

An aerial photograph of a mountain valley. The valley floor is covered in dense green vegetation and a river flows through it. A small settlement with several buildings is visible in the middle ground. The surrounding hills are also covered in green forest.

Asian Development Bank

North South Fast Track Project

TA 4842-NEP

FINAL PROJECT REPORT

Feasibility Studies and Preliminary Design

Volume 1 Main Report

May 2008

Oriental Consultants Co. Ltd.

in association with

ITECO, Kathmandu

and

NDRI, Kathmandu

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(To be provided later by others)

Social Assessment

EIA

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CURRENCY EQUIVALENTS

Currency Unit –		Nepalese Rupees (NRs.)
NRs1.00	=	\$0.0159
\$1.00	=	NRs. 63.25 (March 2008)

NOTES

- (i) The fiscal year of the government ends on 14th July.
- (ii) The Nepali year is based on the Bikram Era calendar and is approximately 57 years ahead of the Gregorian calendar (2065/1/1 = 2008/4/14).
- (ii) In this report, "\$" refers to US dollars.

ABBREVIATIONS

ADB	Asian Development Bank
BOT	Build Operate & Transfer
CSP	Country Strategy and Program
DIFID	Department for International Development (UK)
DoR	Department of Roads
DoTM	Department of Transport Management
EA	Executing Agency
EIA	Environment Impact Assessment
EIRR	Economic Internal Rate of Return
EPA	Environmental Protection Act
EWB	East West Highway
GAM	Goal Achievement Method
GDP	Gross Domestic Product
HB	Highway Board
HDM	Highway Development & Management System
HQ	Headquarters
GoN	Government of Nepal
IEE	Initial Environmental Examination
IP	Indigenous Peoples
IRC	Indian Road Congress
ISA	Initial Social Assessment
JHPC	Japan Highway Public Corporation

MCA	Multi Criteria Analysis
MoF	Ministry of Finance
MPPW	Ministry of Physical Planning and Works
NGO	Non Governmental Organization
NH	National Highway
NPC	National Planning Commission
NPV	Net Present Value
NRM	Nepal Resident Mission
NRs.	Nepalese Rupees
NTP	National Transport Policy
OD (O&D)	Origin and Destination Survey
O&M	Operations and Maintenance
PCU	Passenger Car Unit
PIP	Priority Investment Plan
PMO	Project management Office
PPMS	Project Performance Monitoring System
PPTA	Project Preparation Technical Assistance
PRC	People's Republic of China
PSP	Public Sector Participation
RBN	Roads Board Nepal
RMC	Road Management Company
RMP	Road Master Plan
RoW	Right of Way
RP	Resettlement Plan
RTA	Road Transport Authority
RTU	Road and Traffic Unit (DoR)
RUC	Road User Cost
SA	Social Assessment
SAARC	South Asian Association for Regional Cooperation
SAFTA	South Asian Free Trade Area
SAGQ	South Asian Growth Quadrant
SASEC	South Asia Sub-regional Economic Cooperation
SEIA	Summary Environmental Assessment
SIEE	Summary Initial Environmental Examination
SRN	Strategic Road Network

TA	Technical Assistance
TAR	Tibet Autonomous Region of PRC
ToR	Terms of Reference
TP	Tenth Year Plan
TYIPD	Three Year Interim Development Plan
VDC	Village Development Council
VOC	Vehicle Operating Cost
VPD	Vehicles per Day
WACC	Weighted Average Cost of Capital
UNDP	United Nations Development Program
WB	World Bank
WTO	World Trade Organization

EXECUTIVE SUMMARY

1. Nepal is a landlocked and mountainous country located along the southern slopes of the Himalayan mountain range between India and the Tibet Autonomous Region of China. The country has a rugged terrain and topography of middle and high mountains in the north and a very fertile land the Terai in the south. The Terai, running along the border with India, is the area of greatest food production and industry. Besides agricultural production, the country has high potentials of hydropower, natural resources, and tourism.
2. Although road transport is the dominant mode for moving passenger and freight traffic in Nepal, road density is low at 11.8 km of road per 100 km² and is less than that in neighboring countries to the south. This results in a lack of access to remote areas as well as constrained economic development. At the present time the main trade corridor in Nepal is the East-West Highway (EWH) in the Terai and there is no direct north-south high class road connection linking Kathmandu and other major cities with Birgunj (dry port) and to India, despite the fact that the Birgunj-Kathmandu section of this corridor carries more than 60% of the total north-south long distance traffic.
3. In the recently completed PIP¹ study it was noted that, "The provision of an alternative access to Kathmandu from either the south (Terai) or west (Prithvi Highway) is possibly the single most important prospect for the improvement of traffic conditions and the creation of a major economic impact in Nepal over the coming decade."
4. Currently there are two sealed motorable roads between Kathmandu and Pathlaiya² via Hetauda: the winding mountainous Tribhuvan Highway (133 km Kathmandu-Hetauda), and the route using the EWH from Hetauda to Narayanghat connecting to the Narayanghat - Mugling Highway and in turn to the Prithivi Highway from Mugling to Naubise and on to Kathmandu, a total of 245km (221 km to Hetauda). Over 90 percent of trucks carrying loads use the latter longer route via Mugling as the Tribhuvan Highway route is too narrow winding and hilly for loaded trucks and large passenger buses and is subject to landslides in the monsoon season.
5. The main aim of the project is to improve transport reliability by providing a cost-effective investment program to improve transport links between Birgunj and Kathmandu, and on to Kodari, by investigating the feasibility of a high class road ("fast track") connecting Kathmandu with the Terai and the Indian border with considerable savings in both travel time and costs.
6. The overall Project will help promote sustainable economic growth and poverty reduction in Nepal as a whole and the project area in particular. It will achieve this by (i) improving the road transport network by building a new high class direct North South Connection from Kathmandu to the Terai and (ii) Improving trade linkages with India and improving the Asian Highway network (iii) Improving transport conditions for trade from Nepal to other countries through India, (iv) reducing transport operating costs, in particular, fuel savings, and (v) with ongoing improvements to the Arniko Highway, improving transit trade to India and PRC.
7. The Project's scope of work comprises the following components:

¹ Road Maintenance and Development Project. "Sector Wide Road Programme & Priority Investment Plan", April 2007, DHV Consultants

² Pathlaiya is the junction of the EWH with the Birgunj-Hetauda Road

- Prepare a feasibility study for about 100 km of “fast track” high class road from Kathmandu to the Terai, considering engineering, economic, social, resettlement, road safety and environmental aspects;
- Prepare preliminary engineering design for the preferred alignment;
- Advise Government as required on 30 km road rehabilitation and slope stabilization between Kathmandu to Kodari;
- Prepare a road safety improvement program for the road;
- Identify the needs for operation and maintenance of the “fast track” road and further capacity building of DoR;
- Establish benchmark indicators and monitoring system for the project implementation; and
- Conduct a risk assessment for safe and effective project implementation;

8. The study was divided into two Phases. Phase I included the feasibility study of various alignments for the fast track road setting out the advantages and disadvantages of each alignment based on multiple criteria to allow GoN to select the most suitable design and alignment. It included analysis of the economic and financial implications of the various alignments, the social and environmental impacts of the alignments and standards and the operational and maintenance requirements for each alignment analyzed. The study also set out recommendations for the appropriate design standards, toll systems and access control and suggested a suitable organizational structure to manage and operate the new high class toll road. After the preferred alignment was agreed by GoN, Phase II of the study covering the remaining scope of work set out above, was completed.

Summary of Results

Selection of Alignments

9. The preliminary selection of the alignment corridors was based on alignments suggested in previous studies and the initial site surveys. The project area between Kathmandu and Pathlaiya is located in rolling, mountainous and steep terrains with three high mountain ranges running east west, and possible feasible routes are limited. Six initial route corridors were selected for further investigation.

10. Approximate costing of all six alternatives were prepared and walk-over surveys carried out. The upgrading of the existing road, while not achieving the aims of the project, was retained for economic comparison. After preliminary screening, feasibility design and analyses were carried out for four new road alignments,. Both two lane and four lane roads were considered. (Supplementary Appendix 1 and Map 3).

Multi-Criteria Analysis

11. The alignments were subjected to economic and financial analysis, and environmental, resettlement and social impact assessment. The data derived from those analyses provided input into a prioritization process (Multi Criteria Analysis (MCA)) to arrive at a favored alignment.

12. The MCA technique produces a weighted multi-criteria Index for each of the alignments which reflects the achievement by the particular alignment of the selected criteria. The criteria, and the weightings to be applied to each, were agreed and finalized at a seminar of various stakeholders from Government, donors and other organizations

as being the most important in the construction of a high class North-South connector and, generally, in the future transport network in Nepal. These weights thus represented the value judgments of the stakeholders as to the relative importance of each criteria in meeting the defined objectives of the project.

13. The most attractive route based on multiple criteria evaluation was Alignment 3A, the Bagmati Valley route directly to the East West Highway with an 18 km connection to Hetauda from Budune, 48 km from Kathmandu. ((Supplementary Appendix 1)).

Traffic Forecasts

14. Existing traffic flows on the highway between Kathmandu and Pathlaiya were determined from traffic surveys, including interview surveys. Traffic on the existing highway is heavy in places (9,800 pcu per day south of Hetauda³) and has a high proportion of long distance heavy goods and passenger vehicles. Over fifty percent of vehicle drivers make trips to or from Kathmandu, with trips of 200 km or more, while agriculture and food accounts for 27 percent of all road freight, fuel 25 percent and cement 15 percent.

15. Traffic forecasts were developed for both passenger and freight vehicles for future years from the base 2007 matrix by relating growth in trip numbers to GDP growth and elasticity for demand for passenger and freight traffic. Added to the growth in “normal” traffic there is new, or “generated”, traffic that arises because the project road makes travel less costly and more convenient, traffic diverted from other routes and modes, and an increase in goods and passengers going to and from India and other countries. Available statistics indicate that cross border traffic has risen since 2004, and will continue to rise over the coming years, with a significantly higher growth rate than normal traffic.

16. The resulting traffic forecasts give an average of about 8,600 pcus on opening in 2014, on the new road between Kathmandu and Pathlaiya on the East West Highway (EWH) rising to an average of 32,000 pcus in 2034. These are initially well within the capacity of a two lane road as designed; after 2018, however, widening to four lanes will be required.

17. Between 2008 and 2014 the annual growth rate on the existing road is estimated to be 6.5 percent, from 2014 and 2024 the annual growth rate on the new road is estimated to be about 7 percent, dropping to 6 percent between 2024 and 2034.

18. It is apparent from these flows that the existing road will be well over capacity by 2014 and will require extensive improvement to carry estimated volumes. By 2018 the traffic would virtually be at a standstill on the existing road unless it is widened to 4 lanes. (Appendix 14 and Supplementary Appendix 6)

Design

19. The proposed road consists of a main line from Kathmandu to Nijgadh on the EWH (76km) with upgrading of the EWH to four lanes for 18 km from Nijgadh to Pathlaiya, and a two lane access controlled connector from km 48 on the main line to Hetauda (18km). The main line has been designed as a four lane road; two lane design has also been

³ Pcu are equivalent “passenger car units” for each vehicle type, and are used to determine the capacity of the new road. For traffic on the existing highway network and on the new road, one vehicle is approximately equal to 1.8 pcu.

shown on the drawings. The designs⁴ generally conform to Asian Highway Class I road standard for a two lane road (with climbing lanes on grades of over 4 percent to allow slow vehicles to be passed safely), and a four lane road, with a design speed of 80 kph (50 kph in mountainous terrain) and an asphalt bitumen pavement for the whole of its length. The pavement structure thickness has been calculated based on estimated cumulative axle loading and subgrade testing. Interchanges are planned at either end of the road and at Shripur rural center at Km 50. Future interchanges are proposed at two other locations.

20. Typical road cross sections were developed for each terrain type and plan and profile designed based on the topographic surveys and are set out in the Design Drawings (Volume 4). A total right of way, required for immediate or future widening of the road to four lane, follows the GoN standard of 50 m although this is extended where mountainous terrain requires a wider Right of Way.

21. Construction materials, such as boulders, stones, gravel and sand are locally available at a reasonable distance. Suitable sites have been identified and quantities estimated. Other materials, principally bitumen, steel re-bars and cement would be imported.

22. Bridge design has followed GoN specifications. HS 20 – 44 or Indian Road Congress (IRC) Class AA loading standard is adopted for the design of the structures. Flood frequency of 1 in 100 years has been adopted for bridges which is higher than that generally used in Nepal. There are 51 bridges over 30m, with seven high/long bridges, the total length of bridges is 9,061m. Major parts of the bridge superstructure have been standardized as far as possible so as to facilitate construction.

23. The Project Road is located in seismic zone IV and V and requires anti-seismic measures to be included in the design of cross drainage structures.

24. The road has one tunnel 1.35 km in length. As road tunneling will be a new innovation in Nepal, preliminary design of the tunnel has been based on overseas standards. The proposed road width of the road in the tunnel is 9 m, including shoulders, with a walk way on one side giving a total width of about 11 m and a height of 7.5 m. For four lane road design twin tube tunnels are proposed. Horizontal jet fans are proposed for ventilation and illumination will be required.

Cost Estimates

25. Quantity estimation of earthworks cut and fill were estimated from the surveyed cross sections, as were quantities of retaining structures, and minor drainage. The quantity of pavement works were calculated based on the thickness adopted in design and the pavement cross section. The lengths of bridge spans were estimated from the longitudinal section and geological survey.

26. Lengths of the tunnels and quantity of estimation were estimated from the profile and the plan of the alignment long section and geological surveys.

27. Unit Rates of the major cost items were developed based on local district standard rates for labor and materials, where applicable. Per meter cost of small bridges were based on the prevailing rates of similar bridge works in Nepal., for larger bridges rates from other countries have been used, adjusted where possible for imported materials.

⁴ Design standards were agreed with DoR during the study.

Rates for items not included in the standard rates (tunnels, toll works etc.) were estimated based on rates in India or PRC, adjusted for Nepal conditions.

