, increased access to markets, lower prices of major commodities, and more self- and wage-employment opportunities.

51. Four hundred and fifty households were surveyed in each road section during the project performance monitoring study, which categorized the household into (i) non poor, (ii) poor, and (iii) very poor. The survey was conducted prior and after the construction of the road sections and the findings of the study (footnote 19) indicated reduction in the number of very poor household by 8.5%, poor household by 9.3% and an increase in non poor household by 15.3%. The number of poor household graduating to non poor household was estimated at 8.9% in the project areas (Appendix 8).

52. The same study findings also indicated that employment increased in the project areas by 6.9%; and the average cash income of the household increased by 26.2% due to the change in livestock and crop production and start of new enterprises. The average household expenditure decreased by 1.7% due to reduction in the cost of (i) food commodities; (ii) medical facilities; and (iii) transport and communications. Further, the study findings also emphasized that the average time required to access economic and social services in the project area decreased by 36.0% and the annual average daily freight and passenger movements increased by 14.1% and 2.7% respectively (Appendix 8)

53. Approximately 2,000 unskilled laborers were employed through 73 road building groups in the Hile–Basantpur and Basantpur–Khandbari road sections (Part C). In addition, the project generated job opportunities for skilled labors during road construction.

54. The project supported pro-poor economic growth by improving transport efficiency that facilitated domestic trade and cross-border transport that contributed to an increase in employment opportunities, including for the poor. It was also considered to be an intervention for poverty reduction because the proportion of the poor among project beneficiaries is larger than their proportion in the overall population. The PBM contract financed under the project was targeted to districts with a high incidence of poverty. Part G of the project, complemented by DFID's RAP, enhanced the project's impact on poverty reduction.

### **2. Social**

56. The project affected a total of 1,440 households;<sup>22</sup> the 9,278 affected persons were duly compensated as per the resettlement plan during the project implementation period. Acquisition of 2.3 hectares (ha) of private land was unavoidable for road improvements to maintain minimum road safety and standards. For the Basantapur–Mudhe–Khandbari road section (Part C), the project tried to align the works within the 30 meters right-of-way that was acquired by the

<sup>22</sup> (i) 584 households lost land only, (ii) 27 households lost land and structures, (iii) 105 households lost land and trees, (iv) 10 households lost structures and trees, (v) 31 households lost structures only, and (vi) 581 households lost trees only. Including 80 tenants and 22 labors, the total number of affected households is 1,440.

Arun III Hydroelectric Project. However, 3.7 ha of land had not been compensated for under the Arun III and was compensated under the project. Compensation for an additional 5.5 ha of land outside the Arun III right-of-way was provided after the opening of the road in 1995. The total land acquisition figure for the project increased from 3.4 ha in 2001 to 12.6 ha in 2007, mainly due to retroactive compensation for 9.2 ha of land for the Arun III alignment and the existing track.

57. A grievance redress mechanism was established for all the project road sections. All affected households were individually informed about the social mobilization input and about the grievance redress procedures. Most grievances were resolved locally through negotiations with affected persons. Socioeconomic data on the affected people and communities were collected through household surveys, focus groups, interviews with local officers, and from other published sources. Local consultative forums were formed for affected village development committees to ensure project-affected people were informed, consulted and involved in the project.

58. The project recognized direct harm and indirect adverse social impacts that would result from the road construction and improvement. These potential adverse impacts were mitigated by the project through complementary activities including (i) participatory development and effective implementation of a resettlement plan for compensation, resettlement, and rehabilitation of people affected by land acquisition for the project; (ii) awareness raising on (a) alternative work opportunities, (b) social damage resulting from undesirable social practices, and (c) migrant labor and prioritizing the use of local labor in road building groups; (iii) an income restoration strategy; (iv) poverty reduction activities for the poor and vulnerable groups; and (v) assistance to women and vulnerable groups. The resettlement plan was implemented in conjunction with the poverty reduction component.

59. No specific ethnic or caste groups were adversely affected by the project. The poverty reduction component specifically targeted all poor and socially excluded communities and groups living in the vicinity of the project roads, regardless of ethnicity or caste.

### **3. Environmental**

60. The project was classified as environment category A, as one of the road sections, Basantpur–Khandbari (Part C), was to be constructed as a new alignment, whereas other project road sections were limited to maintenance and improvement of existing roads, which included minimal widening or changes in alignment, with minimal adverse environmental impacts. The effect on forests and wildlife of the EWH strengthening and road improvement component was considered minimal, as the roads passed through no forest reserves or national park. An environmental impact assessment for the Basantpur–Khandbari road section and initial environment examination for the other road sections concluded that the adverse environmental impacts arising from construction and operation of project facilities would be minimized through implementation of a set of mitigation measures. The costs of these measures were included in the contract cost and DOR ensured timely release of funds to implement the mitigation measures. The supervision consultant visited the project road sections on a semiannual basis to review the environmental mitigation measures, and progress on the mitigation measures was updated and reported to ADB on a monthly basis.

## IV. OVERALL ASSESSMENT AND RECOMMENDATIONS

### A. Overall Assessment

61. Overall, the project is rated *successful*. It was designed in line with the strategic priorities of the government and ADB. It was implemented as conceived, despite the fact that the project areas were highly affected by the conflict during the implementation period (2001–2005). The project achieved all the key output targets through mobilization of users, consultants, and contractors.

### B. Lessons

62. Effective orientation programs on project approaches, implementation modalities, and the roles of stakeholders contributed to successful project implementation. Implementation partners should be well informed of the approaches and strategies of the project prior to implementation.

63. The absence of international joint venture partners in implementation of ICB contracts awarded to joint ventures was observed during project implementation. In all cases, it was clear that the local contractors had applied for prequalification and submitted bids in joint venture with a foreign partner simply to meet the pre-qualification and post-qualification requirements. This defeated one of the main purposes of a joint venture, which is for the local contractor and, ultimately the client, to benefit from the experience, expertise, capability, and resources of an international foreign partner. To ensure involvement of all joint venture partners in contract implementation, it would be necessary to review the threshold for ICB and NCB contracts for road construction works to have fair competition among the bidders.

64. A few civil works contracts could not be completed even after extending the loan closing date by 18 months. The timeframe, working season, and site analysis should be considered prior to award of contract to ensure timely completion of the contracts.

65. The project was implemented during the conflict period (2001–2006) and it faced challenges from local communities, which made additional demands and at times disrupted the work progress. Part A could not be completed as it was highly affected by unrest in Terai. A proper analysis of road design and selection of road sections should be carried out during the design phase to ensure timely completion of the selected road sections is possible.

66. During the implementation of Part C, the change in construction method from labor to equipment based (otta seal standard) had an effect on the original road length. Detailed study on the construction method needs to be carefully undertaken during the design phase to avoid changes during the implementation phase.

### C. Recommendations

#### 1. Project Related

67. The government will give priority to providing funding to complete the asphalt overlay on the remaining 47 km of the EHW from Belbari to Chuharwa (the project completed 93 km of the 140 km total). At the request of the government, and given the strategic importance of the EWH, the remaining 47 km of road section has been included under the ADB Subregional Transport Enhancement Project (footnote 5). DOR should ensure timely completion of this road section.

68. DOR will undertake construction of Sabha Khola Bridge using new funding from DFID, and upgrade the existing Sabha Khola–Khandbari road section under its national program.

69. The maximum threshold for NCB contracts under the project was \$1.0 million; this was too low for road construction contracts, which require a large investment. Increasing the threshold for NCB contracts in future projects should be considered in view of the lack of incentive to the contractors to provide dedicated equipment for the major works, to cover transaction costs for contract management, and to increase the capacity of the national contractors to undertake large contracts.

70. The PBM contract is a new concept that is not well understood in Nepal. It is recommended that continuous assistance, or more frequent inputs, from an engineer experienced in PBM be included in any further contracts until the principles of PBM are well understood and established.

71. The government has not fully complied with the covenant related to the amendment of the Vehicle and Transport Management Act under the project. However, this covenant is also one of the covenants under ADB Road Connectivity Sector 1 Project (footnote 19) and the resident mission will closely monitor and follow up with DOR and MPPW on the progress of and compliance with this covenant.

## **2. General**

72. The design and monitoring framework needs to be developed with clear outcome and output statements, as well as relevant, specific, and quantifiable performance indicators and a specific timeframe for each outcome and output to enable measurement of their achievement.

73. Consultants and contractors involved in project implementation should be made fully accountable for the quality of their work and their effect on project outputs. The government needs to develop and implement a performance monitoring mechanism.

74. PBM is relatively a new and innovative concept and is not well understood in Nepal. Awareness among the local communities, transparency in operation, and professionalism on the part of the contractors are prerequisites to enhanced PBM effectiveness. Further, there is a need to ensure that DOR provides continuous supervision and monitoring of contractors implementing future PBM contracts until the principles of PBM are well understood and established as a part of road improvement work.