28. Cost of special equipment was estimated using overseas rates adjusted for Nepal. Consulting services costs were estimated for both international design and for international/domestic supervising engineering organizations. Costs of land acquisition and resettlement were not available for the Final Report and were estimated as three percent of direct costs after consultation with ADB resettlement consultants. An allowance of five percent of total cost was added for physical contingencies to cover the cost of minor adjustment of alignments and variations in the lengths of bridges and tunnels etc in final design.

29. Based on the above methodology the total costs of the project were estimated and are set out in **Appendix 10**. The total estimated cost, including land, consulting services and physical and price contingencies, for a four lane road is NR 67,478 million (\$922 equivalent). For a two lane road the cost is NR 50,078 million (\$595 equivalent)⁵.

Economic Evaluation

30. The economic evaluation is consistent with ADB guidelines and uses internationally accepted techniques. The study recognized that the existing road would not meet future traffic demand without some improvement, and allowance was made in the “base case” for the cost of increasing road capacity just enough for the traffic to get through.

31. The proposed alignment passes through difficult terrain and has a high cost per kilometer. Despite this high capital cost, the distance saving (150 km) and time saving (over 4 hours) for through traffic and the poor state of the existing road gives very high EIRRs for all alignments studied in Phase 1, ranging from 18.6 percent to 37 percent per annum. For the selected alignment (Phase 2) the EIRR for a four lane road is 31.1 percent. Sensitivity tests show that the project is economically robust. (Appendix 14).

32. Fuel savings in the first year of operation was estimated to be 32 million liters, or about NRs 1.8 billion (\$28 million) in economic prices..

Financial Evaluation and Projections

33. A preliminary financial evaluation was carried out to give a financial analysis of the selected alignments, assuming it operates as a closed toll road with an independent road operating company.

34. As the mode of funding for the road has not yet been determined, two funding scenarios were tested, one a mixture of Government equity and domestic and international loans, and the other a single international loan.

35. Project costs included capital costs of design and construction as well as operation and maintenance costs for the road, tunnel and toll operations over the life of the project.

36. Toll rates were assumed to be similar, but less than, the direct saving in fuel costs and ranged from NR 180 for a motor cycle to NRs 1,800 for a heavy truck or bus for a one way trip from Kathmandu to Pathlaiya.

37. The evaluation was conducted under the assumption that the expressway would be operated as an independent entity or business center. The base case FIRRs for the four lane road ranged from 14.57 percent before taxes to 12.91 percent after business and

⁵ Includes essential works required for future upgrading to four lanes.

income tax. Using 50 percent of the suggested tolls dropped the FIRR, to 8.78 percent after taxes, whilst raising the tolls by 25 percent raised it to 14.27 percent, indicating that project financials are very sensitive to any changes in toll rates.

38. Based on either of the financing plans, the financial projections would indicate that the project could be a viable self financing entity. Some Government or donor equity would improve the viability. (Appendix 15).

Environmental Assessment

39. The Project will require an environmental impact assessment (EIA) under both the Government's Environmental Protection Rules (1997) and ADB environmental assessment guidelines (2003)⁶.

40. A review of environmental implications was carried out for all options to present Government and other stakeholders with sufficient information to consider the relative environmental impacts and implications and also to contribute to the multi-criteria analysis. The analysis made a broad brush comparison of options in environmental terms using selected criteria.

41. The impacts associated with most criteria, except ecological function, should be able to be mitigated well by avoiding impacts through detailed design and careful attention to the implementation of engineering controls on construction techniques. Erosion control, dust control, waste management and forest compensatory planting can be implemented during construction and the expected traffic flows should not give rise to any unacceptable concentrations of emissions in the operational phase.

42. The project will require significant inputs from the Government (and ADB) to ensure environmental concerns are addressed in the EIA and implemented throughout all stages of the project planning, construction and operation. The EIA findings will need to be incorporated into the detailed design and contractual requirements; defined clearly and strictly monitored. Complex environmental issues are involved and DOR must ensure continued efforts in addressing ongoing environmental concerns of the project. (Appendix 16).

Resettlement

43. An initial resettlement, poverty, social analysis was prepared for the Phase I alignments. Public consultations were held during the initial social screening stage at different places, in order to gather views of villagers regarding the need of the proposed projects in their vicinity. Various sections of affected persons (APs) and other stakeholders were consulted through informal focus group discussions and individual interviews which aimed at promoting public understanding and fruitful solutions of developmental problems such as local needs of the road, problems of resettlement, etc. The project will, therefore, ensure that the affected population and other stakeholders are informed, consulted, and allowed to participate actively in the development process.

44. Resettlement screening of the selected alternative reveals that there will be land acquisition and resettlement along with some impacts on informal settlers who are encroachers and squatters. The impact calculated at this stage is approximate in nature and will be updated after completion of the resettlement surveys. The approximate resettlement budget for the selected alignment is NR million 1,689 (\$US 25.6 equivalent).

⁶ If ADB funding is part of the project financing.

Poverty Reduction

45. The proposed project will contribute to poverty reduction by bringing both direct and indirect positive impacts along with short term and long term impacts to the area. The provision of transport services, including the construction and maintenance of transport infrastructure, generates demand for labor (often unskilled labor) and provides income-earning opportunities for the poor. Gender participation should be ensured during the project preparation and efforts should be made to see how the project could impact women positively. It is evident that availability of better roads and safe connectivity with better transport services will benefit the women of the area. Their mobility will be improved in terms of access to social services, higher levels of schooling and better health facility access etc. Additionally, during the project implementation, efforts should be made by the project implementation authority to ensure that women receive preferential treatment for employment in the civil works, with proper safeguards for the safety of their health. The Project will provide construction job opportunities with better wages. Men and women will be paid equally for equal work. During the implementation of the project, child labor should be prohibited from road construction activities and this should be ensured by the project implementation authority. Human trafficking and HIV/AIDS problems are fast growing and a major problem associated with highways, especially in Indo-Nepal cross-border areas. The risks associated with the improved highway network, such as increased incidence of HIV/AIDS and human trafficking, should to be mitigated by raising awareness among high-risk and other vulnerable groups.

Indigenous People

46. There is significant presence of indigenous people in the districts covered by the road alignments as well as in the project affected areas. Indigenous People (called mainly Janajatis or Nationalities in Nepal) constitute about 37.2 percent (8.4 million) of Nepal's total population. Government has declared 59 groups, categorized 10 'endangered groups', 12 'highly marginalized groups', 20 'marginalized groups', 15 'disadvantaged groups', and 2 'advanced groups'.

47. Screening for IP issues was carried out on the selected route and found that there are no IPs belonging to 'endangered' and 'highly marginalized' groups in the project area. It seems unlikely that there would be adverse impact on IPs in terms of threat to their way of life, however some may lose a part of their land and structures.

Regional Trade Impacts

48. The value of Nepal's total trade in 2006/07 was NRs.256.7 billions (\$US 4.05 billion), and international trade has gradually increased over the last decade.

49. Nepal has entered into various transit and trade agreements with other South Asian countries, India, Bangladesh, PRC. Nepal is also a member of the South Asia Association for Regional Cooperation (SAARC). One charter objective of SAARC is the "acceleration of economic growth amongst member countries". The South Asia Free Trade Area (SAFTA) Agreement came into force in January, 2006 and is being implemented through, in part, a trade liberalization program which will reduce existing tariff rates. Nepal is also a member of the South Asia Sub-regional Economic Cooperation (SASEC) which is more focused on enhancing existing transportation facilities and improving the operational efficiency of the transport sector. This includes addressing transport "bottlenecks" on road links and border crossing points. With the

implementation of SASEC, intra-regional and sub-regional trade is expected to grow at an accelerated rate.

50. There are nine official border crossing points with PRC, of which Tatopani is the most important and busiest, accounting for 24 percent of Nepal trade with PRC, and 22 crossing points with India, of which Birgunj is the most important and busiest, accounting for about 52 percent of the total import/export trade value.

51. Although there have been substantial improvements in physical and non-physical conditions of the Birgunj and Tatopani Customs there are still many choke points hindering the smooth flow of exports and imports of goods. Removal of these constraints would substantially speed up transport of border trade flows, however, full advantage of the improvements would not be utilized unless the travel distance and time from the border to Kathmandu is reduced by the introduction of the new high class road.

52. The only road corridor open between India and the PRC via Nepal is Birgunj – Kathmandu–Tatopani, and transit trade through Nepal could be more attractive to India for surface trade with PRC when the Project road is complete.

53. India's exports to the PRC in 2007 amounted to \$35 billion, an increase of 71 percent over the previous year, imports rose by 70 percent, reaching \$20.8 billion in 2007. Clearly there is an opportunity for Nepal to promote transit trade through Nepal and take advantage of the tremendous growth in trade between the two countries by entering into tripartite negotiations, completing a high class road link and developing additional infrastructure and other necessary systems adequate to attract and divert through Nepal some of the present sea trade between India and PRC. (Appendix 6)

Organizational Structure

54. The project road will be the first high class toll road in Nepal. The tolls suggested would raise a significant amount of revenue, a proportion of which would be required for operation and maintenance to keep the road asset in a good and safe condition and also for debt servicing. It will be important therefore for Government to provide a dedicated entity to implement and operate the new road.

55. Two main scenarios have been considered as regards organization requirements:

- Government implementation of the project by raising the necessary funding directly, either loan or a combination of loan and grant, and Government overseeing the implementation of the project (“Direct Funding”); or
- Government award of a BOT concession agreement for the design, construction, maintenance and operation of the project road (“BOT Funding”)

Direct Funding

56. If direct funding is the preferred option then funding for the project road will need to be raised from a variety of sources, probably a large proportion from the private sector. For a project to attract non-government money, it must be packaged and presented in a form that gives investors, be they private or institutional, comfort that their investment will be properly managed and will provide an acceptable financial return. An essential prerequisite to this is for the project entity to be established as a separate company with its own autonomous management and separate accounts.

57. The suggested organizational structure would start with the establishment of a Highway Board (HB) consisting of representatives of Government, local Government, commercial transport associations, professional associations, the business community

and civil society, initially selected by Government. The HB would then set up a road management company (RMC) to co-ordinate the finalization of the project, based upon the findings of the preliminary design, and would also take responsibility for the financing plan. It would liaise with MoF and the finance section of DoR in the allocation of Government funds and would liaise with them and possible donors, to finalize the funding plan. The RMC would oversee the detailed design and the implementation of the project. RMC should be corporatized at an early stage as a step toward seeking additional investors in the project. After completion of the project, the operation, maintenance and debt servicing of the new road would become the responsibility of RMC who would then liaise with MoF, the appropriate Government Department, or a separate regulatory body to set toll levels before the operation of the project road.

BOT Funding

58. If Government decides to invite proposals for BOT concessions for the Project road it is recommended that Government still set up an HB and RMC to oversee the implementation and operation of the project road. The RMC would be responsible for overseeing all aspects of design, construction, operation and maintenance of the road by the BOT concessionaire. The RMC would initially employ independent consultants with appropriate expertise and experience but eventually RMC should have its own fully trained staff to carry out the work.

59. Further details of the suggested operating structures are set out in Appendix 17 Supplementary Appendix 10.

Capacity Building and Training

60. The new road will involve some sophisticated and modern techniques both in construction and operation. Some of the skills required are not available in Nepal at the present time. This will be particularly important as this will be the first road project in Nepal with a major tunnel and a sophisticated toll system and, therefore, if direct funding is the option chosen then a significant amount of capacity building and training will be required to enable a competent organization to be established for the operation and maintenance of the road, tunnel and toll system. Personnel will need to be well trained for respective activities from the construction stage to understand what is being constructed and installed, and be trained for tunnel operation and maintenance, especially for emergency. Training should be carried out in a foreign country which has sufficient experience in this area.

61. If BOT is the selected scenario, Government, through RMC, will need to monitor ongoing operation and maintenance of the road and the tunnel by the BOT operator, and also monitor toll operations. RMC staff should be trained to eventually take over these functions.

62. PSP is usually viewed only in terms of financing. If Nepal is to develop PSP in the transport sector then it must have a development program to expose its senior and mid-level staff to:

- The opportunities and threats of, and potential benefits from, PSP, particularly in O&M;
- Performance based highway operation and maintenance standards;
- Negotiation and content of toll road BOT concessions; and

- How “monitoring without supervision” operates and delivers what this and other projects might need.

63. The capacity building program, which could be included as part of this project, could take the form of seminars and workshops in Nepal led by international experts, but, to fully understand these new concepts, it will be essential for selected candidates to make visits and undergo training in overseas countries.

Project Risks

64. The project is being designed to reduce potential technical, economic, financial and social risks. The main technical risks are associated with the design and construction of the large bridges and tunnel and the risk of land slips and slope failures in unstable terrain. To minimize risks, international consultants have reviewed the preliminary design of tunnels and major bridges and specialists should also be included in the consulting services to review detail design of the bridges and the design and construction methodology of the tunnels. There is still a risk however, that further detail geological investigation will reveal adverse geological conditions which may increase cost and/or change the alignment.

65. Tunneling is an underground activity where complete geotechnical conditions generally are not foreseen at the design stage. Unanticipated changes in underground conditions during implementation often lead to changes in cost and construction schedules. Misjudgment of rock mass and quality can lead to cost and time overruns unless extensive testing is carried out during detail design.

66. The alignment goes through areas of steep rock slopes where there is a risk of landslides both during construction and later during the operation period. Testing and careful inspection has been carried out and the alignment relocated where necessary. This has meant, in places, the use of high bridges.

67. The implementation of the road will require substantial land acquisition and resettlement. On some recent infrastructure projects in Nepal delays in completing resettlement has led to delays in project implementation.

68. To minimize operation risks it will be important to have a fully trained operation organization for both tunnel and toll systems, a dedicated traffic police unit is also desirable for the new road.

69. The financial risk associated with the construction and operation of the project road will depend on the actual level and composition of traffic, the construction costs, the ability of the commercial management, and the tolls charged. Traffic volumes on toll roads in neighboring countries have been low in the early years of operation leading to financial returns less than expected. Forecasts in the PPTA allowed for this by ramping down traffic forecasts in the first years of operation. To control the financial risks, it has been recommended that Government create a commercial business environment for toll road operations.