## PROJECT FRAMEWORK

Design Summary	Performance Indicators/Targets	Assessment/Recommendations
<p>I. Goal</p> <p>Promote economic growth by improving transport infrastructure in the project areas</p>	<p>Per capita income of regions and districts</p> <p>Rural incomes and employment rates at district, village and household levels</p> <p>Number of poor people in the project areas and their expenditures</p> <p>Freight and passenger flows and access to economic and social services in the project areas at the district level</p>	<p>The average cash income of the household in the project areas increased by 26.2% due to the change in livestock and crop production and start of new enterprises.</p> <p>Agricultural income increased by 6.5% and employment rate increased by 6.9%.</p> <p>Number of poor people in the project areas decreased by 8.9%. The average household expenditure decreased by 1.7% in the project areas.</p> <p>The average time required to access economic and social services in the project areas decreased by 36.0%. The annual average daily freight and passenger movements increased by 14.1% and 2.7% respectively.</p>
<p>II. Purpose</p> <p>Reduce transport costs and induce more efficient movement of goods and passengers</p>	<p>Improved 315 kilometers (km) of roads</p> <p>Reduced vehicle operating costs and reduced freight and passenger service charges (in real terms) in the project areas</p> <p>Reduced travel time on the project areas</p> <p>Increased average annual daily traffic by about 7% per year</p> <p>Increase volume of marketed agricultural products in the project areas</p> <p>Increased ownership of motorized vehicles by rural community in the project areas</p>	<p>A total of 613.5 kms of road improved — (i) About 93 kms of East-West Highway pavement strengthened; (ii) 177 kms of feeder and district road upgraded; (iii) 62.5 kms of feeder/district road constructed; and (iv) 281 kms of road maintained.</p> <p>Average vehicle operating cost reduced by 30.7%. Passenger fare and freight rates reduced by 48.6% and 30.7% respectively in the project road sections.</p> <p>Average travel time of different types of vehicles reduced by 138.9%</p> <p>Annual average daily traffics increased by 38.6%.</p> <p>Volume of marketed agricultural products increased by 6.5% in the project areas.</p> <p>Ownership of motorized vehicles in the project areas increased by 88.9%.</p>

<b>Design Summary</b>	<b>Performance Indicators/Targets</b>	<b>Assessment/Recommendations</b>
Improve access of the rural poor to social services, markets, and employment opportunities	Reduced travel time to nearest health services and schools	Travel time to the nearest health services and schools decreased by 24.1% in the project areas.
	Growth of rural enterprises	Growth in rural enterprise increased due to increased market access and improvement in supply of inputs (fertilizers, pesticides etc) and raw materials.
	Generated employment in the off-farm sector	Off-farm employment opportunities increased due to creation of grocery stores, vehicle operation and maintenance workshop and other trading activities along the road corridor and influence areas of Hill roads.
Improve road maintenance	Increased labour mobility	Labour mobility increased due to improved information flow and new employment opportunity for road construction, creation of new enterprise and market for agricultural products.
	Pilot projects capable of being replicated	Pilot project was implemented with success in Narayani Bridge to Heduda section while it was unsatisfactory in Kohalpur-Gadda Chauki section. The lessons learned from project implementation could be replicated.
	Sufficient allocated budget	Adequate budget was allocated by the Government.
Develop viable and efficient domestic road construction industry	Long-term contracted road maintenance	Pilot project was successfully implemented.
	Enforced heavy vehicle management policy	Government approved the heavy vehicle management policy under the project.
	More stable flow of opportunities in road improvement and maintenance	Opportunities in road improvement and maintenance have been emerging in the newly opened road corridor section.
Improve cross-border transport in Kakarbhitta	Improved cross-border access road	This component was dropped after mid-term review mission.
Outputs		
Improvement of 140 km of the East West Highway and 165 km of feeder and district roads	Procurement complete by May 2003 for Phase I and by June 2004 for Phase II	Procurement process completed on 16 February 2005 for Phase I. Phase II procurement completed in May 2006.

<b>Design Summary</b>	<b>Performance Indicators/Targets</b>	<b>Assessment/Recommendations</b>
Construction of Basantapur-Khandbari road, 96 km		62.5 km of the road constructed from Mudhe to Sabha Khola.
Maintenance of 300 km or roads	All maintenance, improvement and construction works completed in accordance with technical specification and requirement of the engineering design by June 2006  Year-round passage after completion	About 281 kms of road maintained using performance based management contract.  Flow of passengers year round increased after the completion of project intervention with the increase of average annual daily traffics increased by 42%.
Black spots improvement and axle-load control	Complete annual road maintenance plan	Government prepared the annual road maintenance plan.
	Installation of axle-load measurements	10 portable axle-load weigh bridges procured and provided to DOR's road division in Butwal, Chitwan, Hetauda, Mahendranagar and Nepalgunj for installation.
Improvement of cross-border facilities in Kakarbhitta	Improved access road	This output was dropped after mid-term review mission.

ADB = Asian Development Bank, DFID = Department for International Development, DOR = Department of Roads, RAP = Rural Access Program

Sources: ADB. 2000. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the Kingdom of Nepal for the Road Network Development Project*. Manila; Project Performance Monitoring Study Report, June 2009 and ADB project completion review mission, June–July 2010.

**PROJECT OUTPUTS**  
(As of 31 May 2010)

	Component	Details	Remarks/Assessment
1.	Part A: East–West Highway strengthening	About 140 km of East–West Highway was envisaged to be strengthened.	Of the total 140 km road section, 93 km were fully strengthened with asphalt overlay and the remaining 47 km have been included under ADB's Subregional Transport Enhancement Project. <sup>a</sup>
2.	Part B: Roads improvement	165 km of feeder and district road to be improved Hill region: (i) Pouwa Bhanjyang–Phidim, 24 km; and (ii) Dolalghat–Chautara, 25 km.  Terai region: (i) Biratnagar–Bardanga, 39 km; (ii) Urlabari–Bardanga, 28 km; and (i) Damak–Gauriganj, 22 km.	A total of 177 km of road were improved under this component  Hile–Basantapur (26 km) and Basantapur–Mudhe (13 km) road sections were also constructed through ADB financing.  Piluwa Khola Bridge was also constructed through this component.
3.	Part C: Feeder road construction	Construct a 96 km feeder road to connect Basantapur to Khandbari (district headquarters) through a DFID grant.	62.5 km of the road constructed from Mudhe to Sabha Khola.
4.	Part D: Performance-based maintenance	Development of a 3-year road maintenance program in EWH and provision of financing for the first-year for maintenance of about 200–300 km of road through PBM contracts (i) Kohalpur–Gadda Chauki, 204 km; and (ii) Hetauda–Narayani Bridge, 77 km, along EWH.	The project developed a 5-year road maintenance program and provided financing for 2 years.  A total of 281 km of road maintained through PBM
5.	Part E: Cross-border access road improvement	Improve an access road of about 10 km to the border crossing at Kakarbhitta	The final report of ADB's TA for Preparing the Subregional Transport Facilitation Project <sup>b</sup> concluded that no significant road works were required at Kakarbhitta. The midterm review mission also had the same recommendation. The component was dropped after the midterm review.
6.	Part F: Road safety and axle-load control	(i) Road safety civil works at selected accident-prone areas or black spots and axle-load	Ten portable axle-load weigh bridges procured and provided to DOR's division

	Component	Details	Remarks/Assessment
		measurement along the project roads and at selected cross-border locations in accordance with ADB's Road Safety Guidelines for Asian and Pacific Region, and (ii) training and public awareness on road safety improvement.	road offices <sup>c</sup> for installation to control vehicle overloading  DOR provided training for public awareness on road safety improvement during and after completion of construction of the road sections.
7.	Part G: Poverty intervention	(i) Community-based construction of facilities to improve community access, (ii) formation of a revolving fund and capacity building and training for community groups on how to use the income and invest in income-generating activities, and (iii) enhancement and development of protective interventions.	Included in the contract packages  ADB TA for Enhancing Poverty Reduction Impact of Road Projects (\$350,000) <sup>d</sup> also supplemented this component.  Poverty intervention for component C was carried out by DFID through the RAP approach and later continued by DOR.

ADB = Asian Development Bank, DFID = Department for International Development, DOR = Department of Roads, EWH = East West Highway, RAP = Rural Access Program

<sup>a</sup> ADB. 2010. *Report and Recommendation of the President to the Board of Directors: Proposed Loan and Grant to Nepal for the Subregional Transport Enhancement Project*. Manila (Loan 2685-NEP and Grant 0225-NEP).

<sup>b</sup> ADB. 2003. *Technical Assistance for Preparing the Subregional Transport Facilitation Project*. Manila (TA 6139-REG).

<sup>c</sup> Butal, Chitwan, Hetauda, Mahendranagar and Nepalgunj division road offices.

<sup>d</sup> ADB. 2006. *Technical Assistance to the Kingdom of Nepal for Enhancing Poverty Reduction Impact of Road Projects*. Manila (TA 4760-NEP).

Sources: ADB.2000. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the Kingdom of Nepal for the Road Network Development Project*. Manila; and ADB project completion review mission, June–July 2010.

## LOAN DISBURSEMENTS

Table A3.1: Annual Loan Disbursement  
(\$)

Category	Description	2003	2004	2005	2006	2007	2008	2009
01A	Civil works (components A and E)	...	...	1,599,450	3,409,186	7,082,615	9,408,873	10,547,561
01B	Civil works (components (B)(i) -B(v) and G)	...	1,000,000	3,867,763	9,848,104	17,359,740	20,329,112	20,356,107
01C	Civil works (component D)	...	...	194,504	691,430	2,585,207	3,472,231	3,472,231
02	Equipment	...	...	...	...	178,860	178,860	178,860
03	Consulting services	1,330,513	2,959,148	3,950,620	5,078,200	6,955,965	9,044,619	9,465,068
04	Interest charge	2,966	23,382	71,673	192,695	431,380	823,620	1,042,066
<b>Total</b>		<b>1,333,479</b>	<b>3,982,530</b>	<b>9,684,010</b>	<b>19,219,615</b>	<b>34,593,767</b>	<b>43,257,315</b>	<b>45,061,893</b>

... = not available.