70. A major risk of delay to the project lies with the transitional stage of Nepal's political situation at present. It is hoped that this risk will be minimized now that successful elections have been completed. In particular Government decisions, involving new legislation, will be required to set in place the organizational structure to successfully implement and operate the project road.

Study Conclusions and Recommendations

The following conclusions and recommendations are made by the Technical Assistance (TA) study team based on their investigations and analysis. These are set out in more detail in the main text and appendices.

Road Standard and Design Speed: The new road should be built as a high class road to international standards. It is recommended that it be constructed to Asian Highway design for a Class I road. Traffic volumes would indicate that the road will need to be four lanes from Kathmandu to Shripur by 2018. At the request of Government design was carried out for both two and four lanes.

Road Access: It is important that traffic on the project road be allowed to travel quickly and safely and that there is no interaction between through traffic and local traffic and pedestrians. It is therefore recommended that access to the new road be only at interchanges, located near traffic generation centers, and that local traffic, including tractors, pedestrians, bicycles and animals should not be allowed on the highway except where the highway makes use of the existing road (e.g. Nijgadh to Pathlaiya).

Toll System: To pay for the maintenance and operation costs and to provide debt servicing without drawing on additional Government budgets, it is recommended that the road be tolled using an open toll system with full width toll plazas close to Kathmandu and to Nijgadh and that tolls be set having regard to users willingness to pay so as not to deter traffic from using the road or diminish possible reduction in freight and passenger transport charges. Suggested tolls range from NR 800 for a car to NR 1,800 for a heavy bus or truck. Traffic traveling to and from Kathmandu and Hetauda would pay approximately 65-70 percent of the toll levied on traffic traveling to/from Kathmandu to Nijgadh. Traffic traveling from Shripur interchange to Hetauda would not be tolled, nor would traffic traveling only on the upgraded East West Highway.

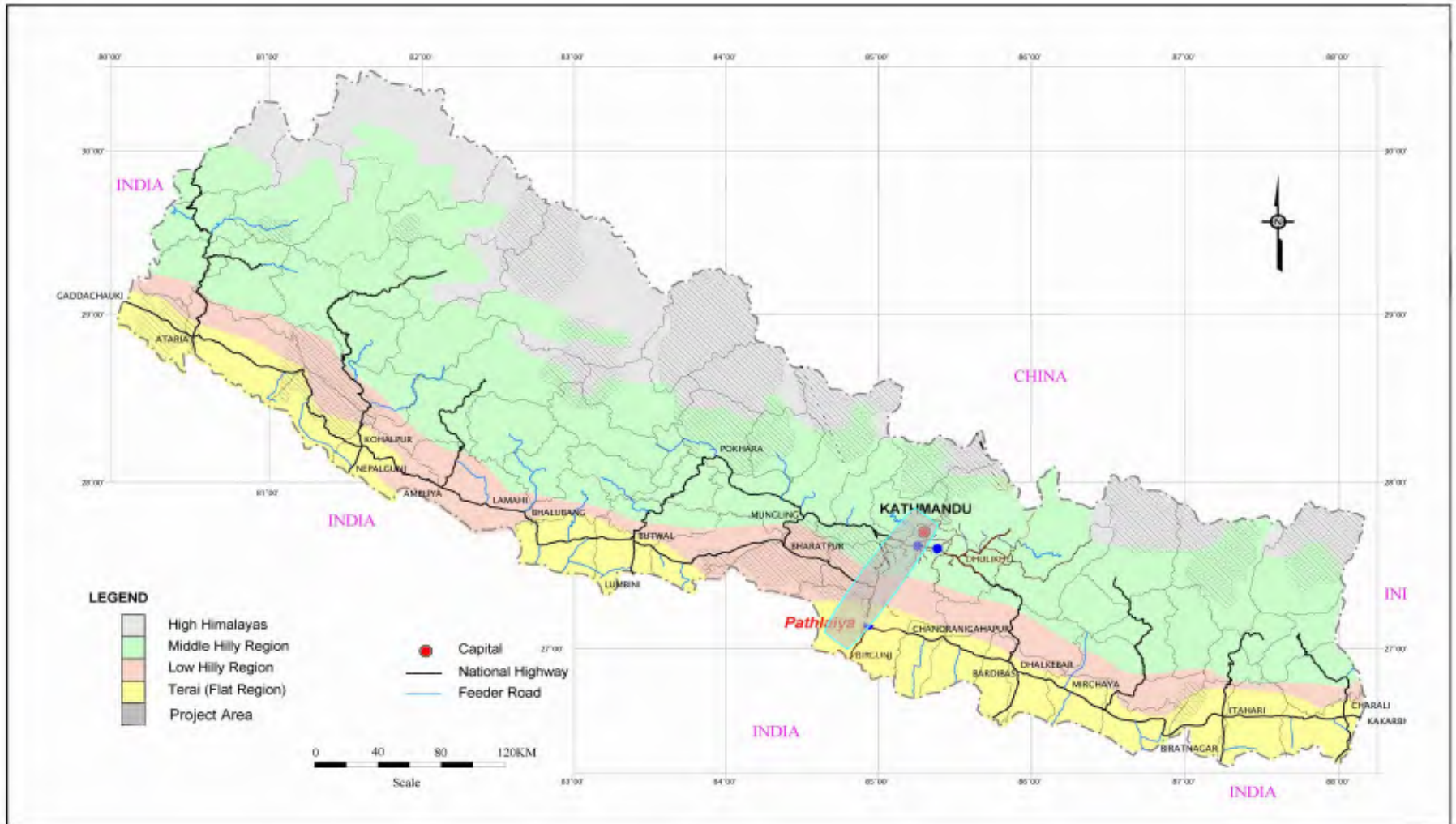
Costs: Based on the preliminary costs the estimated cost for the four lane option is NR 67,478 million (\$ 922 million equivalent) in March 2008 prices, including, land, design, supervision and physical and price contingencies but not including any interest during construction.

Economic and Financial Analyses: Based on the preliminary costs the Economic Rate of Return (EIRR) of the four lane option is 30.92 percent. The financing plan for the project is not yet decided but, assuming that the project would be fully funded by an international loan (approximating a BOT operation), then the Financial Rate of Return (FIRR), using the suggested tolls is 14.6 percent pre-tax, about 13.6 percent after normal business taxes, and 12.9 percent if income tax is levied.

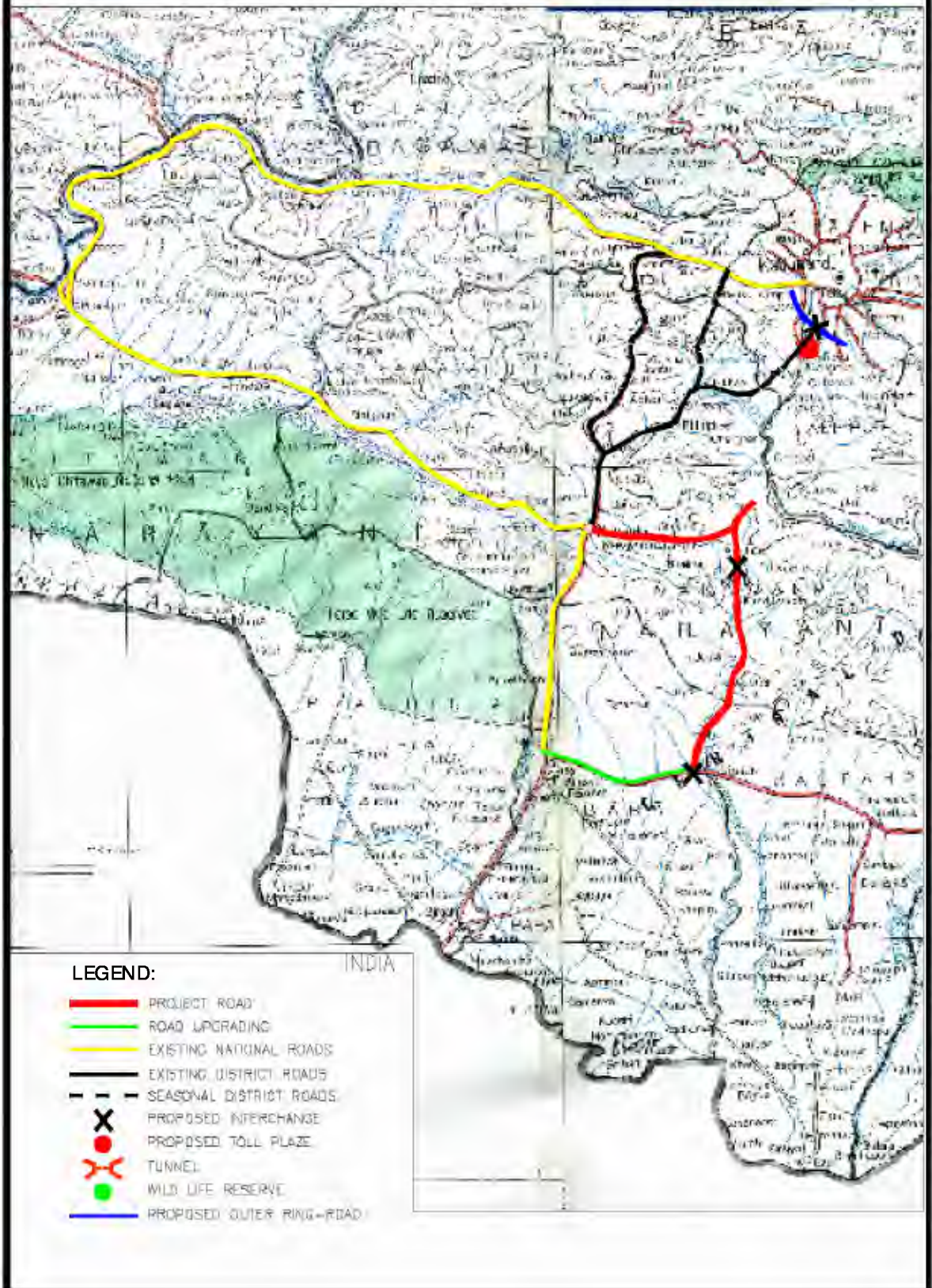
Organization: The report sets out a possible organizational system for the new road based on establishing a corporatized road management company to construct and operate the road or to oversee any BOT operation. It is recommended that Government consider this structure.

Capacity Building: The construction and operation of this high class road will require technical and operational skills that are not yet at present in Nepal. It is recommended that, as part of the project, an extensive training program be initiated to develop these skills during construction and before the project opens. These skills would include, tunnel design and construction, operation and maintenance, toll system operation and management of private sector involvement in infrastructure projects.