Source: Loan Financial Information Systems, Asian Development Bank.

**Table 3.2: Quarterly Contract Awards and Disbursements**  
(\$)

Year	Quarter	Contract Awards		Disbursements	
		Projected	Actual	Projected	Actual
2003	I	0.000	0.000	0.000	0.000
	II	0.000	9.465	0.000	0.000
	III	5.700	0.000	0.850	0.964
	IV	0.000	0.000	0.150	0.370
	<b>Subtotal</b>	<b>5.700</b>	<b>9.465</b>	<b>1.000</b>	<b>1.334</b>
2004	I	0.000	0.000	0.100	0.434
	II	0.000	0.000	0.100	0.369
	III	3.080	0.000	0.410	0.304
	IV	13.600	0.000	1.720	1.542
	<b>Subtotal</b>	<b>16.680</b>	<b>0.000</b>	<b>2.330</b>	<b>2.649</b>
2005	I	6.990	6.011	0.700	0.000
	II	17.311	12.625	4.160	1.001
	III	2.340	11.061	2.134	2.490
	IV	0.000	0.000	3.275	2.210
	<b>Subtotal</b>	<b>26.641</b>	<b>29.697</b>	<b>10.269</b>	<b>5.701</b>
2006	I	0.000	0.179	1.860	1.884
	II	3.560	0.000	3.920	3.300
	III	0.000	1.043	1.400	1.317
	IV	0.000	0.000	2.830	3.036
	<b>Subtotal</b>	<b>3.560</b>	<b>1.222</b>	<b>10.010</b>	<b>9.537</b>
2007	I	2.000	1.799	2.000	2.148
	II	1.200	1.836	3.000	3.952
	III	0.000	0.000	5.000	4.264
	IV	0.000	0.000	2.000	5.010
	<b>Subtotal</b>	<b>3.200</b>	<b>3.635</b>	<b>12.000</b>	<b>15.374</b>
2008	I	0.000	0.000	3.000	2.192
	II	0.000	0.000	3.000	2.918
	III	0.000	0.000	3.000	2.644
	IV	0.000	0.000	3.000	0.910
	<b>Subtotal</b>	<b>0.000</b>	<b>0.000</b>	<b>12.000</b>	<b>8.664</b>
2009	I	0.000	0.000	1.580	0.157
	II	0.000	0.000	1.920	0.371
	III	0.000	0.000	1.500	1.207
	IV	0.000	0.000	0.000	0.070
	<b>Subtotal</b>	<b>0.000</b>	<b>0.000</b>	<b>5.000</b>	<b>1.805</b>
<b>Total</b>		<b>55.781</b>	<b>44.019</b>	<b>52.609</b>	<b>45.062</b>

Source: Loan Financial Information Systems, Asian Development Bank.

## IMPLEMENTATION SCHEDULE

[illegible]

	Activities	2001				2002				2003				2004				2005				2006				2007				2008				2009			
		Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
	RI-02 contracts																																				
	PBMCs																																				
	Cross border access																																				
	Road safety and axle control																																				
8	Liability period																																				
	EWB + cross border access																																				
	RI-01 contracts																																				
	Basantpur–Khandbari																																				
	RI-02 contract																																				
	PBMCs																																				

DDS = detailed design and supervision, EWB = East–West Highway, PBMC = performance-based maintenance contract, RI-01 = road improvement (Dolalghat–Chautara and Terai roads), RI-02 = road improvement (Pouwa Bhanjyang–Phidim and Hile–Basantapur).

Source: Government of Nepal. 2009. *Project Completion Report*. Kathmandu. up to June 2009.

 Planned  
 Actual

### STATUS OF COMPLIANCE WITH MAJOR LOAN COVENANTS

Serial No	Covenants	Reference in Loan Agreement	Status of Compliance
1	The Project Executing Agency shall be MPPW, and the Project implementing agency shall be DOR. A Project directorate shall be maintained within DOR for overall coordination, monitoring and implementation of the Project. DOR shall maintain the appointed full time Project Director who is a senior officer with adequate technical and administration experience and qualifications acceptable to ADB.	Schedule 6, para. 1	Complied with.
2	DOR shall appoint four full-time Project managers, based in Chautara, Dharan, Basantpur and Damak, to be responsible for day-to-day implementation and reporting to PD.	Schedule 6, para. 2	Complied with.
3	The Borrower shall ensure that the Resettlement Plan agreed upon between the Borrower and the Bank is implemented by DOR under arrangements satisfactory to the Bank in accordance with the Bank's Policy on Involuntary Resettlement and the Bank's Handbook on Resettlement 1998, as amended from time to time.	Schedule 6, para. 7	Complied with.
4	The Borrower shall ensure that all environmental mitigation measures identified in the Summary Environmental Impact Assessment are incorporated into the Project design and followed during the Project construction, operation and maintenance, in consultation with the Ministry of Population and Environment and in accordance with the Bank's environmental guidelines and Environmental Management Plan agreed with the Bank. Monitoring shall be carried out in accordance with Project Performance Monitoring System and be reported by DOR to the Bank through the progress reports on Project implementation, and an evaluation report on year after completion of construction.	Schedule 6, para. 8	Complied with.
5	DOR shall be responsible for the operation and maintenance of the Project roads through proper technical supervision and adequate allocation of funds. Loan proceeds set aside under the Project for performance-based maintenance (PBM) on selected subprojects in the road network selected in accordance with ARMP, shall be applied through the first year of implementation. DOR shall continue to supervise the implementation of PBM and finance through the proposed Road Maintenance Fund.	Schedule 6, para. 9	Complied with.
6	The Borrower shall establish and implement a pragmatic and enforceable Heavy Vehicle Management Policy, acceptable to all concerned agencies by the end of 2002. The Borrower shall put forward an amendment to the Vehicle and Transport Management Act to the Parliament to incorporate an appropriate penalty structure sufficient to act as a deterrent to potential violators. Sufficient enforcement staff shall be recruited and necessary equipment for heavy vehicle control shall be procured. The Borrower shall set up axle load control	Schedule 6, para. 11	Partly complied with. The government has approved the Heavy Vehicle Management Policy. The amendment to the Vehicle and Transport

	stations at appropriate locations, and provide regular quarterly reports to the Bank on the status of load enforcement measures, incidence of vehicle overloading, and other benchmarks that are consistent with the enforceable Heavy Vehicle Management Policy.		Management Act could not be achieved under the project.
7	The Borrower shall ensure that the civil works contractors (i) comply with all applicable labor laws, (ii) do not differentiate wages between men and women for work of equal value, and (iii) do not employ child labor in the construction and maintenance activities. A specific clause shall be included in bidding documents and compliance shall be strictly monitored during Project implementation.	Schedule 6, para. 12	Complied with.
8	Financial Administration Rules. The Borrower shall approve the Public Works Directives prepared under TA 3306-NEP: Strengthening Project Implementation Practices as appropriate to the Borrower and amend the concerned regulations accordingly.	Schedule 6, para. 13	Complied with.
9	Supervision consultants are due to mobilize by the end of June.	Schedule 5	Complied with.
10	The Borrower shall make arrangements satisfactory to the Bank for insurance of the Project facilities to such extent and against such risks and in such amounts as shall be consistent with sound practice.	Section 4.05 (a)	Complied with.
11	The Borrower shall furnish ADB all reports and information as the Bank shall request.	Section 4.07 (a)	Complied with.
12	The Borrower shall furnish to ADB trimester reports on the carrying out of the Project and on the operation and management of the Project facilities.	Section 4.07 (b)	Complied with.
13	Promptly after physical completion of the Project, but not later than three months, the Borrower shall prepare and furnish to ADB a report, on the execution and initial operation of the Project, including its cost, the performance by the Borrower of its obligations under this Loan Agreement and the accomplishment of the purposes of the Loan.	Section 4.07 (c)	Complied with. Government PCR submitted in September 2009.
14	The Borrower shall enable the Bank's representatives to inspect the Project, the goods financed out of the proceeds of the Loan, and any relevant records and documents.	Section 4.08	Complied with.
15	The Borrower shall (i) maintain, or cause to be maintained, separate accounts for the Project; (ii) have such accounts and related financial statements audited annually, in accordance with appropriate auditing standards consistently applied, by independent auditors whose qualifications, experience and terms of reference are acceptable to the Bank; (iii) furnish to the Bank, as soon as available but in any event not later than 9 months after the end of each related fiscal year, certified copies of such audited accounts and financial statements; and the report of the auditors relating thereto (including the auditors' opinion on the use of the Loan proceeds and compliance with the covenants of the Loan Agreement as well as on the use of the procedures for imprest account/statement of	Article IV, Section 4.06 (b)	Complied with.

	expenditures), all in the English language; and (iv) furnish to the Bank such other information concerning such accounts and financial statements and the audit thereof as the Bank shall from time to time reasonably request.		
16	DOR shall develop a baseline for performance monitoring in accordance with Bank's Project Performance Management System Handbook, and establish a systematic project performance monitoring, including benefits monitoring and evaluation. The survey shall be conducted prior to construction, three months, one year and four years after completion of construction. The indicators to be collected and the form and content of reporting shall be agreed upon between DOR and the Bank.	Schedule 6, para. 6	Complied with.