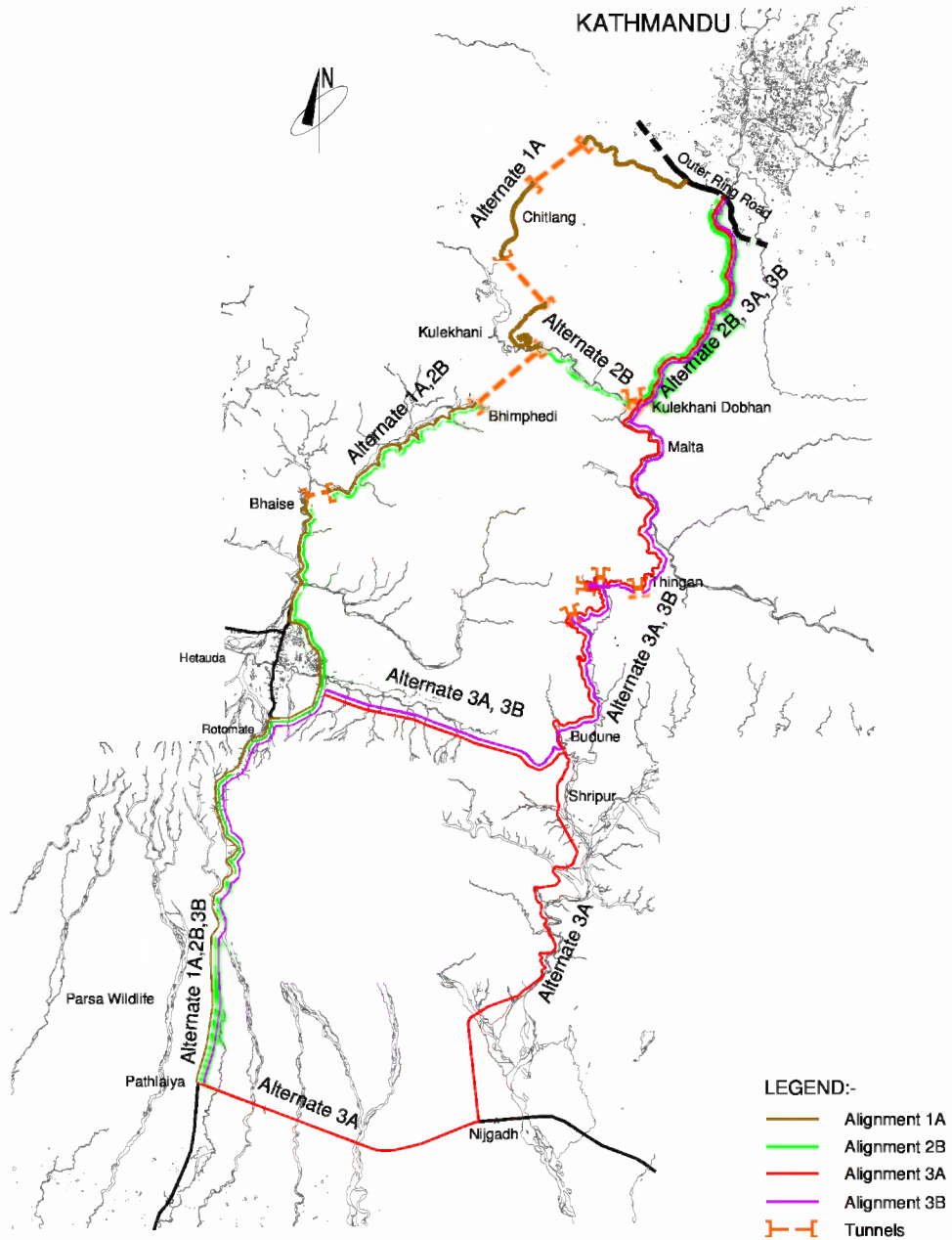
MAP 1: PROJECT LOCATION



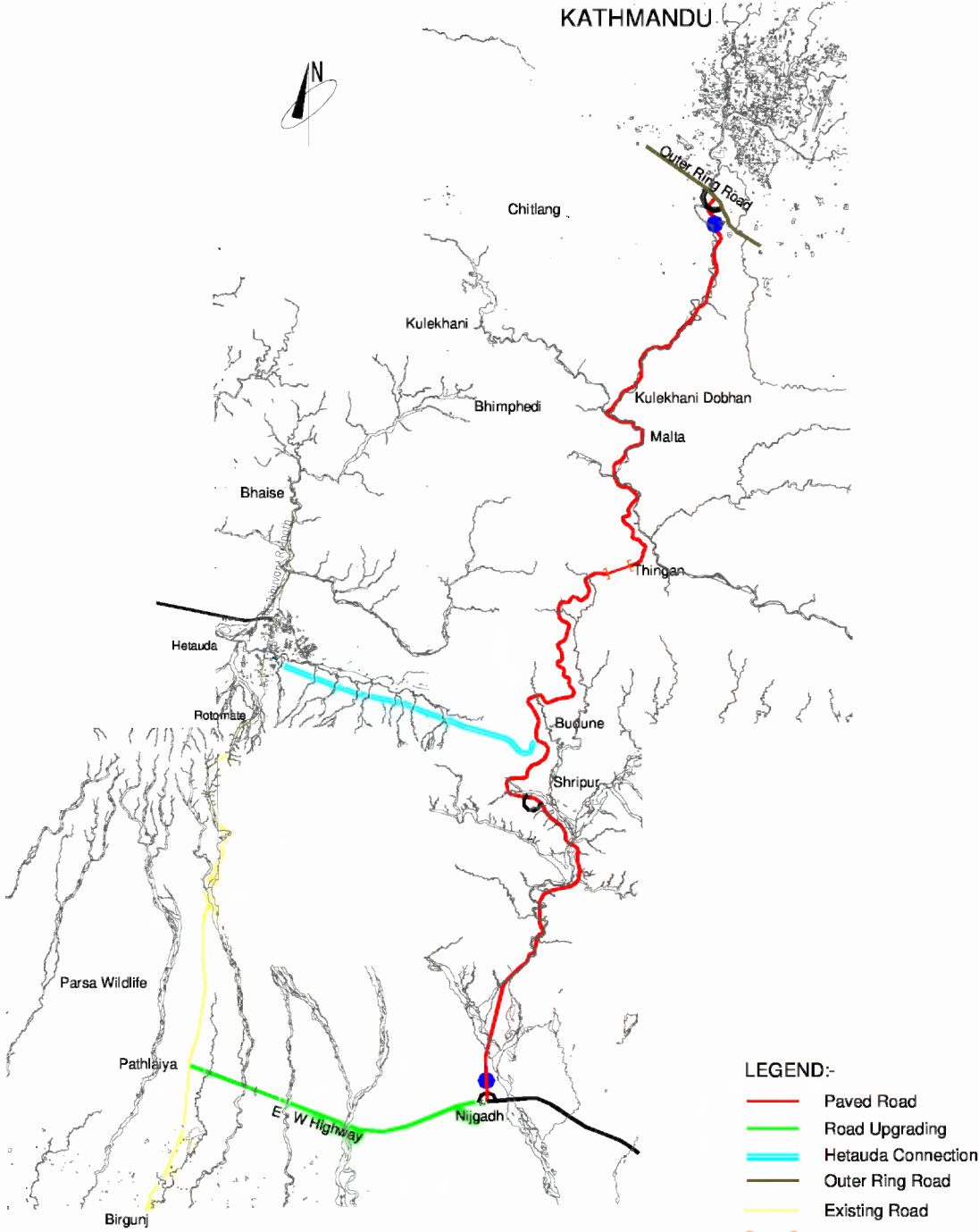
MAP 2. PROJECT LOCATION



MAP 3 FEASIBILITY ALIGNMENT ALTERNATIVES



MAP 4 SELECTED ALIGNMENT



I. INTRODUCTION

A. Background to the Study

1. Nepal is a landlocked and mountainous country located along the southern slopes of the Himalayan mountain range between India and the Tibet Autonomous Region of China. The country has a rugged terrain and topography of middle and high mountains in the north and a very fertile land the Terai⁷ in the south. The Terai, running along the border with India, is the area of greatest food production and industry. Besides agricultural production, the country has high potentials of hydropower, natural resources, and tourism.
2. Nepal has a population of approximately 25.3⁸ million people. In 2006, gross domestic product (GDP) per capita was estimated⁹ at US\$311, making Nepal one of the poorest countries in the region. Several structural factors hinder the country's attempts at development: (i) the difficult terrain of a mountainous, landlocked country with poor transport connections to India; (ii) heavy dependence on subsistence agriculture; (iii) low levels of physical infrastructure and human capital; (iv) low domestic resource mobilization and the consequent dependence on international assistance; (v) inadequate institutional capacity for development management; (vi) lack of good governance, and (vii) recent internal low level conflict.
3. Official development assistance is derived from bilateral, multilateral, and non-government organization (NGO) resources. The principal bilateral sources are Denmark, Germany, Japan, Switzerland, United Kingdom, and the United States. Among the multilaterals, ADB and World Bank (WB) are the largest loan providers. The United Nations system is the largest multilateral grant provider.
4. Although road transport is the dominant mode for moving passenger and freight traffic in Nepal, road density is low at 11.8 km of road per 100 km² and 0.69 km per 1,000 population, and is less than that in neighboring countries to the south. This results in a lack of access to remote areas as well as constrained economic development. At the present time the main trade corridor in Nepal is the East-West Highway (EWH) in the Terai and there is no direct north-south high class "fast track" connection linking Kathmandu and other major cities with Birgunj (dry port) and to India despite the fact that the Birgunj-Kathmandu section of this corridor carries more than 60% of the total north south long distance traffic.
5. In 2002, the DoR produced a National Transport Policy and 20 Year Road Master Plan (RMP) and in June 2004 produced a draft Master Plan for the Strategic Road Network (SRN). Both the RMP and ADB country strategy promotes (i) continuing to improve the existing core network, (ii) ensuring appropriate funding for road maintenance, (iii) supporting sub-regional connection, (iv) strengthening road sector institutions and (v) promoting private sector participation. The RMP also

⁷ The Terai is the name for the southern plains of Nepal bordering India. It has an average width of about 20 km. In general it has a sub-tropical climate.

⁸ 2005 Central Bureau of Statistics estimate.

⁹ ADB Nepal Country Operations Business Plan

discusses the importance of international trade corridors and proposed eight such corridors between India and PRC; included in these corridors is the Birgunj-Kathmandu “fast track”. At a Sub-regional Expert Group meeting in 2004, the Government of Nepal (GoN) highlighted the construction of a high standard link from the Terai to Kathmandu as a priority project and this link is also considered a priority transit link in the South Asian Sub-regional Economic Cooperation (SASEC) program and is part of the Asian Highway network.

6. In the recently completed PIP¹⁰ study it was noted that “The provision of an alternative access to Kathmandu from either the south (Terai) or west (Prithivi Highway) is possibly the single most important prospect for the improvement of traffic conditions and the creation of a major economic impact in Nepal over the coming decade.”
7. The present route from Kathmandu to the Terai (Pathlaiya) requires 5-6 hours travel using a roundabout route of about 260 km; if the “fast track” route is realized the travel time is expected to shorten to 1.5 hours.
8. During the 2006 Country Programming Mission of the Asian Development Bank (ADB), GoN requested technical assistance (TA) to carry out feasibility studies and preliminary design of a preferred alignment from Kathmandu to Pathlaiya and the TA was included in the ADB’s 2007 country-assistance plan for Nepal. Also included in the project was identification and design of remedial measures to provide all weather access along the Arniko highway to Tatapani, the border with the Tibetan Autonomous region of the Peoples republic of China (PRC). At present the final 35 km section of this road to the border is only to intermediate lane design and is often closed or disrupted to traffic because of landslides. Department of Roads (DoR) have allocated budget to upgrade this road in 2007/08 and the work carried out in this TA has been advisory only, designed to complement that work.

B. Description of Project

1. Project Area

9. The direct project area includes the eleven districts through which the existing highway and the proposed ‘fast track’ alignment pass as set out in Table 1. The total population of these districts is over 5 million. Excluding the metropolitan area around Kathmandu, over 33 percent of the population lie below the poverty line¹¹.
10. The indirect project area covers most of the rest of Nepal (Population 25.3 million) as they will ultimately benefit from the lower transport costs of agriculture and manufactured goods traveling over the new road.

¹⁰ Road Maintenance and Development Project. “Sector Wide Road Programme & Priority Investment Plan”, April 2007, DHV Consultants.

¹¹ Average annual per capita below NRs 7,696 (2003).

Table 1. Project Area Districts

	Population January 2007	% population below poverty
Kathmandu+	1,299,296	4.4
Lalitpur+	398,586	10.1
Bhaktapur	264,466	8.7
Dhading	383,361	43.3
Makwanpur+	449,924	43
Rautahat	643,256	30.2
Bara+	667,607	26.9
Parsa	590,199	23.5
Chitwan	560,321	11.9

+ Project Road districts

2. Components

11. The Project aims at improving transport reliability by providing a cost-effective investment program to improve transport links between Kodari and Birgunj, via Kathmandu, with considerable savings in both travel time and costs.
12. To achieve the above objectives, the Project's scope of work comprises the following components:
 - Prepare a feasibility study for about 100 km of "fast track" **high class** road from Kathmandu to the Terai, considering engineering, economic, social, resettlement, road safety and environmental aspects;
 - Prepare preliminary engineering design for the preferred alignment including draft tender documents;
 - Prepare engineering advice for about 30 km road rehabilitation and slope stabilization between Kathmandu to Kodari;
 - Prepare a road safety improvement program for the new road;
 - Identify the needs for operation and maintenance of the "fast track" road and further capacity building of DoR based on completed or on-going programs;
 - Establish benchmark indicators and monitoring system for the project implementation;
13. The study was divided into two Phases. Phase I included the feasibility study of various alignments for the fast track road with recommendations to GoN and ADB for the most suitable design and alignment, the financial implications of the various alignments, the social and environmental impacts of the alignments and standards and the operational and maintenance requirements for each alignment analyzed. Phase II of the study includes the preliminary design of the selected alignment and the remaining scope of work set out above.
14. The results of Phase I of the study were reported in full in the Phase I Draft Final Report and are summarized in this Report which also sets out the results of the Phase II work.

C. Conduct of the Study

1. Executing Agency and Counterparts

15. The EA for the study was the Department of Roads through its Project Directorate (ADB). Counterparts for the study included:

Project Director	Prakash Jung Shah/Bhoj Bahadu Dakhal
Project Coordinator	Uttam Lal Pradhan/Indu Sharma Dakhal

16. The Project team would like to express its thanks for the help, support and advice given to them by the counterparts and other staff of DoR and the support of staff from Nepal Resident Mission during both phases of the project.

2. Study Team

17. The study team for the Project consisted of:

Team Leader/Transport Planner	Geof Connor
Road Design Safety	T. Inami
Tunnel Specialist	S. Mitani
Bridge Specialist	Colin Snow
Geotechnical Engineer	Tuk Adhikari
Geologist	Achyuta Bhandary
Traffic Engineer	Subhash Dhungel
Road Safety Engineer	Ramji Pahadi
Structural Engineer	Suresh Regmi
Transport Economist	Ishwor Man Shrestha
Survey Engineer	Prasad Agrahari
Highway Design Engineer	Sanat Upadhaya
Pavement/Hydrologist	Akal Singh

18. Dr. D. Green and Nawa Raj Khatiwada (Environmental Specialists), Dr. S. Jena, Jaganath Adhikari, and Kamal Shresta (Social/Resettlement Specialists) also participated in the Project as ADB consultants.

3. Summary of Methodology

19. There have been previous studies, starting in 1974, of a direct North South connection, however, the first major study was in 1993 and the latest study in 2003. The consultants reviewed all past studies and an initial selection of possible alignments was made based on the review of those studies and available mapping. Field surveys were made of each route and plotted on digital mapping.
20. Traffic studies were carried out including classified 12 and 24 hour counts and Origin and destination (O&D) surveys. In Phase 2 these counts were updated and a comprehensive 'route choice' interview survey conducted to enable feasible toll

rates to be used in the financial analysis. Forecasts were made for normal traffic, generated traffic, traffic diverted from other roads and modes and traffic from proposed or possible future development in the project area (e.g. Second international airport).

21. The Project Road will be the main transit route for trade from and to Nepal to and through India, and also future transit trade from/to India to PRC. A study was carried out on the nature of this existing trade, future estimates of trade and existing bottlenecks to the smooth passage of interregional trade.
22. Feasibility design was carried out on the preliminary alignments and the location of tunnels and major bridges identified and field visits made to most sites. Costs for each alignment were estimated for both a two lane (with passing lane) and a four lane road. Feasibility design drawings including long sections, plans and standard cross sections were produced.
23. Using forecast traffic volumes and construction and operation costs, economic analyses were carried out for each alignment and design standard in Phase 1. Based on a varying level of toll rates and systems, preliminary financial analyses were also carried out. Environmental, land acquisition, resettlement and other social impacts were assessed by ADB consultants for each alignment and their assessment included in the analyses.
24. Using all the data and analysis a multi criteria analysis (MCA) was carried out in Phase 1. The importance allocated to each criterion was decided at the stakeholders' workshop. The MCA led to a ranking of the alignments based on the agreed criteria.
25. A preliminary risk analysis was carried out for each alternative. This included construction risks and operational risks.
26. At the end of the Phase I work the consultants produced a set of conclusions and recommendations for GoN and ADB. In September 2007 GoN accepted the recommendations.
27. It was agreed with GoN and ADB that the preliminary design should allow for a four lane road to be constructed either immediately or at a later date, dependent on the type of financing to be obtained.
28. Work started in November 2007 on more detail topographic and geotechnical surveys of the preferred alignment, the route from Kathmandu to the E-W highway using the Bagmati and then through Thingan, Budune and Nijgadh, with a connection from Budune to Hetauda (Map 3).
29. Based on these surveys and further site inspections preliminary design was carried out on the alignment, pavement, bridge and other drainage structures and tunnels. Following this, more detailed cost estimates were made of the preferred alignment (both two and four lane options). These were based on the preliminary design, availability of materials and the maximum use of local labor.
30. The ToR for the PPTA specified the production of draft contract documents for the work. After discussions with ADB/DOR it was agreed that these were not appropriate at this stage of the work as they could not be completed until detail design was carried out. Although not included in the report, these have, however, been prepared and are available if requested.
31. A road safety audit was carried out on the preliminary design of the project road

and a road safety program prepared to prepare drivers and local residents of the particular safety problems of a high speed road.