ADB = Asian Development Bank, ARMP = annual road maintenance plan, DOR = Department of Roads, PBM = performance based maintenance, PD = project director.

Source: ADB's project completion review mission, June–July 2010.

## PROJECT OUTCOMES

Table A6.1: Vehicle Operating Cost in the Project Road Sections (NRs/km)

Road Section	Stage	Car	Utility	Bus	Mini Bus	Truck	Mini Truck	Tractor	Motor Cycle	Total	% Change
Pouwa Bhajnyang – Phidim Road Section	Pre-const.	22.01	29.02	38.04	30.24	52.80	27.15	27.95	5.45	24.01	-12.2
	Post-Const.	20.60	27.14	35.72	28.30	49.55	25.23	25.75	4.96	21.09	
Damak – Gauriganj Road Section	Pre-const.	23.39	30.77	30.56	27.95	39.94	24.03	27.87	5.96	14.30	-0.9
	Post-Const.	18.21	23.46	23.67	22.32	31.50	18.64	24.01	4.64	14.17	
Biratnagar – Bardanga – Ularbari Road Section	Pre-const.	26.47	34.64	34.27	31.00	44.50	26.85	29.60	6.68	26.97	-49.5
	Post-Const.	18.83	24.44	24.79	23.10	32.80	19.49	24.49	4.77	13.61	
Hile – Basantapur Road Section	Pre-const.	24.41	32.07	31.77	...	41.50	24.96	28.47	6.2	27.00	-23.9
	Post-Const.	18.83	24.44	24.79	...	32.80	19.49	24.49	4.77	20.56	
Basantapur – Sabha Khola Road Section	Pre-const.	...	...	53.68	...	53.68	...	39.08	...	50.61	-48.1
	Post-Const.	...	26.18	34.67	...	34.67	...	24.01	4.83	26.28	
Dolalghat – Chautara Road Section	Pre-const.	23.39	30.77	30.56	...	39.90	24.03	27.87	5.96	22.39	-36.7
	Post-Const.	18.21	23.46	23.67	...	31.50	18.64	24.01	4.64	14.40	
All Project Road Sections	Pre-const.	24.27	32.33	30.92	30.73	43.37	25.60	28.47	6.14	22.52	-30.7
	Post-Const.	18.97	23.22	23.22	24.14	34.39	20.40	24.19	4.72	15.60	

... = not available, const = construction, km – kilometer, NRs = Nepalese rupees.

Sources: Consultants' survey, Roads Economic Decision Model and Project Performance Monitoring Study Report, June 2009.

**Table A6.2: Passenger Fare and Freight Rates in the Project Road Sections**

Road Section	Stage	Passenger Fares (NRs./Passenger)				% Change	Freight Rates (NRs./Kg)				% Change
		Bus	Min Bus	Jeep	Average		Truck	Mini Truck	Tractor	Average	
Pouwa Bhajnyang – Phidim Road Section	Pre-const.	52.0	0	110.0	63.60		2.95	2.95	2.95	2.959	
	Post-Const.	48.0	0	72.0	73.17	-15.0	2.00	2.00	2.00	2.00	-32.0
Damak – Gauriganj Road Section	Pre-const.	56.0	64.0	121.0	90.93		0.60	0.60	1.30	0.78	
	Post-Const.	25.3	27.5	33.0	30.57	-66.4	0.40	0.50	0.50	0.47	-40.2
Biratnagar – Bardanga – Ularbari Road Section	Pre-const.	131.0	197.0	229.0	176.80		1.50	1.50	1.00	1.32	
	Post-Const.	72.0	64.0	121.0	104.82	-40.7	0.70	0.80	0.80	0.76	-42.3
Hile – Basantapur Road Section	Pre-const.	118.0	0	322.0	198.36		0.80	0.90	0.80	0.89	
	Post-Const.	50.0	0	66.0	61.46	-69.0	0.50	0.50	0.70	0.57	-28.2
Basantapur – Mudhe Road Section	Pre-const.	4.8	0	0	4.80		2.90	0.00	2.90	2.90	
	Post-Const.	2.5	0	0	2.50	-47.9	2.20	0.00	2.20	2.20	-24.1
Dolalghat – Chautara Road Section	Pre-const.	72.0	0	121.0	79.09		0.60	0.60	0.06	0.59	
	Post-Const.	53.0	0	70.0	63.20	-20.1	0.40	0.50	0.50	0.46	-22.9
Average	Pre-const.	87.24	190.53	200.10	133.32		1.41	1.24	1.01	1.23	
	Post-Const.	52.35	45.38	76.12	68.54	-48.6	0.80	0.89	0.88	0.85	-30.7

% = percentage, const = construction, kg = kilogram, NRs. = Nepalese rupees

Source: Consultants' survey and Project Performance Monitoring Study Report, June 2009

**Table A6.3: Travel Time of Different Types of Vehicles in Project Road Sections**

Road Section	Stage	Travel Time (km/hr)					Average	% Change
		Utility	Bus	Truck	Mini Truck	Tractor		
Pouwa Bhajnyang – Phidim Road Section	Pre-const.	16.00	8.00	8.00	8.00	6.00	8.61	65.4
	Post-Const.	18.00	16.00	16.00	16.00	8.00	14.24	
Damak – Gauriganj Road Section	Pre-const.	22.00	11.00	11.00	14.70	7.30	13.14	116.3
	Post-Const.	44.00	22.00	29.30	44.00	14.70	28.42	
Biratnagar – Bardanga – Ularbari Road Section	Pre-const.	9.80	17.50	7.30	7.30	4.90	8.09	339.6
	Post-Const.	44.00	32.80	32.80	43.70	22.00	35.57	
Hile – Basantapur Road Section	Pre-const.	15.00	7.40	7.30	8.80	5.50	7.17	163.6
	Post-Const.	30.00	22.00	14.70	22.10	11.00	18.89	
Basantapur – Mudhe Road Section	Pre-const.	...	9.00	...	7.00	5.00	6.26	140.7
	Post-Const.	32.00	26.00	30.00	17.00	9.00	15.07	
Dolalghat – Chautara Road Section	Pre-const.	22.00	11.70	11.00	14.70	11.00	11.41	63.4
	Post-Const.	20.00	23.40	13.00	3.00	12.00	18.63	
All Project Road Sections	Pre-const.	11.49	11.79	8.06	10.71	5.39	10.93	138.9
	Post-Const.	37.30	23.42	22.43	28.98	14.47	26.11	

... = not available, % = percentage, const = construction, hr = hour, km = kilometer.

Sources: Consultants' survey and Project Performance Monitoring Study Report, June 2009.

**Table A6.4: Annual Average Daily Traffic of Project Road Sections**

Road Section	Stage	Annual Average Daily Traffic									% Change
		Car	Utility	Bus	Mini Bus	Truck	Mini Truck	Tractor	Motor Cycle	Total	
Pouwa Bhajnyang – Phidim Road Section	Pre-const.	136	12	48	10	48	15	8	79	384	74.7
	Post-Const.	36	86	28	17	87	56	100	261	671	
Damak – Gauriganj Road Section	Pre-const.	20	61	51	2	101	19	33	646	942	34.0
	Post-Const.	40	114	38	25	127	68	197	653	1,262	
Biratnagar – Bardanga – Ularbari Road Section	Pre-const.	149	70	97	39	327	66	178	377	1,351	22.7
	Post-Const.	114	242	28	24	130	50	148	922	1,658	
Hile – Basantapur Road Section	Pre-const.	68	39	60	0	38	1	155	55	457	32.0
	Post-Const.	29	96	38	0	123	59	109	149	603	
Basantapur – Mudhe Road Section	Pre-const.	...	...	22	...	8	...	6	...	38	79.0
	Post-Const.	...	15	21	...	12	...	8	12	68	
Dolalghat – Chautara Road Section	Pre-const.	15	11	68	0	16	48	1	61	217	100.4
	Post-Const.	10	57	38	0	47	24	37	222	435	
All Project Road Sections	Pre-const.	388	193	343	51	538	149	379	1,246	3,389	38.6
	Post-Const.	229	610	191	66	526	257	599	2,219	4,697	

... = not available, const = construction, % = percentage.

Sources: Consultants' estimates and Project Performance Monitoring Study Report, June 2009.