32. Maintenance requirements for a “whole life” maintenance regime were identified to be carried out either through Roads Board Nepal (RBN) or the operation company.
33. Using updated traffic forecast for the preferred alignment and estimated construction, maintenance and operation costs from preliminary design, the economic analysis was updated for the preferred alignment compared to the existing road. Sensitivity and risk analysis were also updated.
34. Using the revised traffic diversion forecasts, the results of the ‘perceived cost’ survey and transport operator interviews, the financial analysis was updated for the preferred alignment using a range of toll values and the assumption of BOT operation using international and domestic loans.
35. Further details of the work carried out are set out in later sections of the Report and, in more detail, in the Supplementary Appendices.

4. Progress

36. In March 2007 ADB signed a contract with Oriental Consultants Co. Ltd. (Japan) in association with ITECO and NDRI, both of Kathmandu, to carry out the TA for the North-South Fast Track Feasibility and Preliminary Design and the consultants’ team started work in Kathmandu in April 2007. An Inception Report was presented on 30th April, 2007 and a workshop/seminar held in early May with various government, private and institutional stakeholders to set out the methodology to be used in the study and to discuss and agree upon the criteria to be used in the Feasibility Studies.
37. An Inception mission by ADB was made in late May to assess the progress of the project and to carry out discussions with GoN and possible donors and a site visit to some of the alternate alignments was carried out with stakeholders in early June.
38. The team completed the Phase I analysis work and documentation and the Draft Final Report was submitted on July 7th, 2007.
39. In October 2007 GoN accepted the recommendations of the Phase I work and the team remobilized in November 2007. The team completed the preliminary design and analyses in March 2008 and the results are presented in the Draft Final Report. Comments were received from ADB and, where feasible, incorporated in the report. The preliminary design drawings were completed by the end of April 2008 and are included with the Final Report, with an updated cost estimate and economic and financial analyses. The Final Report was submitted on May 5th.

D. Contents of the Report

40. The main body of this report summarizes the results of the Feasibility Studies in the first phase of the project and the work carried out during Phase 2. The appendices to the report describe in more detail the methodology used in the Phase 2 of the study, the design standards and methodology, cost estimates and implementation plans, a summary of the updated economic and financial analyses. The remaining sections of this report are as described in the following paragraphs.
41. Section II gives the rationale for the project and gives the background to the transport and road sector in Nepal.

42. Section III gives the impact and outputs from the proposed project and sets out the cost estimates for the preferred alignment. It discusses the stakeholder participation and consultation carried out in both Phases of the project and also discusses possible implementation arrangements for the project.
43. Section IV describes the technical benefits and risks for the preferred alignment based on updated traffic projections and construction and operation costs. It gives the results of the economic and financial analyses. It also summarizes the impact of the preferred alignment on resettlement, minorities, poverty and the environment. It also describes the risks associated with the Project.
44. Section V summarizes the consultants' recommendations.
45. There are 17 appendices included in Volume I which describe the study methodology, technical analyses, and conclusions and recommendations in more detail.
46. The Report is accompanied by 11 Supplementary Appendices describing in more detail the work carried out both in Phase 1 Studies and during Preliminary Design. Volume 2 contains the alignment selection, preliminary design and cost estimates while Volume 3 contains the traffic, economic, financial and other analyses The Design Drawings, are presented in a separate Volume 4.
47. The Social Assessment, Environmental Impact Assessment and Resettlement Plan will be presented by others.

II. RATIONALE: SECTOR PERFORMANCE, PROBLEMS AND OPPORTUNITIES

A. Performance Indicators and Analysis

48. Road Network: The National Road Network is made up of National Highways, Feeder Roads, Urban Roads, District Roads and Village Roads. The National Highways together with the Feeder Roads form the Strategic Road Network (SRN) of the country. The SRN is the backbone of the National Road Network. The construction and maintenance of the Strategic Roads is the responsibility of the DoR. As at 2006, the National Road Network had a total of 17,782 km of roads, with 7,917 km (44 percent) Strategic Roads.
49. Outside the Kathmandu Valley, the highest traffic volumes are 6,000 vehicles per day (vpd) on the existing route to the Indian border. Traffic studies carried out during the project indicate that the existing road will reach capacity in the next 3-5 years. It is estimated that by the time the project road is completed (2014) it will carry over 9,000 passenger car units (pcu).
50. Although there are several well developed cross border connections from Nepal to India, at the present time there is one low standard international connection with People's Republic of China (PRC) at Kodari and this provides the only connection through Nepal from India to China. Up to seven additional north-south international connectivity routes are planned and talks have recently been held, and are continuing, to set a framework for development of these routes.
51. Vehicle Fleet: The registered motor vehicle fleet in 2006 comprised 528,570 units: with an average annual growth rate of about 12 percent since 2000. About 49 percent of these vehicles are registered in the Bagmati Zone which includes Kathmandu. Except around Kathmandu, where cars are common, traffic is still dominated by buses and trucks, and increasingly, motorcycles.
52. The vehicle fleet, especially the truck fleet, is aging and often underpowered. This leads to congestion and delays to other traffic, as well as heavy vehicle emissions. It is important that some control is enforced of prohibition of unsuitable vehicles on the project road.
53. Organizational Structure: The National Planning Commission (NPC) sets overall development objectives and coordinates the investment programs of external agencies and individual government agencies. The Ministry of Physical Planning and Works (MPPW) has prime responsibility for planning, formulating policies, and managing all land transport facilities, including roads and bridges; within MPPW, DoR is responsible for network planning, design, construction, and maintenance of the country's Strategic Road Network; and municipalities are responsible for urban roads.
54. Within DoR, administration of ADB-financed road projects is carried out by the Project Directorate (ADB), headed by the Project Director. Currently, DoR has 268 engineers, 261 overseers, and 1,862 technical and administrative support staff.
55. Road Transport: The bus and freight transport industry is regulated by Department of Transport Management (DoTM) at all levels. The majority of operators of road passenger services are privately owned. All bus operators need to be registered,

either as an individual or as a company and there were 14,859 and 4,919 registered buses and mini-buses in 2004.

56. DoTM designates the bus routes and issues route permits for the majority of sealed roads in Nepal and sets the fare for routes, taking account of road pavement type. However, DOTM carries out no scheduling of buses on the route and appears to carry out no overall route planning.
57. The road freight transport industry carries over 90 percent of freight traffic and is dominated by private operators who are mostly owner-drivers. Commercial vehicles must be licensed by DOTM to operate in a commercial trucking operation. DOTM also approve freight rates. Typically freight rates between Kathmandu and Birgunj, on the Indian border are 1.99 NRs./ton-km.
58. Bus fares are clearly related to road and terrain conditions. If roads are allowed to deteriorate, bus fares will likely increase, and conversely, if roads are improved, fares will likely reduce. A general relationship between terrain and road condition and freight charges also applies, a general link between road condition and freight rates, which has underpinned the increase in trade volume, is seen in all areas.
59. The police HQ, the Road and Traffic Unit (RTU) of DoR and the Department of Transport Management (DoTM) all work towards road safety and management of traffic. DoTM is responsible in issuance of driving license, vehicle registration and testing, and maintaining vehicle safety. The RTU was set up in 1994 to provide road safety and traffic engineering services, it also collects some limited traffic accident records and conducts limited demonstration schemes and carries out safety audits on selected roads. They have also produced, with DIFID assistance, guidelines for road safety including a traffic sign manual, road safety notes and a highway code and have conducted training courses for the traffic police.
60. A road sector analysis is included as **Appendix 2** and an analysis of revenue and the road sub-sector as **Appendix 3**.
61. Interregional Trade. Because of geography, Nepal's external trade has been limited in the past but there has for many decades been trade with neighboring countries, principally India and PRC Tibet Autonomous Region (TAR).
62. In the last few decades international level trade has gradually increased and Nepal now trades not only with India and PRC but, through India, with other countries.
63. The Birgunj – Kathmandu- Kodari corridor is the only corridor currently available for transit traffic from India to PRC (TAR) and the Birgunj dry port is the main entry/exit for goods to/from Nepal and India and beyond. The existing route is long and subject to frequent disruption during the monsoon season. Therefore, a new high class connection from Pathlaiya to Kathmandu will have significant benefits for bilateral, international and transit trade flows.
64. Nepal has entered into various transit and trade agreements with other South Asian counties:
 - South Asia Association for Regional Cooperation (SAARC) was launched in 1985 to promote the welfare of peoples in South Asia and to improve the quality of life through accelerated economic growth, social progress and cultural development within the region.
 - The South Asia Free Trade Area (SAFTA) Agreement came into force in

January, 2006 and is being implemented through, in part, a trade liberalization program which will reduce existing tariff rates.

- In 1996 Bhutan, Bangladesh, India and Nepal formed the South Asian Growth Quadrangle (SAGQ) under the umbrella of SAARC with the objective of accelerating sustainable economic development.
- In 2001 the South Asia Sub-regional Economic Cooperation (SASEC) program was commenced¹².

65. SASEC is more focused on enhancing existing transportation facilities and improving the operational efficiency of the transport sector to facilitate the trade and the movements of goods and people across borders. This includes: addressing transport “bottlenecks” on road links, development and improvements of Customs Stations; construction of new access roads and enhancements of the existing access roads that connect the main highways to the Customs Stations; harmonization of the different standards in roads and rails between the participating countries; and revitalization of the Asian Highway Concept to facilitate road connectivity to all SASEC countries.
66. With the implementation of SAFTA Agreement and SASEC, intra-regional and sub-regional trade is expected to grow at an accelerated rate.
67. In March 2004, Nepal became a member of the World Trade Organization (WTO). Nepal has committed to a timetable of legislative reforms required to comply with WTO rules on trade related domestic regulations. New legislation is required on the valuation of imports for customs and taxation purposes which will increase the transparency and predictability of customs offices for imported goods.
68. The value of Nepal's total trade in FY 2005/2006 was NRs. 222.9 billions with a trade deficit of NRs. 102.8 billions. Exports were constrained by a prolonged phase of general strikes, industrial closures, and political turmoil during the second half of the fiscal year.
69. There are nine official border crossing points with PRC and 22 with India for bilateral and international trade. Among the 22 official border crossing points with India, Birgunj is the most important and busiest for bilateral and international trade, accounting for about 40 percent or NRs. 90 billion of the total trade value.
70. Although there have been substantial improvements in physical and non-physical conditions of the Birgunj customs post there are still many choke points hindering the smooth flow of exports and imports of goods. Although removal of the above constraints will substantially speed up transport of border trade flows, full advantage of the improvements would not be utilized unless the travel distance and time from the border to Kathmandu is reduced by the introduction of the project road.
71. Further details of the extent and impact of regional trade are set out in **Appendix 6** and **Supplementary Appendix 4**.

¹² RETA 5936: the Identification and Prioritization of Sub Regional Projects in South Asia

B. Analysis of Key Problems and Opportunities.

1. Problems and Constraints.

72. There has been a relatively small investment in road transport in Nepal, the road network still does not provide access to large parts of the country, particularly the poorer regions, and is inadequate in places to support sustainable economic growth. Roads built to a high standard (Nepal class I and above) account for a small percent of the total network and there are no high class access controlled roads. Most roads are medium to low grade paved roads and gravel roads (**Appendix 2**). As a result, the expansion in the demand for road transport, particularly north-south long distance traffic, has strained the road infrastructure, as manifested by bottlenecks in the existing north south road network. The resulting high cost of shipping goods between Kathmandu and the Terai and importing/exporting goods between Kathmandu and India has been a serious constraint to economic development.
73. The area through which the proposed road passes is relatively poor. In the immediate project area, 2 Village Districts (VDCs) are in poverty; 29 to 43 percent of the rural people are poor earning less than NR 7,700 per year. Ethnic minorities, mainly Newar, Tamangs and Tharus, account for some 35 percent of the population and about the same percent of the poor population. Outside of the Kathmandu valley the area's remoteness and inadequate road infrastructure are among the main causes of the area's poverty. In the project area, neither of the rural VDCs is served by an all weather road and 40 percent of rural villages have no highway access. The roads which do run through the project area have with steep slopes, sharp turns, and low allowable speed. Nearly all roads are intermittently closed during the monsoon season and there are frequent landslides.
74. The poor road conditions have resulted in inadequate and unaffordable transport services in the area. The poor quality of the roads deters many licensed bus and truck operators from plying the routes to villages. As a result, many villages in the project area still have no direct bus service. Inadequate road access is an impediment to higher agricultural productivity and prevents the poor from taking advantage of job opportunities in the major towns in the area. A high speed access through the project area is needed to promote economic growth and integrate the poor, isolated regions with the economic centers of Kathmandu and Hetauda through improved transport services.
75. The Ministry of Finance through the Roads Board Nepal (RBN) and DOR provides funds for the maintenance of SRN. Whilst DOR is the sole implementing agency for SRN, since the establishment of the RBN in December 30, 2002, RBN approves the annual road maintenance plan of DOR and controls the budget out of the fund it receives. DOR remains the planning and implementation agency for maintenance and uses other funds, such as direct allocation by GoN and through projects funded by ADB and WB.
76. For fiscal year 2004/05, the maintenance budget, including rehabilitation and upgrading, allocated for the SRN was NRs. 2,593 million, in fact the average annual budget estimate for SRN in the RMP was NRs. 1,700 to 1,900 million but that covered only about half of the road length planned by RMP.
77. It has become apparent that the RBN requires extensive reorganization and redefinition of its' responsibilities before it can become effective and, in its present

form, could not be responsible for the maintenance of the project road. (**Appendix 2**).