**Table A6.5: Average Production of Marketed Agriculture Products (Cash Crop)  
(ton/ha)**

Road Section	Stage	Mustard	Pulses	Sugarcane	Cardamom	Green Leafy Veg.	Tomato	Cauliflower	Potato	Average
Pouwa Bhajnyang – Phidim Road Section	Pre-const.	0.86	0.55	24.61	7.39	10.33	16.70	17.70	15.03	11.7
	Post-Const.	0.68	0.60	0.00	6.67	13.17	16.30	14.38	15.33	8.4
Damak – Gauriganj Road Section	Pre-const.	0.95	1.25	8.70	7.12	7.50	13.50	14.75	17.10	8.9
	Post-Const.	0.98	1.25	12.50	0.00	12.35	17.90	14.90	17.45	9.7
Biratnagar – Bardanga – Ularbari Road Section	Pre-const.	0.92	0.95	11.38	2.01	13.01	14.10	13.58	15.71	9.0
	Post-Const.	0.98	1.25	12.50	2.72	13.35	17.80	14.90	17.47	10.1
Hile – Basantapur Road Section	Pre-const.	0.93	1.67	8.57	7.12	13.01	14.10	13.58	15.71	9.4
	Post-Const.	0.98	1.85	9.50	9.21	13.35	17.80	14.90	17.47	10.6
Basantapur – Sabha Khola Road Section	Pre-const.	1.40	1.30	4.50	0.30	5.30	12.90	5.60	4.50	4.5
	Post-Const.	1.60	1.35	4.50	0.50	13.35	17.80	14.90	5.80	7.5
Dolalghat – Chautara Road Section	Pre-const.	0.91	1.76	8.75	0.00	14.00	13.50	12.57	6.90	7.3
	Post-Const.	0.97	1.78	9.15	0.00	14.35	17.80	14.90	1.47	7.5
All Project Road Sections	Pre-const.	1.00	1.25	11.09	3.99	10.53	14.13	12.96	12.49	8.4
	Post-Const.	1.03	1.35	8.03	3.18	13.32	17.57	14.81	12.50	9.0
% Change		3.69	8.02	-27.60	-20.22	26.56	24.27	14.27	0.05	6.5

... = not available, const = construction, ha = hectare, veg = vegetable.

Sources: Project Performance Monitoring Study Report, June 2009.

**Table A6.6: Vehicle Ownership in Area of Project Road Sections**

Road Section	Stage	Number of Vehicles								% Change
		Car	Bus	Utility	Truck	Mini Truck	Tractor	Motor Cycle	Total	
Pouwa Bhajnyang – Phidim Road Section	Pre-const.	...	...	1	4	3	1	7	16	1,181.3
	Post-Const.	6	10	35	30	14	5	105	205	
Damak – Gauriganj Road Section	Pre-const.	25	16	30	80	60	7	300	518	-22.0
	Post-Const.	18	16	40	45	25	10	250	404	
Biratnagar – Bardanga – Ularbari Road Section	Pre-const.	135	190	135	245	57	32	450	1,244	-15.7
	Post-Const.	50	24	132	90	25	53	675	1,049	
Hile – Basantapur Road Section	Pre-const.	1	3	2	6	1	14	14	41	375.6
	Post-Const.	9	12	35	40	22	27	50	195	
Basantapur – Sabha Khola Road Section	Pre-const.	...	5	...	5	...	5	...	15	520.0
	Post-Const.	...	12	7	8	30	11	25	93	
Dolalghat – Chautara Road Section	Pre-const.	0	15	4	7	26	5	55	112	100.9
	Post-Const.	6	16	15	25	16	12	135	225	
All Project Road Sections	Pre-const.	89	90	264	238	132	118	1,240	2,171	88.9
	Post-Const.	250	319	435	581	276	181	2,059	4,101	

... = not available, const = construction, % = percentage

Sources: Project Performance Monitoring Study Report, June 2009

**Table A6.7: Time Required to Reach Different Services in Project Road Section  
(In Hours)**

Road Section	Stage	Average Round Trip Time Required											% Change
		Sub-health Post	Health Post	Health Clinic	Hospital	Primary School	Lower Secondary School	Secondary School	Vocational School	Higher Secondary School	College	Average	
Pouwa Bhajnyang - Phidim Road Section	Pre-const.	1.55	2.01	2.00	3.72	0.44	1.04	1.53	14.29	3.65	3.70	3.39	-10.6
	Post-Const.	1.52	1.92	1.92	3.25	0.40	1.02	1.37	13.72	2.86	2.35	3.03	
Damak – Gauriganj Road Section	Pre-const.	1.10	1.20	1.04	4.80	0.40	1.10	1.50	4.00	4.40	4.00	2.39	-14.4
	Post-Const.	0.75	0.90	1.02	4.25	0.40	1.05	1.43	3.45	3.86	3.35	2.05	
Biratnagar – Bardanga - Ularbari Road Section	Pre-const.	1.10	1.20	1.40	4.80	0.70	1.10	1.30	6.10	2.70	3.30	2.37	-26.8
	Post-Const.	1.05	1.07	1.15	3.75	0.60	1.05	1.03	3.45	1.86	2.35	1.74	
Hile - Basantapur Road Section	Pre-const.	1.10	1.20	1.40	3.80	0.70	1.10	1.30	6.10	2.70	3.30	2.27	-29.3
	Post-Const.	1.05	1.07	1.15	2.45	0.40	1.05	1.23	3.45	1.86	2.35	1.61	
Basantapur – Sabha Khola Road Section	Pre-const.	2.60	4.20	6.70	9.30	0.90	1.40	2.20	51.40	6.20	7.00	9.19	-29.0
	Post-Const.	1.05	1.07	1.15	4.75	0.40	1.05	1.60	49.76	1.86	2.57	6.53	
Dolaighat – Chautara Road Section	Pre-const.	1.20	2.30	3.10	3.20	0.60	0.90	1.00	3.71	2.20	2.80	2.1	-28.3
	Post-Const.	1.05	1.07	1.15	2.45	0.40	0.55	0.73	3.45	1.86	2.35	1.51	
All Project Roads	Pre-const.	1.40	1.86	2.44	5.14	0.62	1.12	1.49	13.65	3.71	4.05	3.55	-24.1
	Post-Const.	1.05	1.14	1.22	3.71	0.46	1.01	1.25	12.08	2.43	2.60	2.70	

Const = construction, % = percentage

Source: Consultants' survey and Project Performance Monitoring Study Report, June 2009

## ECONOMIC ANALYSIS

### A. Introduction

1. Consistent with the report and recommendation of the President for the Road Network Development Project,<sup>1</sup> the economic analyses of all project road sections were carried out using the same methodology as at appraisal and in accordance with the Guidelines for the Economic Analysis of Projects of the Asian Development Bank (ADB).<sup>2</sup> The economic internal rate of return (EIRR) evaluated for all project road sections is significantly higher than 12%, indicating that the project is justified from an economic perspective. The approach takes into account only those factors that can be quantified, such as project implementation and maintenance costs, forecast volume of traffic, potential benefits and residual value of the project investment.

2. The economic analysis of project implementation in the project road sections is undertaken by comparing cost and benefit streams. All costs and benefits are expressed in economic terms at 2008 constant prices, since most of the project road sections were completed in 2008. In the evaluation of the net benefits, costs are discounted as of 2008 using a discount rate of 12%.

3. Costs and benefits are estimated in economic prices. The economic price reflects the resource cost or value of an item to the country. The economic prices are obtained by excluding all taxes, duties, or subsidies included in the financial prices.

### B. Traffic Volumes and Traffic Growth Forecasts

4. Current traffic volumes on the project roads are determined from the traffic counts and origin and destination surveys carried out in 2008, which were normalized through the application of factors to convert specific counts to annual average daily traffic (AADT).

5. Traffic levels recorded before and after the project in the project road sections are compared. The traffic levels are assessed in terms of a common year that is the first full year following the completion of the road improvement, which is taken as 2008 for the project roads. Before the project, road traffic levels were recorded in 2004 and 2005. The traffic growth rates applied during appraisal were used to convert the calculated AADTs of 2004 and 2005 to the 2008 level; the annual normal growth rates used were 6.1% for freight (utility vehicles, truck, mini-truck, and tractors); 7.8% for cars and motorcycles; and 6.7% for buses and minibuses.

6. Diverted traffic—traffic that switches from another route or mode of transport if the project is implemented, but still travels between the same origin and destination—is not observed on the project roads, because there are no alternate routes.

7. All actual project road AADTs recorded in 2008 are higher than the projected 2008 non-project AADTs (based on the adjusted pre-implementation AADTs), with the exception of buses. The increased traffic and additional vehicles operating after the project are assumed to be generated traffic (i.e., additional traffic stimulated by the implementation of the project that would not have made the journey by any means in the absence of the project).

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<sup>1</sup> ADB. 2001. *Report and Recommendation of the President to the Board of Directors: Proposed Loan to the Road Network Development Project*. Manila.

<sup>2</sup> ADB. 1997. *Guidelines for the Economic Analysis of Projects*. Manila.

8. To calculate users' benefits from future traffic for the economic evaluation of the road subprojects, the estimated normal and generated traffic are projected using the same annual growth rates of freight (porter, truck, and utility vehicles); car and motorcycles; and buses and minibuses, including pedestrians, from 2008 to 2027.

**Table A7.1: Annual Average Daily Traffic of Project Road Sections  
2008**

No.	Road Section	Annual Average Daily Traffic								
		Car	Utility	Bus	Mini Bus	Truck	Mini Truck	Tractor	Motor cycle	Total
1	Pouwa Bhajnyang–Phidim Road Section	136	86	48	17	87	56	100	261	791
2	Damak–Gauriganj Road Section	41	114	36	25	127	68	197	623	1,231
3	Biratnagar–Bardanga–Ularbari Road Section	149	242	97	39	327	66	226	922	2,068
4	Hile–Basantapur Road Section	68	96	60	0	116	56	196	140	732
5	Basantapur–Khandbari Road Section	0	15	25	0	12	0	8	12	72
6	Dolalghat–Chautara Road Section	10	57	38	0	47	24	37	222	435
7	Belbari–Chuharwa Road Section	490	204	364	794	572	111	174	2,283	4,992
8	Hetauda–Narayani Bridge Road Section	212	194	636	492	1,706	72	99	2,278	5,689
9	Kohalpur–Gadda Chauki Road Section	18	32	78	406	209	30	183	681	1637

Source: Consultants' survey and estimates.