78. **Road Safety:** Nepal is at an early stage of motorization with a vehicle population of 528,000. This has been expanding at 12 percent each year since 2000. Road traffic accidents in Nepal also have been increasing and this has become a major social issue in the country. The number of road accident nationwide in 2006-07 was recorded as 4,445 with 780 fatalities, with most fatal accidents concentrated along the trunk highways in rural areas.
79. Nepal's fatality-rate of 113 per every 10,000 registered vehicles in fiscal year 2006-07 is extremely high even when compared to neighboring countries and has been rising in recent years. Accident rates are high even in the remote areas of the Country with little motorization but the bulk of accidents still occur in the heavily motorized Kathmandu valley. The economic loss from road-accidents is significant at 0.48 percent of the GDP.
80. The road safety analysis for the Project included a review of existing accident trends, a safety audit of the preliminary design and recommendations for road safety awareness programs carried out as part of the Project. Countermeasures at potentially hazardous locations have been recommended for incorporation into the design.
81. Long-term measures to enhance tunnel and road safety include, timely maintenance, including safety-facilities, and prompt monitoring of traffic operations and incidents. Daily safety inspections and regular safety-audits are recommended with emphasis on safety-structures and hazardous/critical locations. ITS monitoring of tunnel and critical locations is recommended. A long-term education program on code-of-behavior for road-users is also critical based on new and complex traffic operations of the Project road. Strict enforcement of traffic rules in tunnels and Project-Road with stiff penalties to violators is also essential in promoting road safety.
82. Further safety audits will be required during detail design and construction and also during operation phase of the road. Other requirements include (i) sustained safety training programs; (ii) strong coordination and collaboration between the Toll Operator, Traffic Police and emergency services for effective traffic and incidence management; (iii) adoption of ITS technologies such as variable message signs, automatic toll-collection, etc; (iv) amendment to the existing regulations to incorporate tunnel safety rules and (v) development of a national ITS standards. Further details of the road-safety analysis and ITS proposals are set out in **Appendices 7 and 8**, and Supplementary Appendices 9 and 11.

2. Government Strategies

83. Since the 1970s, the Government's main objective in the road sub-sector has been the completion of SRN as well as integrating the country. Improved access and reduced transport costs are expected to stimulate economic development, particularly in agriculture. This will help reduce regional disparities.
84. The policy instruments in place such as National Transport Policy 2001 recognizes these objectives by stressing the need to connect all districts centers, increase overall road density, and provide a high density of all-weather farm to market roads in low lying Terai and mid hill valleys. In addition, a long term road development

master plan was prepared covering the Tenth to Thirteenth Plan periods.

85. The main objectives of the Tenth Plan (2002-07) in the road sub-sector were to develop and manage the road transport network to support the socio-economic development efforts and to promote private sector participation in the construction of new road networks and their maintenance. Sustainability and integrated development of transportation has been addressed through recognition of the need for institutional reforms such as the establishment of a Road Transport Authority, a National Transportation Board and the devolution of local road responsibilities to local bodies.
86. To encourage increased private involvement in the road sub-sector, legislation has been enacted for the implementation of BOT and BOOT¹³ policies.
87. A framework is being established for improved road maintenance through the establishment of the Roads Board Nepal, financed by a fuel levy, vehicle taxes and toll revenue.
88. A Three Year Interim Development Plan (TYIDP) for 2007/08 to 2009/10 was approved by the Government in 2007 to address development challenges during the transition period and which aims to achieve a gross domestic product growth of 5.5 percent per annum. In the road sector it aims to connect all the remaining 12 district headquarters by road in addition to upgrading and carrying out periodic maintenance of about 4,000 km of strategic roads. Progress during the three year plan, however, needs to show at least 70 percent improvement over that of the 10th plan period. (**Appendix 1**)

3. ADB Strategies and Lessons Learnt.

89. The Nepal CSP for 2005-9 sets out the strategy for promoting broad based economic growth. A key element of this strategy is the development of the road network. The CSP builds on a rigorous analysis of the poverty situation in the country, ADB's operational experience in Nepal, and a comprehensive assessment of the evolving political context.
90. ADB's strategic approach in Nepal over the period 2005-9 is to foster a broad-based and inclusive social and economic development process so as to achieve a steady decline in poverty. ADB's support for a more inclusive development process will assist the Government in promoting greater balance in the development of different regions of the country; in improving access of the poor to basic services, their opportunities for economic advancement, and their participation in the development process; and in addressing the needs of disadvantaged, women, ethnic groups, and castes.
91. The tentative country program for 2008-10 is aligned with Government's priority sectors and also in line with the medium term strategy II priority sectors.
92. In the transport sector, the key focus in the CSP is to bring excluded regions and social groups into the economic mainstream by fostering connectivity between all parts of the country and by facilitating trade between Nepal and its neighbors. ADB will assist the Government in developing connectivity by improving accessibility and reducing isolation within the country and by promoting sub-regional connectivity

¹³ Build, Operate, Transfer and Build, Own, Operate, Transfer

with neighboring countries through the development of roads, airports, and telecommunications infrastructure.

93. In the road sub-sector, the sector loan modality will be used more frequently to assist in improving and completing the major road networks. This will enable ADB support to be used in distressed regions. Labor-intensive, environment-friendly construction methods will be promoted. Better road linkages and improved customs and transshipment facilities at the principal border crossings will be supported to reduce transport costs and customs-processing delays. Implementation of the Road Fund and other measures to bolster road maintenance will be supported.
94. In the last few years, the performance of ADB transport projects in Nepal has improved considerably. The Third Road Improvement Project (TRIP) was completed on time and on budget and the Road Network Development Project (RNDP) is performing adequately. The Road Connectivity Sector I Project has recently started which will connect three District headquarters by 2012. Project completion and project performance audit reports have been issued for all completed projects.
95. The TRIP included extensive off-road bioengineering works aimed at re-vegetating and stabilizing slopes disturbed by construction. The slope protection manual prepared under the TRIP will be applied under the Project.
96. At the time of presenting the report the country is undergoing significant political changes which may delay Project implementation, also adverse macroeconomic conditions may affect the actual costs of implementation. Under the Project, possible delays have been addressed by providing a sufficient implementation period and contingencies.
97. The recent civil disturbance in the Terai region has subsided but could still pose a law and order problem for the Government. Violence and transport strikes still sometimes hinder delivery of basic services and private sector activities. Once the political situation stabilizes then the law and order situation should also stabilize. The Project, which is partly located in the Terai area, has promoted consultation and public participation particularly to increase public awareness of the Project and how it will address community road-related needs. This may increase public support for the Project and reduce disruptions during implementation. DoR and ADB have learned from the TRIP and RNDP that an active community consultation component is needed for the road design and implementation process. Under the Project, community participation should be further promoted.
98. ADB's institutional strengthening efforts in the transport sector through TAs have been relatively minor. WB, DFID, and SDC, among others, have been actively involved in policy dialogue with the Government, and major actions have been taken to date, including (i) institutional capacity building, and (ii) road maintenance planning and funding construction and implementation. ADB has been supportive of these efforts and is concentrating on ensuring that its operations complement these initiatives. The PPTA for this Project examined institutional strengthening needs, especially as they relate to toll roads, and identified areas for training and improvement. (**Appendix 17** and Supplementary **Appendix 10**).
99. The focus on using local contractors and packaging contracts into forms suitable for this in ADB-funded projects has contributed to the availability of work to support growth of the local construction industry, and parallels similar increasing use of

domestic contractors by other funding agencies in the road subsector. The good performance of the completed works suggests that local contractors are capable of handling many of the types of road works. Although, because of the nature of the works, international contractors will be needed for the major contracts, the Project should make maximum use of local contractors for the minor contracts.

100. Other lessons learned from past ADB experience has led to this Project to be more sharply focused and results oriented; more sector-wide, and participation of a wider spectrum of stakeholders and institutions in the planning, design and implementation. To this end, a series of workshops and presentations were made during the PPTA to interested stakeholders and suggestions were considered in the Project preparation.

4. External Assistance to the Sector

101. ADB began lending to Nepal in 1969 with total public sector loans totaling about \$2.1 billion, mainly from the Asian Development Fund (ADF) resources. As of 1 Jan 2008, 23 ADB assisted projects were ongoing with a total net loan amount of about \$615.7 million.
102. The first transport sector technical assistance (TA) to Nepal was completed in 1994, and as of January 2008, 11 transport sector TAs had been approved.
103. Since 1976, ADB has provided the Government with 9 road projects totaling \$152.4 million in loans and grants and TA totaling over \$3.5 million. Overall, ADB's involvement in the road subsector has been significant, addressing a large portion of the road upgrading and periodic maintenance needs of the East West Highway as well as improvement to hill roads. ADB has financed about one quarter of road development expenditure in Nepal since the 1980s
104. The development and maintenance of the road network in Nepal is heavily reliant on international and bi-lateral loan and grant funding. Since 1980, ADB has provided 7 loans in the transport sector to construct or upgrade about 1,800 km rural roads and highways. Other major donors have been China, India, Japan, UK, Germany, Switzerland and USA. Multilateral donors include WB and UNDP. Details of external assistance in the transport sector are set out in **Appendix 4**.

5. Revenues and Expenditure

105. During the Ninth Plan (1996-2002) and Tenth Plan (2002-07), GoN's total investment in road transport reached NRs. 24,000 million (US\$ 322 million) and NRs. 26,000 million (\$US 393 million) respectively. In 2006-07, investment in roads was 6,585 NRs. million (US\$ 103 million), in 2007-08, the allocated budget is NRs. 8,861 million (US\$ 135.4 million), in 2005-06 the investment was NRs. 4,735 million (US\$ 75.9 million), a rise of 35 percent over actual expenditure in 2006-07.
106. The construction of the Project Road will require a heavy investment, between NRs. 16 billion (\$US 220 million) each year of the four year construction period for the four lane option (NR8 billion over 8 years for the 2>4 lane option). Clearly this cannot be covered by normal GoN revenue. Possible sources of investment and suggested toll revenue levels have been investigated and are discussed in the appendices (Supplementary Appendix 8 and 10). Road sector revenues and expenditures are set out in **Appendix 3**.

C. Stakeholder Participation and Consultations

107. Public participation is essential for every developmental activity and is a statutory requirement in Nepal. To ensure peoples' participation in the planning phase of this project and to treat public consultation and participation as a continuous two way process, public consultations were held during the initial screening and preliminary design stages at different places along the alignments in order to gather their views regarding the need of the proposed projects in their vicinity.
108. Extensive consultations were also held with government agencies involved in environmental protection, water and forest resources management during the preparation of the Project. Government officers in relevant ministries and departments, transport and commerce related organizations, and regional leaders were consulted during the feasibility and design studies and were apprised of the Project objectives and asked for comments. The results of the consultations were taken into consideration in the design of the Project.
109. During the social, environmental and resettlement assessment various stakeholders will be consulted through informal focus group discussions and individual interviews which aim at promoting public understanding of developmental problems such as local needs of the road, problems of resettlement, etc. The project will, therefore, ensure that the any affected population and other stakeholders are informed, consulted, and allowed to participate actively in the development process. Stake holder participation will be continued throughout the project, both during planning, preparation, and implementation and during post implementation of the project.
110. The people consulted during the reconnaissance and other surveys viewed that the road will facilitate the development in the zone of influence of the proposed road. Most of the people welcomed the proposed project. In the case of resettlement and land acquisition, people viewed that they should be properly compensated.
111. An Inception workshop was held in Kathmandu early in the project period to which all stakeholders were invited, including relevant Government departments, International agencies, interested foreign embassies, semi-government agencies and transport, trade and commerce organizations. The purpose of the workshop was to present the aims and methodology of the project, to discuss and agree on the criteria to be considered and to decide on the relative importance of each of the criteria to be used in the multi-criteria analysis.
112. A stakeholder's site visit was arranged in early June to visit accessible sections of the alignments under study and a final workshop conducted to present the results of feasibility studies as set out in this report. Presentations were also given by Government to interested stakeholders at various stages during preliminary design.
113. During the preliminary design stage of the project regular briefings were given to DoR and MPPW and further consultations held with stakeholders, including people in the zone of influence during the field survey and transport operators through survey and discussion. **(Appendix 9).**

III. THE PROPOSED PROJECT

A. Development of the Kathmandu North-South Road Access

114. Prior to 1950 there was a railway from the Raxaul (India) to Amlekhgunj in Nepal, about 32 km. Travel from Kathmandu was on foot or horseback to Bhimphedi, a three day walk, and then by earth road to Hetauda and on to Amlekhgunj, the journey taking from 3-5 days. In the 1930's a ropeway was constructed from Hetauda to Kathmandu for freight transport using a similar corridor to one of the old foot tracks. In the 1950's the need of linking Kathmandu with the Terai by motorable road was recognized and the first long distance road (115km) to link Kathmandu was started in 1953, with Indian assistance, between Thankot of Kathmandu District and Bhainse of Makawanpur District following the old footpath corridor. This was opened to traffic in 1956 and named the Tribhuvan Rajpath (Highway). About the same time work started on the Kanti Rajpath, a route from Kathmandu to Hetauda using the Bagmati valley, but the central section of this was never completed although, except in monsoon season, the road is still motorable by four wheel drive for a considerable distance from each end. Between 1960-1970, there was a considerable expansion of road network with assistance from some bilateral agencies. The People's Republic of China constructed the Kathmandu-Kodari Road. The Indian Government built the Sunauli-Pokhara Road and the Kakarbhitta-Dhalkebar Sector of the East-West Highway (EWH). The former USSR helped Nepal to construct a 109 km Pathlaiya-Dhalkebar Sector of the EWH. The British Government built the 113 km Butwal-Narayanghat Sector of EWH. Thus an alternate route from the Terai to Kathmandu was completed.
115. Currently there are two sealed motorable roads between Kathmandu and Pathlaiya via Hetauda: the winding mountainous Tribhuvan Highway (133 km Kathmandu-Hetauda), and the route using the EWH from Hetauda to Narayanghat connecting to the Narayanghat-Mugling Highway and in turn to the Prithivi Highway from Mugling to Naubise and on to Kathmandu, a total of 245km (221 km to Hetauda). Over 90 percent of trucks carrying loads use the latter longer route via Mugling as the Tribhuvan Rajpath route is too narrow windy and hilly for loaded trucks and large passenger buses and is subject to landslides in the monsoon season. There are also dry weather routes from Kathmandu through Pharping over Humane pass to Kulekhani Dam, another from Pharping via Chisnari pass, thence following the Kulekhani River, crossing it downstream of the dam, a route from Thankot through Chitlan pass and down the Chitlan valley to Kulekhani dam and an Electricity Authority access road from Tistung on the Tribhuvan Highway to Kulekhani dam. All routes then use the Electricity Authority road from Kulekhani Dam to Bhimphedi and then the district road to Bhainse and Tribhuvan Highway to Hetauda. All routes are over 100 km and only carry four wheel drive taxis/micro buses and local agricultural traffic. It takes about 4-5 hours from Kathmandu to Hetauda if conditions are good; in the monsoon period the routes are often impassable.