**Table A7.2: Projected Annual Average Daily Traffic of Project Roads  
2010–2025**

Road link	2010	2015	2020	2025
<b>East–West Highway Strengthening</b>				
Belbari–Chuharwa	4,038	5,457	7,388	10,024
<b>Road Improvement</b>				
Biratnagar–Bardanga–Bardanga	1,598	2,117	2,813	3,748
Damak–Gauriganj	1,082	1,478	2,022	2,773
Pouwa Bhajnyang–Phidim	462	631	862	1,179
Hile–Basantapur	537	703	924	1,216
Dolalghat–Chautara	519	698	941	1,272
Basantapur–Khandbari	80	105	139	183
<b>Performance-Based Maintenance</b>				
Hetauda–Narayani Bridge	4,352	5,699	7,477	9,828
Kohalpur–Gadda Chouk	905	1,187	1,562	2,059

Source: Consultants' estimates.

### C. Construction Standards and Project Costs

9. According to the project design, the then-existing Urlabari–Bardanga and Basantapur–Mudhe earthen road sections; Pouwa Bhajnyang–Phidim, Damak–Gauriganj, Hile–Basantapur,

and Dolalghat–Chautara gravel road sections; and Biratnagar–Bardanga and Belbari–Chuharwa (East–West Highway) paved road sections were to be upgraded to an all-weather, full bituminous paved condition. Similarly, the project design of the then-existing Mudhe–Chainpur earth track was to be constructed to a full bituminous paved road and the Chainpur–Sabha Khola earth track was to be constructed to a gravel standard road. The project design also required improving the pavement condition of the Hetauda–Narayani Bridge and Kohalpur–Gadda Chauki paved road sections under performance-based maintenance. The project works were undertaken between February 2005 and June 2009.

10. The road sections were designed in accordance with international practice for a 10-year lifespan, with provision for overlay during the period to extend the life another 10–15 years. The designs were based on projected traffic, axle loads, existing pavement structure, sub-grade California Bearing Ratio, and assumed quality materials were available. The pavement design width of the road sections was 3.5 meters, with 0.5 meter single bituminous surface treatment shoulders.

11. The above project activities in Belbari–Chauharwa, Biratnagar–Rangeli–Bardanga–Ularbari, Basantapur–Mudhe, and Hetauda Narayani Bridge road sections were carried out under international competitive bidding, whereas project activities in other road sections were carried out under national competitive bidding.

12. The upgrading of road sections in Pouwa Bhajnyang–Phidim; Damak–Gaurigunj; Biratnagar–Rangeli; and Dolalghat–Chautara was completed in 2008, as were pavement improvements for Hetauda–Narayani Bridge and Kohalpur–Gadda Chauki; project works for Hile–Basantapur, Basantapur–Sabha Khola, and Belbari–Chuharwa were completed by June 2009.

13. The total implementation costs for the project road sections are summarized in Table A6.3. This includes costs of resettlement, construction, supervision, and project management, and shows the comparison between the original cost estimates and actual costs of implementation. To allow proper comparison with the actual implementation costs, the original appraisal estimates have been inflated to 2008 values, using construction material price indices published by Nepal Rastra Bank.

**Table A7.3: Project Implementation Costs in 2008 Prices**  
(NRs million)

S.No.	Road Section	Original Estimate <sup>a</sup>	Adjusted Estimate <sup>b</sup>	Actual (Total)
1	Road Network Development Project Consulting Services	...	...	850.47
2	Pouwa Bhajnyang–Phidim Road Section	280.90	362.50	209.58
3	Damak–Gaurigunj Road Section	163.88	234.24	128.82
4	Biratnagar–Bardanga–Ularbari Road Section	611.10	873.49	677.15
5	Hile–Basantapur Road Section	266.09	380.34	184.79
6	Basantapur–Khandbari Road Section	891.25	1,273.93	924.34
7	Dolalghat–Chautara Road Section	246.74	352.68	189.33
8	Belbari–Chuharwa Road Section	1,013.97	1,449.35	966.79
9	Hetauda–Narayani Bridge Road Section	260.26	372.01	186.07
10	Kohalpur–Gadda Chauki Road Section	301.53	431.00	177.22
11	Equipment Purchase	...	...	12.80

<b>Total</b>	<b>4,035.72</b>	<b>5,729.54</b>	<b>4,683.17</b>
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... = not available.

<sup>a</sup> Original cost estimate used for appraisal of upgrading to paved standard.

<sup>b</sup> Adjustment of the original cost estimate at 2008 prices.

Source: Consultants' survey and estimates.

14. Actual costs were NRs1,046.37 million below the initial cost estimates due to very low bidding by the contractors as a result of tough competition.

15. ADB financed 67.85% of actual expenditures, the Department for International Development of the United Kingdom (DFID) 12.65%, and the Government of Nepal 19.50%; the estimated financing shares were ADB 66.20%, DFID 13.80%, and the government 20.00%. ADB's actual percentage contribution increased and that of DFID and the government decreased compared with the estimated contribution.

16. Although economic prices were estimated by excluding every tax, duty, or subsidy included in the financial prices, it is a normal practice to convert financial costs into economic or border price equivalents by using a standard conversion factor (SCF). SCFs for converting financial construction and maintenance costs to economic costs of road projects in Nepal are derived by the Department of Roads (DOR). DOR has derived an SCF of 0.88 for the project implementation cost. The same factor is used to convert the above financial costs into economic costs for economic evaluation.

17. The factor is checked with other recent studies in Nepal for consistency as well as with the initial feasibility studies for the project roads. Overall, the value is consistent with those values applied in earlier studies.

#### **D. Maintenance**

18. Standard maintenance measures after project implementation are assumed in accordance with DOR's Policy Document on Design Standards. The suggested maintenance activities (annual regular and recurrent maintenance and a periodic resealing every fifth year) are assumed adequate to maintain the average surface condition at the same level over the project life. Deterioration of the road over time as a result of traffic loadings and environmental impact are therefore not considered for economic evaluation. The estimated average maintenance cost for all project road sections is given in Table A6.4.

**Table A7.4: Economic Maintenance Costs**  
(NRs million/km/annum)

<b>Activity</b>	<b>Amount</b>
Routine and recurrent maintenance	0.044
Periodic maintenance (every fifth year)	0.667

Source: Consultants' survey and estimates

19. Any further deterioration of the project roads before project implementation is assumed to be controlled by such maintenance activities aimed at sustaining the condition of the road. The level of expenditure on these maintenance activities is defined as the "holding maintenance" cost. The holding maintenance cost is assumed to include routine and recurrent maintenance costs.

20. The average economic holding maintenance cost per kilometer of the project road sections is estimated to be NRs0.056 million/km/year. DOR has derived an SCF of 0.90 for road maintenance costs. This factor is used to convert the above financial maintenance costs into economic costs for economic evaluation.

## E. Benefits

21. The major benefits from the project road sections (with the exception of the Mudhe–Sabha Khola road section) are benefits accruing to road users after the project implementation, and arising from the savings in vehicle operating costs (VOCs) for both freight and passenger vehicle traffic and travel time savings for passenger vehicles. In the case of the Mudhe–Sabha Khola road section, road users' benefits after project implementation arise from savings in the costs of porters, and travel time savings by pedestrians.

22. The savings in VOC for both freight and passenger vehicle traffic resulted from the improved road surface condition in the case of road upgrading, and from savings in transport cost resulting from a modal shifting from porters to motorized vehicles in the case of new construction. Table A6.5 shows road surface roughness in the project roads before and after project implementation.

**Table A7.5: Road Roughness in the Project Roads Before and After Project Implementation (IRI m/km)**

Road Section	IRI (m/km)	
	Without Project	With Project
<b>East–West Highway Strengthening</b>		
Belberi–Chuharwa	7.0	5.0
<b>Road Improvement</b>		
Biratnagar–Bardanga–Uralbari	12.5	4.7
Damak–Gaurigunj	9.3	4.0
Pouwa Bhanjyang–Phidim	6.4	5.1
Hile–Basantpur	10.5	5.1
Dolalghat–Chautara	10.1	5.1
Basantpur–Khandbari	14.5	4.5
<b>Performance-Based Maintenance</b>		
Hetauda–Narayani Bridge	7.0	5.0
Kohalpur–Gadda Chouk	7.0	5.0

IRI = international roughness index, km = kilometer, m = meter.

Note: Costs include passenger time savings.

Source: Consultants' survey and estimates

23. To estimate VOC in the project road sections before and after project implementation, the RED<sup>1</sup> model (HDM-4<sup>2</sup> module calibrated to the Nepali situation) was used. The RED model is suitable for evaluation of low traffic volume roads. Table A6.6 shows the VOC of vehicles in the project roads before and after project implementation.

<sup>1</sup> Roads Economic Decision Model which is based on HDM-4 vehicle operating cost relationship.

<sup>2</sup> Highway Development and Management System Model, the World Bank.

**Table A7.6: Vehicle Operating Cost in the Project Road Sections**  
(NRs/km)

Section No.	Road Section	Stage	Motorcycle	Car	Truck	Minitruck	Utility	Bus	Mini-bus	Tractor	Porter (NRs/kg/km)
1	Pouwa Bhanjyang–Phidim Road Section	Pre-const.	5.45	22.01	52.8	27.15	29.02	38.04	30.24	27.95	...
		Post-Const.	4.96	20.60	49.55	25.23	27.14	35.72	28.30	25.75	...
2	Damak–Gauriganj Road Section	Pre-const.	5.96	23.39	39.94	24.03	30.77	30.56	27.95	27.87	...
		Post-Const.	4.64	18.21	31.5	18.64	23.46	23.67	22.32	24.01	...
3	Biratnagar–Bardanga–Ulrahari Road Section	Pre-const.	6.68	26.47	44.5	26.85	34.64	34.27	31.00	29.60	...
		Post-Const.	4.77	18.83	32.8	19.49	24.44	24.79	23.1	24.49	...
4	Hile–Basantapur Road Section	Pre-const.	6.2	24.41	41.5	24.96	32.07	31.77	...	28.47	...
		Post-Const.	4.77	18.83	32.8	19.49	24.44	24.79	...	24.49	...
5	Basantapur–Khandbari Road Section	Pre-const.	8.58	35.95	53.68	38.02	47.29	53.68	38.02	39.08	3.00
		Post-Const. (1)	4.83	20.01	34.67	24.41	26.18	34.67	24.41	24.01	...
		Post-Const. (2)	5.45	22.01	27.15	52.80	29.02	27.15	52.80	25.84	...
6	Dolalghat–Chautara Road Section	Pre-const.	5.96	23.39	39.9	24.03	30.77	30.56	...	27.87	...
		Post-Const.	4.64	18.21	31.5	18.64	23.46	23.67	...	24.01	...
7	Belberi–Chuharwa	Pre-const.	2.51	11.25	25.13	19.71	12.79	20.33	18.14	12.36	...
		Post-Const.	2.33	10.37	23.28	18.22	11.83	18.14	15.73	12.02	...
8	Hetauda–Narayani Bridge	Pre-const.	2.51	11.25	25.13	19.71	12.79	20.33	18.14	12.36	...
		Post-Const.	2.33	10.37	23.28	18.22	11.83	18.14	15.73	12.02	...
9	Kohalpur–Gadda Chouk	Pre-const.	2.51	11.25	25.13	19.71	12.79	20.33	18.14	12.36	...
		Post-Const.	2.33	10.37	23.28	18.22	11.83	18.14	15.73	12.02	...

... = not available, kg = kilogram, km = kilometer, NRs. = Nepalese rupees.

Sources: Consultants' observations and Roads Economic Decision (RED) Model.

24. The financial VOCs were converted to economic costs by deducting all prevailing duties and taxes. The savings in passenger vehicle travel time result from (i) the increased speed of vehicles due to the improved road surface condition, in the case of road upgrading; and (ii) the modal shift from walking to riding of vehicles, in the case of new construction.

25. The value placed by travelers (drivers on motorcycles, passengers in cars and buses, and pedestrians) on travel time savings is best established by using appropriate income levels. Nonwork trips are given no value. The value of passenger travel time increases as income rises.

Table A6.7 sets out the personal travel time values used. The value of pedestrian travel time is considered equal to that of a passenger on a bus (NRs4.5 per hour).

**Table A7.7: Estimates on the Value of Passenger Time Savings per Vehicle Hour**

Passenger Vehicle	Monthly Income per Passenger Traveling for Work Purposes	Percent of Passengers Traveling in Work Time	Value of Time Savings per Average Passenger-Hour	Passengers per Vehicle	Value of Passenger Time Savings per Vehicle-Hour
Motorcycle	6,000	10	3.75	1.8	6.75
Bus	3,600	20	4.50	40.0	180.00
Minibus	3,600	20	4.50	20.0	90.00
Cars	3,600	20	4.50	20.0	67.50

Sources: Drivers, passengers, and consultant's estimates.

26. In the Basantpur–Khandbari road section, incremental benefits resulting from increased agriculture production are also considered for economic analysis. Most of the usable land in the zone of influence is used, but with good road access a modest switch to higher-value cash crops is assumed, with 4% converting to the growing of fruit, vegetables and pulses, producing annual producer surplus benefits of about NRs6.0 million.

## F. Economic Analysis

27. Three indicators of economic viability (net present value, benefit–cost ratio, and internal rate of return) are calculated to test the viability of project implementation. The economic evaluation results are summarised in Table A6.8.

**Table A7.8 Economic Evaluation Results**

Road	NPV	BCR	IRR (%)
	(NRs million)		
Powa Bhanjyang–Phidim Road	415.14	4.59	34.49
Damak–Gaurigunj Road	290.77	7.51	50.84
Biratnagar–Bardanaga–Urlabari Road			
Hile–Basantapur Road	110.59	1.93	20.78
Basantapur–Khandbari Road	3,080.44	5.36	43.79
Dolalghat–Chautara Road	125.45	2.05	22.76
Belbari–Chuharwa Road Section	2,717.57	5.41	45.63
Hetauda–Narayani Bridge Road Section	2,069.00	20.77	120.04
Kohalpur–Gadda Chauki Road Section	1,285.06	21.96	71.48

BCR = benefit cost ratio, IRR = internal rate of return, NPV = net present value.

Source: Performance Monitoring and Evaluation study's estimates

28. It is evident that the project roads generate adequate returns to ensure the economic viability of the road improvement works. This conclusion is supported by positive net present values, a benefit–cost ratio above 1, and rates of return above 12%.

## G. Sensitivity Analysis

29. The sensitivity of each road component's EIRR is analyzed with respect to changes in the benefit and cost streams (Table A6.9). The tests applied for the road improvement component are (i) an increase of 20% in construction costs, (ii) a decrease of 20% in normal and generated traffic VOC benefits, and (iii) exclusion of the value of time benefits.

**Table A7.9 Sensitivity Test of Road Improvement Components  
(Economic Internal Rate of Return %)**

Road	Const. Cost + 20%	VOC Savings -20%	Exclude Time Benefits	Traffic Growth Rate -50%
Powa Bhanjyang–Phidim Road	30.28	29.59	19.56	18.49
Damak–Gaurigunj Road	38.89	38.03	36.12	34.26
Biratnagar–Bardanaga–Urlabari Road	37.38	36.42	32.53	27.30
Hile–Basantapur Road	11.42	12.53	12.62	12.62
Basantapur–Khandbari Road	37.26	38.18	34.43	31.87
Dolalghat–Chautara Road	12.03	13.15	11.16	10.73
Belbari–Chuharwa Road Section	35.50	36.53	20.46	19.56
Hetauda–Narayani Bridge Road Section	95.80	96.54	63.58	59.63
Kohalpur–Gadda Chauki Road Section	69.70	71.53	36.29	33.70

VOC = vehicle operating cost

Source: Performance Monitoring and Evaluation study's estimates

30. A slightly larger impact occurs with either a 20% increase in construction costs or a 20% decrease in benefits. Excluding passenger time benefits has a higher negative impact on viability. The EIRRs for all project road sections in the Hill region are about 12% or below.

31. A decrease in traffic growth of 50% causes major reductions in benefit levels in the later years of the evaluation period, but the impact on EIRRs is generally only a little larger than that of the other tests. However, in the case of the roads with the lowest rates of return, this impact is very significant. The switching values for the overall project are 1,282% higher for costs and 20% lower for benefits.

32. For the Basantpur–Khandbari section, reducing producer surplus by 20% cause the EIRR to decrease to close to 42.78%. The switching values are a 382% increase in costs and 79% lower benefits.