B. Impact and Outcome

116. The overall Project will help promote sustainable economic growth and poverty reduction in Nepal as a whole and the project area in particular. It will achieve this by (i) improving the road transport network by building a new high class direct North South highway from Kathmandu to the Terai allowing faster transport of agriculture and goods, (ii) Improving trade linkages with India and improving the Asian Highway network (iii) Improving transport conditions for trade from Nepal to other countries through India, and (iv) reducing transport operating costs in general and, in particular, fuel savings.
117. The output of the TA Project comprises (i) the preliminary design of about 76 km access-controlled toll highway from Kathmandu to Nijgadh, upgrading of 18km of the East West Highway to Pathlaiya, with a connection from the main line to Hetauda, and (ii) advice to DoR on remedial measures to the Arniko Highway from Lamasangou to Kodari, about 35 km, including slope protection and stabilization, (iii) safeguard measures for the North-South Connection including environmental, land acquisition, resettlement and social as required by GoN and ADB¹⁴.
118. The output of Phase I of the study comprised feasibility design of four alignments with cost estimates for various options on each alignment; traffic forecasts for traffic using the new road, up to 2034; results of economic, financial and multi criteria analyses; discussion of organization and technical requirements for the construction and operation of the new road, and a table of advantages, disadvantages and risks of each alignment option which allowed GoN and ADB to agree on a preferred alignment for Phase 2 design.
119. The outputs of Phase 2 of the study comprise preliminary design of the preferred alignment, including design drawings and report; cost estimates and implementation plan; updated economic and financial analyses; road safety plan for the new road; discussion and plan for capacity building of DoR in the areas of toll road management and commercialization; a monitoring system for assessing the implementation of the project road and a risk assessment for the safe and effective implementation of the project.

C. Outputs

120. The scope of the Project included the components described below:

1. Alternative Alignments

121. A preliminary selection of the alignment corridors was made based on previous studies and initial site surveys. The project area between Kathmandu and Pathlaiya is located largely in rolling, mountainous and steep terrain. High Mahabharat ranges including Chandragiri (northwest of Kathmandu), Bhattedada (south), Mahabharat Lek and Siwalik (Churia) run in an east west direction and block easy egress. Six route corridor alternatives were selected for initial study. A full description of each alignment studied is set out in **Supplementary Appendix 1**.
122. As a result of the multi-criteria analysis (**Supplementary Appendix 1**) alignment 3A, the Bagmati Valley route was recommended and selected by Government as

¹⁴ Surveys for the EIA, social assessment and resettlement plan are in progress and the results will be presented by others and are not part of this report.

the preferred alignment for further study.

2. Route Description of the Preferred Alignment

123. The preferred alignment starts from the proposed outer ring road of Kathmandu and follows the Bagmati River in the Kathmandu valley for 7 km, starting on the left bank before crossing the river to avoid unstable ridge noses. The alignment finally re-crosses the river to the left bank which it follows as far as the confluence with the Kulekhani River. For the four lane option the carriageways are divided on either side of the river over this section. After crossing this river the alignment continues to follow and descend the right bank of Bagmati River, crossing the Ipa Khola (river) where it gradually leaves the Bagmati river climbing to the south west. It then passes close to Thingan village through a 1.3 km tunnel and several high bridges to reach Budune village at 52 Km., where the Hetauda Connector road branches off to the west. The alignment then descends and initially follows the right bank of the Simat (Bakaiya) Khola, crosses it at several places and reaches Nijgadh on the EWH. Thereafter it follows the upgraded EWH to reach Pathlaiya. Photographs along the selected alignment are set out at the end of the Appendices.

3. Road Design Component

124. Since the project road will be a part of the Asian Highway and its aim is to provide a high-class connection between Kathmandu and the Terai with high traffic volumes, a higher road standard than those normally used in Nepal is proposed. The proposed standard is Asian Highway Class 1 road with minor modifications.
125. Design was carried out for both two and four lane road options. Design speed will be generally over 80 kph with some mountainous sections dropping to 65 kph. The proposed design speed is the minimum design speed; most sections of road are actually designed for a higher travel speed where conditions permit and the average road driving speed should be above the design speed. Maximum grade is generally 4 percent. A total right of way of 50m follows the GoN standard, however in some mountainous road sections and at interchanges, this width has been increased.
126. The pavement structure thickness has been calculated based on the estimated cumulative number of heavy vehicle axles in the design life. Cross road drainage is through culverts and bridges. Bridge design has followed GoN specifications. Considering the importance of this road the flood frequency has been increased over that generally used in Nepal.
127. Since the Project Road is located in a seismic affected area anti-seismic measures have been included in the design of cross drainage structures. The alignment has 51 major bridges of 50m or longer and a total length of bridges of 9,061 m.
128. There is one tunnel of 1.35km. There are no existing Nepal design standards for tunnels, the design of the tunnel has been based upon Japanese design standards. Twin tube tunnels are proposed for four lane design. Tunnel ventilation and lighting will be required as will traffic safety and emergency facilities. A technical and design summary is set out in **Appendix 5** and a full design report in **Supplementary Appendix 2**.

4. Technical Capacity and Capacity building

129. The new road will involve some sophisticated and modern techniques both in construction and operation. Some of the skills required are not available in Nepal at the present time. This will be particularly important in tunnel design, construction and operation and a significant amount of capacity building and training will be required in this area. If the road is built by Government using direct funding personnel will need to be well trained for tunnel operation and maintenance and, especially, for emergency operation, if the road is designed and built under BOT concession Government will still need trained personnel to carry out monitoring of the design, construction and operation. Training is needed both domestically by international specialists but also in foreign countries which have sufficient experiences in this area. Training will also be needed in toll road operation and ITS for toll roads.
130. If Nepal is to develop Private Sector Participation (PSP) in the transport sector then it must have a development program to expose its senior and mid-level staff to the opportunities for, and potential benefits from, PSP, particularly in O&M and performance based highway operation and maintenance standards.
131. A development program is proposed which would take the form of seminars and workshops in Nepal led by PSP experts as well as visits to overseas countries, such as India, Malaysia, and the United Kingdom, which have successful PSP in highways. Further details are set out in **Appendix 17**.

D. Cost Estimates

132. The total project cost estimate for both two and four lane design is summarized in Table 3 and 4. The costs do not include any interest paid during construction as funding details are not yet decided. Details are set out in **Appendix 10 and Supplementary Appendix 6**. The cost for two lanes includes immediate essential earthworks and drainage for four lanes to minimize disruption to traffic during later upgrading. The total cost of the project, including consulting services, land, and contingencies, but excluding interest during construction, is estimated at \$US922 million for the four lane road, of which \$378 million (41.2%) is foreign exchange cost. Local currency costs, including taxes and duties, are estimated at \$US544 equivalent (58.8%).

Table 2. Project Cost Estimate – 4 Lane Road

\$US million (at forecast exchange rate)

Item	Foreign	Local	Total	%Foreign
Civil Works	330.3	373.0	703.3	47.0
Equipment	2.6	0.5	3.0	85.0
Land	0.0	25.6	25.6	0
Consultancy	11.3	37.6	48.9	23.0
Subtotal	344.0	437.3	781.3	44.0
Physical Contingency	17.1	21.5	38.6	44.0
Price Contingency	17.3	84.7	102.0	17.0
Grand Total	378.4	543.5	921.9	40.5

Table 3. Project Cost Estimate – 2 Lane Road

\$US million (at forecast exchange rate)

Item	Foreign	Local	Total	%Foreign
Civil Works	205.8	238.1	443.9	46.3
Equipment	1.4	0.3	1.7	0.3
Land	0.0	25.6	25.6	0.0
Consultancy	8.1	26.8	34.9	23.2
Subtotal	215.3	290.7	506.0	42.5
Physical Contingency	10.7	14.3	25.0	42.8
Price Contingency	9.9	54.5	64.4	15.4
Grand Total	235.9	359.5	595.4	39.6

Includes essential earthworks for upgrading but only single carriageway bridges and tunnels.

E. Implementation Arrangements

1. Project Management and Organization

133. The project road will be the first high class toll road in Nepal. The tolls suggested would raise a significant amount of revenue, most of which would be required for operation and maintenance to keep the road asset in a good and safe condition and also for debt servicing. It will be important therefore for Government to provide a dedicated entity to implement and operate the new road.
134. Although the funding modality for the project has not yet been finalized it will

need to be raised from a variety of sources, possibly some from the private sector. If direct funding raised by Government is the preferred option then an essential prerequisite would be for a project entity to be established as a separate company with its own autonomous management and separate accounts.

135. This would start with the establishment of a Highway Board (HB) which would set up a Project Management Office (PMO) to co-ordinate the finalization of the project including detail design and would also take responsibility for the financing plan. It would liaise with MoF and the finance section of DoR in the allocation of Government funds and would liaise with them and possible donors, to finalize the funding plan. A new management organization should then be corporatized at an early stage as a step toward seeking additional investors in the project. After completion of the project, the operation, maintenance and debt servicing of the new road would become the responsibility of the new road management company (RMC) which would liaise with MoF, the appropriate Government Department, or a separate regulatory body to set toll levels before the operation of the project road.
136. If BOT concession is selected as the funding option then Government should still set up a project entity to oversee all aspects of the design, construction and operation of the Project road by the BOT concessionaire. Further details of the recommended operating structure are set out in **Appendix 17**.
137. It is required that the Environmental Management Plan (EMP) shall be included in the contract documents and that the contractor be required to implement the EMP to its full extent. It has been recommended that payment milestones linked to environmental performance in this respect.
138. The environmental assessments are made at an early draft stage (preliminary environmental review - **Appendix 16** – prior to the approval of the statutory scoping report and ToR by MOEST under the Environmental Assessment Rules 1997 as amended) but already it is clear that the specific responsibilities of DOR are numerous and detailed, both prior to and during implementation of the Project under whichever funding modality is used. There are several statutory requirements, approvals and clearances required. DOR will also need to confirm that contractors have the resources to complete the EMP, complied with all statutory requirements and have appropriate and valid permits and permissions to construct and operate plant in appropriate areas.
139. Prior to any construction, the findings of the Environmental Impact Assessment will need to be reconfirmed and the assessments of interchanges and access roads included. The amended EIA and EMP shall be notified to MOEST by DOR (under the Environmental Protection Rules, 1997). This process may take some time, therefore suitably qualified consultants must be commissioned at the initiation of the implementation phase by the PMO to work with the detailed design engineers to avoid delays in the construction. The detailed design consultants should also ensure that contractual clauses are included to cover all EMP requirements and DOR guidelines (e.g. slope stabilization manual). Performance criteria, including implementation of the EMP and completion of DOR recommended measures shall be linked to milestone payments.
140. The EMP is being prepared taking into account the capacity of the DOR Geo-Environmental Unit (GEU). Additional human resources will be required to undertake environmental monitoring of installation of mitigation measures, compliance with all statutory requirements and monitoring of complaints during the

construction phase. The GEU will need to supplement its fulltime environmental staff with additional personnel as dedicated NSFT monitoring staff, based on the project full time before construction starts, because the GEU will be responsible for auditing the implementation of the whole EMP from the detailed design stages onwards. In addition, it is envisioned that at least one environmental specialist will be engaged by each of the contractors to help them implement and complete all the mitigation measures in the EMP.

2. Implementation Period

141. It has been assumed that the decision by Government to proceed with the project and arrange suitable funding would be available by June 2008. Detail design should then be complete by end 2009 and project preparation should also be complete by that time.
142. With a nine month annual construction period an overall 48 month construction period has been assumed. The early provision of all weather access roads will be essential.
143. Construction could, therefore, be completed by the end of 2013, with the road opened early 2014. All analyses have assumed a full year of benefits and revenue in 2014. A construction schedule and a possible set of construction contracts are set out in Appendix **11 and 12**.

IV. PROJECT BENEFITS, IMPACTS AND RISKS

144. The Project will add improvement of the overall performance of the road sub-sector, contributing to transport efficiency, and widening access to economic opportunities. The beneficiaries of the Project will be communities served by the Project road who, although not necessarily traveling on the new road, will benefit indirectly from the improved, lower cost, and faster transport services, and thereby obtain improved access to economic opportunities and social services. Transport operators, both passenger and freight transport services, will benefit from the new road in terms of lower vehicle operating cost, time savings, and improved road safety, and thereby increase productivity. Government and non-government agencies using the Project road will improve their services delivery due to improved transport efficiency. Traders both sub-regional and regional will also benefit from reduced transport costs and this should result in lower costs to consumers in Kathmandu and Nepal generally.
145. Those benefits and positive impacts will occur based on assumptions that sufficient funding will be obtained, that Government will implement the necessary organizational structures and that the forecast traffic volumes on the new road take place.