# IMPACT ON INCOME, EMPLOYMENT AND POVERTY

**Table A8.1: Average Household Cash Income  
(NRs.)**

Road Section	Stage	Agriculture and Horticulture Produce	Livestock and Livestock Products	Salaried Job	Pension	Remittance	Wages	Trade and Business	Others	Total
Pouwa Bhajnyang – Phidim Road Section	Pre-const.	39,375	802	681	733	375	1,939	47	7,069	51,020
	Post-Const.	16,872	5,312	3,483	10,559	4,369	6,788	2,936	4,008	54,328
Damak – Gauriganj Road Section	Pre-const.	37,384	3,122	1,466	5,649	352	83	2,389	69,364	119,809
	Post-Const.	37,905	3,897	1,873	7,644	1,665	3,490	2,960	88,725	148,159
Biratnagar – Bardanga – Ularbari Road Section	Pre-const.	26,921	5,991	470	694	727	743	11	7,894	43,451
	Post-Const.	32,348	6,247	508	733	952	2,143	954	3,144	47,029
Hile – Basantapur Road Section	Pre-const.	32,431	8,826	694	1,093	278	0	757	58,084	102,163
	Post-Const.	35,807	10,125	1,004	1,483	656	4,774	2,682	60,196	116,727
Basantapur – Sabha Khola Road Section	Pre-const.	45,390	11,901	13,295	3,583	12,593	8,740	6,483	2,122	104,107
	Post-Const.	97,580	14,801	17,396	2,700	14,775	9,448	8,020	5,214	169,934
Dolalghat – Chautara Road Section	Pre-const.	39,581	8,090	0	205	1,626	910	41	20,855	71,308
	Post-Const.	47,658	10,414	29	0	3,346	1,878	139	21,479	84,943
All Project Road Sections	Pre-const.	35,299	6,083	2,724	2,246	2,490	1,947	1,638	26,689	79,115
	Post-Const.	43,382	7,691	3,869	3,856	3,882	4,450	2,885	29,823	99,838
% Change		23.0	26.4	42.1	71.7	55.9	128.6	76.1	11.8	26.2

% = percentage, const = construction

Sources: Consultant survey and Project Performance Monitoring Study Report, June 2009

**Table A8.2: Average Household Expenditure  
(NRs.)**

Road Section	Stage	Food	Clothing	Education	Medicine	Lighting and Cooking	Social, Cultural and Festivals	Trans- port	Communi- -cations	Others	Total
Pouwa Bhajnyang – Phidim Road Section	Pre-const.	21,420	6,845	9,031	3,867	2,547	3,762	2,941	904	8,488	59,804
	Post-Const.	20,387	4,448	3,269	2,543	1,133	3,613	2,305	564	9,284	47,546
Damak – Gauriganj Road Section	Pre-const.	11,615	2,442	19,559	3,769	779	5,649	352	157	2,389	46,712
	Post-Const.	9,608	4,880	13,900	3,050	700	4,897	861	113	1,746	39,756
Biratnagar – Bardanga – Ularbari Road Section	Pre-const.	16,183	4,777	4,454	4,636	1,613	2,536	990	612	1,455	37,257
	Post-Const.	11,430	5,000	4,711	5,640	1,200	4,400	525	250	1,053	34,210
Hile – Basantapur Road Section	Pre-const.	22,098	5,044	4,433	5,534	1,570	5,442	1,144	482	4,584	50,331
	Post-Const.	21,883	4,889	3,554	2,999	2,492	4,567	681	227	5,912	47,204
Basantapur – Sabha Khola Road Section	Pre-const.	14,690	5,596	3,115	2,638	2,346	3,074	1,645	547	1,887	35,538
	Post-Const.	18,500	6,725	11,700	5,800	6,150	5,001	2,980	348	3,013	60,217
Dolalghat – Chautara Road Section	Pre-const.	24,731	6,776	6,996	8,121	3,462	6,401	1,706	991	3,542	62,725
	Post-Const.	30,827	2,414	6,112	490	4,601	5,952	868	2,628	1,737	55,627
All Project Road Sections	Pre-const.	16,911	4,844	8,342	4,395	1,804	4,069	1,278	555	42,199	67,487
	Post-Const.	15,909	4,963	7,625	4,019	2,260	4,639	1,259	457	41,131	66,353
% Change		-5.9	2.5	-8.6	-8.6	25.3	14.0	-1.5	-17.7	-2.5	-1.7

% = percentage, const = construction

Sources: Consultant survey and Project Performance Monitoring Study Report, June 2009

**Table A8.3: Employment Generation**

Road Section	Stage	Workers	
		No.	% Change
Pouwa Bhajnyang - Phidim Road Section	Pre-const.	92,442	8.8
	Post-Const.	100,567	
Damak – Gauriganj Road Section	Pre-const.	150,532	2.5
	Post-Const.	154,330	
Biratnagar – Bardanga - Ularbari Road Section	Pre-const.	235,426	2.7
	Post-Const.	241,865	
Hile - Basantapur Road Section	Pre-const.	65,482	23.5
	Post-Const.	80,837	
Basantapur – Mudhe Road Section	Pre-const.	10,769	37.2
	Post-Const.	14,772	
Dolalghat – Chautara Road Section	Pre-const.	12,699	11.3
	Post-Const.	14,137	
All Project Roads	Pre-const.	567,350	6.9
	Post-Const.	606,512	

% = percentage, const = construction

Source: district profile of project districts and consultants' estimates

**Table A8.4: Change in Number of Poor People in the Project Area**

Road Section	Stage	Total (Sample HH)	Non-poor	Poor	Very Poor	% Change			Total	% of Reduced Poor
						Non-Poor	Poor	Very Poor		
Pouwa Bhajnyang – Phidim Road Section	Pre-const.	450	156	172	122				294	
	Post-Const.	450	171	163	116	9.4	-5.0	-5.0	279	-5.0
Damak – Gauriganj Road Section	Pre-const.	450	128	124	199				322	
	Post-Const.	450	147	116	187	15.1	-6.0	-6.0	303	-6.0
Biratnagar – Bardanga – Ularbari Road Section	Pre-const.	450	132	167	151				318	
	Post-Const.	450	164	150	136	24.1	-10.0	-10.0	286	-10.0
Hile – Basantapur Road Section	Pre-const.	450	155	196	99				295	
	Post-Const.	450	196	169	85	26.6	-14.0	-14.0	254	-14.0
Basantapur – Sabha Khola Road Section	Pre-const.	450	214	127	109				236	
	Post-Const.	450	249	108	93	16.5	-15.0	-15.0	201	-15.0
Dolalghat – Chautara Road Section	Pre-const.	450	208	112	130				242	
	Post-Const.	450	218	108	124	4.6	-4.0	-4.0	232	-4.0
All Project Road Sections	Pre-const.	450	166	150	135				285	
	Post-Const.	450	191	136	123	15.3	-9.3	-8.5	259	-8.9

% = percentage, const = construction, HH =household.

Source: Consultants' survey and estimates.

**Table A8.5: Accessibility to Economic and Social Services  
(In Hours)**

Road Section	Stage	Average Round Trip Time Required					Average	% Change
		Local Market Center	DHQ	Regional Market Center	Health Services	Education Services		
Pouwa Bhajnyang – Phidim Road Section	Pre-const.	2.13	3.70	7.55	2.32	4.11	3.06	-25.7
	Post-Const.	1.06	2.27	5.67	2.15	3.62	2.28	
Damak – Gauriganj Road Section	Pre-const.	1.10	2.56	6.63	2.13	2.57	2.90	-17.9
	Post-Const.	0.60	2.27	4.59	1.73	2.26	1.71	
Biratnagar – Bardanga – Ularbari Road Section	Pre-const.	1.40	3.50	4.98	2.13	2.53	2.39	-29.2
	Post-Const.	1.02	2.27	3.98	1.76	1.72	1.69	
Hile – Basantapur Road Section	Pre-const.	1.40	3.50	15.00	1.88	2.53	2.33	-30.8
	Post-Const.	1.02	2.27	4.75	1.43	1.72	1.61	
Basantapur – Sabha Khola Road Section	Pre-const.	4.60	9.30	12.00	5.70	11.52	7.78	-52.3
	Post-Const.	1.02	2.27	6.73	2.01	9.54	3.71	
Dolalghat – Chautara Road Section	Pre-const.	1.30	3.10	5.35	2.45	1.87	2.18	-28.0
	Post-Const.	1.02	2.27	3.78	1.43	1.56	1.57	
All Project Road Sections	Pre-const.	1.93	4.20	7.87	2.71	4.11	3.24	-36.0
	Post-Const.	0.93	2.27	4.83	1.78	3.30	2.07	

% = percentage, const = construction, DHQ = district headquarters

Sources: Consultants' survey and Project Performance Monitoring Study Report, June 2009

**Table A8.6: Freight and Passenger Movements in the Project Road Sections**

Road Section	Stage	Annual Average Daily Freight Movements		Annual Average Daily Passenger Movements	
		Ton	% Change	No.	% Change
Pouwa Bhajnyang – Phidim Road Section	Pre-const.	258.6	182.1	2,289.3	43.6
	Post-Const.	729.6		3,286.7	
Damak – Gauriganj Road Section	Pre-const.	541.2	99.9	3,164.6	55.6
	Post-Const.	1,082.1		4,925.1	
Biratnagar – Bardanga – Ularbari Road Section	Pre-const.	1,817.4	-43.9	5,204.3	38.0
	Post-Const.	1,018.2		7,181.4	
Hile – Basantapur Road Section	Pre-const.	321.6	198.5	2,544.7	30.8
	Post-Const.	960.0		3,329.3	
Basantapur – Mudhe Road Section	Pre-const.	41.4	91.3	680.0	59.6
	Post-Const.	79.2		1,085.4	
Dolalghat – Chautara Road Section	Pre-const.	158.7	130.4	2,240.5	24.6
	Post-Const.	365.7		2,792.4	
Belbari – Chuharwa Road Section	Pre-const.	4,419.3	-13.5	32,393.1	14.1
	Post-Const.	3,821.7		36,959.1	
Hetauda – Narayani Bridge Road Section	Pre-const.	7,934.1	21.6	37,787.4	-21.2
	Post-Const.	9,648.6		29,791.5	
Kohalpur – Gadda Chauki Road Section	Pre-const.	1,195.2	20.1	11,946.1	-3.6
	Post-Const.	1,435.8		11,513.7	
All Project Road Sections	Pre-const.	16,687.5	14.7	9,8250	2.7
	Post-Const.	19,140.9		100,864.6	

% = percentage, const = construction

Sources: Consultants' survey and estimates