A. Benefits

1. Traffic Analysis

146. The existing national highway from Kathmandu to the Terai via Mugling and Narayanghat to Hetauda is congested and carries high volumes of bus and goods traffic. The project road will increase the corridor's capacity to meet transport demand and will significantly reduce transport costs and travel times. The project road will reduce the travel distance between Kathmandu and Pathlaiya and on to the Indian border by approximately 152km and save over 4 hours. Average traffic on the project road is forecast to grow from 9,000 pcu/day in 2014, the expected year of opening, to over 34,000 pcu/day in 2024. Opening traffic is reduced by the ramp-up effect observed elsewhere on toll roads immediately after opening. The traffic projections also take account of (i) forecast economic growth, (ii) the additional traffic generated by the project through reduced transport costs, (ii) traffic generated by new development as a result of the project road and (iii) the impact of toll levels on the diversion of traffic from alternative routes. (**Appendix 14** and Supplementary Appendix 6).

2. Financial Analysis

147. The assessment and comparison of the FIRR only makes sense if it is assumed that the project road is operated by an autonomous agency. For the financial evaluation it was assumed that the operator is a financially autonomous body subject to standard business taxes and bears the risks and rewards associated with design, supervision and construction.
148. FIRRs were calculated for the period 2008 to 2034, i.e. construction followed by 20 years' operation and the evaluation undertaken from the point of view of the

expressway operator.

149. A base set of tolls were assumed based on probably savings for vehicle operators who would otherwise use the existing road. These tolls assumed that a single set of toll charges per kilometer for each vehicle type would apply to the entire new road.
150. The new road will provide a distance saving of around 150 km so there will be considerable fuel saving for each vehicle type ranging from around 250 NRs for a motor cycle to over 3,000 NRs for a heavy truck. Given that there will also be a 4-5 hour time saving then it has been assumed that operators would be willing to travel with a toll that was not more than the actual fuel cost savings. A separate tunnel toll is not proposed nor are weight based tolls considered. Tolls are assumed to be indexed every five years, i.e. their real value is eroded by inflation over the intervening period. At 2008 prices the weighted mean toll is NR20.5 per pcu-km.
151. For the financial evaluation, financial costs and benefits are estimated using a 2008 first quarter constant price base and evaluation period. The toll road operator will be responsible for the operation of interchanges with tolling points on the main line, one service area, tunnel operating and maintenance costs and road maintenance costs.
152. Funding for the project road has not yet been decided by Government or ADB, thus financial projections could only be carried out for assumed financing plans (i) for a mixture of Government equity, ADB loan and domestic and international loans and (ii) for the case of one international loan to finance the whole project. Income tax on profits and a business tax on gross revenue have also been assumed.
153. The results of the financial evaluation for a road built initially to 4 lanes show a financial internal rate of return (FIRR) of 14.47 percent before taxes and 12.9 percent after business taxes and corporate income tax. This is higher than the post-tax weighted average cost of capital (WACC) of 4.5 percent. The FIRR with combined adverse conditions including a rise in construction cost, reduction in traffic, and delay in construction is robust and still well above WACC.
154. Based on either of the financing plans, the financial projections would indicate that the project could be a viable self financing entity. Some Government or donor equity would improve the viability.
155. If the tolls are changed then the revenue changes giving a change in the FIRR. Changing the tolls may also change the amount of traffic willing to travel on the new road, although given the very large reduction in time and distance small changes in tolls will have little effect. Table 4 sets out the results of the analyses for differing toll levels for the four lane alignment. The results show that even at half the base tolls (car toll at NRs 400 and heavy truck at NRs 900) revenues would still well cover the O&M costs but would be insufficient to attract investors or to pay off loans.
156. It is pertinent that at present DOTM set rates by the ton-km. Theoretically, if these rates were enforced, freight operators would be forced to significantly reduce freight costs for goods carried from/to Kathmandu-Pathlaiya if they used the project road. This would deter some operators from using the road. It may be necessary for Government to adjust regulations in this respect.
157. Further details of the financial analysis are set out in **Appendix 15** and Supplementary Appendix 8.

Table 4 Toll Sensitivity FIRR (%)
Four lane road

Multiple of Base Toll	FIRR ^a
0.5	8.78
0.75	10.90
Base Toll	12.91
1.25	14.27
1.5	14.80
2.0	10.31

^a Post all taxes

3. Economic Analysis

158. The economic appraisal covers the same period as the financial appraisal and uses the same 2008 first quarter costs. In all cases the appraisal compares a project case (with the project road) with a without-project do minimum alternative comprising limited investment on the existing route. A 12 percent discount rate is used throughout. In the case of the project road, traffic will, in the without-project case, use the existing national highways, which will become more congested and expensive to maintain as traffic increases. Some travel may not take place because of congestion and the resulting increased travel times and vehicle operating costs (VOCs). With the project, congestion on existing roads will be reduced and traffic on both the project road and the existing roads will benefit from faster, cheaper and safer travel. Some additional trips will be generated as the economy responds to lower transport costs and some will be generated by new development which would not occur without the construction of the project road (e.g. a new international airport at Nijgadh). The project will provide employment opportunities both during and after construction and will remove constraints on economic growth and, with the increased growth, achievement of higher incomes.
159. Expressway benefits to “normal” traffic (i.e. traffic that would have been present in the do minimum case) result from improvements in road and traffic conditions between the do minimum and project case and amount to savings in (i) VOCs, (ii) personal travel time for vehicle occupants (other than drivers and crew, whose costs are included in VOCs), (iii) road accident costs and (iv) the value tied up in freight during transit. In addition there are the benefits of additional trips made solely as a result of the lower costs brought about by the project (“generated” traffic).
160. The project’s EIRR for the four lane road is estimated at 31.1 percent, well above the 12 percent threshold (**Appendix 14** and Supplementary Appendix 7). If upgrading to four lanes is delayed until 2018 the EIRR rises to 35.87 percent. The high EIRR reflects the very high time and distance savings on the project road. Sensitivity analyses confirm the robustness of the economic viability of the road. Changes in the principal variables, e.g. construction costs, traffic growth, benefits, etc) do not have a significant impact on economic viability, and the EIRR remained well above the threshold of 12 percent in all cases. A risk analysis was also carried out to determine the frequency distribution of the project road EIRRs. Each uncertain input (such as cost, traffic growth, accident savings etc) was varied at

random within defined limits. The results of the risk analysis showed that, with these uncertainties, the mean EIRR is 27.7 percent and the probability of the EIRR falling below 12 percent is zero. The economic analysis of the project was extended further to analyze the distribution of project net benefits by determining the project effects for various beneficiaries. Passenger vehicle users will receive the largest share of net benefits, accounting for 56.5 percent of total net benefits.

4. Multi-Criteria Analysis

161. The feasibility study required an analysis of a set of different alignments for the connection between Kathmandu and the Terai. After an initial screening four alignments and the existing road upgrading were selected for analysis. These were subject to feasibility design, economic analysis, and environmental, resettlement and social impact assessment. The data derived from those analyses provided input into the prioritization process to arrive at a recommended alignment.
162. The Goals Achievement method (GAM) was selected to prioritize the different alignment options which produced a weighted multi-criteria GAM Index for each of the alignments reflecting the achievement by the projects of selected criteria relating to technical, economic, development, social, environmental, local capacity and equity which were agreed and finalized at a seminar of various stakeholders from Government, donors and other organizations. Each, criteria was ranked for each alignment; the weightings and rankings were then combined to give an overall index for each alignment alternative
163. The results indicated that Alignment 3A the Bagmati Valley-EW highway built initially to two lane throughout was the most attractive route based on multiple criteria.
164. Further details of the multi-criteria analysis are set out in **Supplementary Appendix 1**.

B. Safeguard Impacts

1. Environmental Impacts

165. The Project was reconfirmed as Category A Project¹⁵ in accordance with the ADB's Environmental Guidelines (2003). An Environmental Impact Assessment will therefore be prepared when the Statutory Report and ToR are approved by MOEST. Scoping has assumed that the assessments will include including detailed ecological and forestry surveys. Whereas it is not possible to survey the whole 112km of the Project about 20 target areas will be chosen for stratified sampling and analysis in the ecological and forestry surveys. The areas chosen for the surveys will be typical of the project area as a whole and also cover the variations of habitat encountered along the current route. The alignment being assessed is the latest available but the alignments of the construction access roads are not yet

¹⁵ Category A projects are deemed by ADB's chief compliance officer to be environmentally sensitive for the purposes of (i) the 120 day rule, and (ii) the environmental management plan requirement could involve projects that are in environmentally sensitive areas.

included. The access roads will also require detailed environmental assessment when their location is known at the detailed design stage. The EIA and Environmental Management Plan (EMP) will need to be updated and supplemented to take account of any detailed design changes in the construction access roads, main alignment and interchanges and to take account of any other amendments; all of which shall be notified and approved by MOEST and ADB. The amendment of the EIA and EMP will be conducted by suitably qualified environmental consultants engaged to support the detailed design team by the DOR or Highways Board Project Management Office (PMO), depending on the management arrangements.

166. Environmental impacts in the construction phase will mainly result from (i) earthworks, blasting pavement works, rock crushing, (ii) aggregate and asphalt plant and bitumen mixing facilities deliveries of construction materials and removal of spoil materials mainly within the ROW; (iii) constructing new and re-provisioning established drainage in village and at other key areas; (iv) constructing 12 long bridges and numerous small causeways across several rivers and streams (v) rehabilitating numerous culverts; (vi) construction and realignment of geotechnical landslip stabilization works; (vii) boulder protection works, (ix) constructing bus and truck stopping areas; (x) providing bioengineering, landscape and accessories (xi) consumption of local resources; (xii) nuisances and impacts from the work force and at work camps; and (xiii) enhancements due to additional compensatory tree planting. These impacts can be successfully mitigated by the measures enforced in the contracts during the detailed design stage to avoid impacts and through inclusion of the EMP in the construction contracts and thorough implementation of the EMP.
167. In the operational stage there should be acceptable air quality in the settlements as the dust levels can be controlled by good road surfacing and regular maintenance. Noise levels should meet international criteria (subject to confirmation). Water impacts will be managed by improving drainage and re-provisioning any irrigation channels on the main alignment, interchanges and the access road. Environmental improvements will also be realized by stabilizing landslides, improving drainage and alignment and better road safety measures and maintenance. Environmental enhancements can be achieved through a thorough approach to the compensatory planting of trees (25:1) and by the any reductions in fuel consumption that can be achieved, which should be significant. Some of these benefits may be recognized forthcoming in the public consultation.
168. The project does not run through any ecologically sensitive or formally protected area where rare, threatened and protected mammalian species are known to congregate. Cattle raising and other human activity have degraded many areas nearest the Project main road alignment. Nevertheless some protected species such as orchids and walnut trees could be disturbed and will require protection and transplantation prior to construction. In addition, further development, widening or realignment of the project at the detailed design or at later stages shall be notified to MOEST and subject to additional environmental assessment in line with statutory requirements.
169. At this stage the construction and operational impacts will be very significant but they can be manageable if sufficient resources are applied to thorough and robust environmental management. If the EMP (which is still in development) is thorough and is carried out to the full, the impacts should not be insurmountable. If the EMP is not implemented to its full extent and if environmental management details are not

disclosed early to the contractors in tenders and included in contracts as mandatory requirements and enforced by DOR/GEU the impacts may be unacceptable. It has been recommended that payment milestones linked to environmental performance.

170. If the alignment is changed or modified at the detailed design stage environmental screening, Rapid Environmental Assessment, amended EIA and EPM and a summary (SEIA) must be prepared and approved by MOEST prior to construction of the Project. DOR/MPPW will be given a chance to modify the Project to reduce the environmental impacts and submit the amended EIA and EMP to MOEST.
171. If the Project still requires further EIA under GoN rules, the potential completion time will be more than one year, which could have significant impacts on program. Suitably qualified consultants should be engaged early to process this work to secure timely approval and avoid delays.

2. Resettlement Impacts

172. The project has been categorized as A from the resettlement perspective hence will entail substantial land acquisition and resettlement. Initial social and resettlement screening was carried out through reconnaissance site visits and assessment for all the probable alternate alignments. Based on these, tentative resettlement impacts for all the alternatives have been assessed. All the alignments will entail land acquisition and resettlement along with some impacts on informal settlers who are encroachers and squatters. The impact calculated at this stage is approximate in nature and will be updated during the full resettlement survey. An Initial Poverty and Social Assessment will also be prepared. A comparison of resettlement impacts for all the probable alternatives was prepared during Phase I studies.

3. Social and Poverty Scenario

173. The focus in transport sector development project includes reducing costs of transport to and from rural areas and between growth centers, and increasing access of the poor to markets, education, health care, and employment. ADB strategically gives preference to the projects located in poorer parts of countries or those that connect poor or isolated areas to the economic mainstream. Concerted efforts are encouraged to find innovative ways of harnessing the potential of transport and communication system so that it enhances, rather than militate against, the human capital and market access of the poor. The most direct effect of transport interventions should be cost savings to users which further leads to lower costs for factors of production and resulting lower cost of production. The impact of these cost savings on the poor will depend on the extent to which the poor are users of the service provided. However, benefits to non-poor users may also contribute indirectly to the welfare of the poor.
174. Poverty is quite pervasive in Nepal which shows that around 31% of the people live below the poverty line (Poverty Line = Rs.7696/- per capita per year in 2003 price). There is wide diversity in the socio-economic condition in the project affected areas of the proposed project road alignment. The alignment passes through four districts – Kathmandu, Lalitpur, Makwanpur and Bara. A large portion of the proposed alignment passes through very sparsely populated areas. The scale of poverty seems to be high. People depend mainly in subsistence farming. Table 5

describes briefly the socio economic and poverty scenario of the likely project affected districts.

Table 5. Poverty Scenario of the Project Affected Area

Districts covered by road alignments	Population January 2007	Population below poverty Line (%)	Life expectancy at birth	Adult Literacy	
				Male	Female
Nepal	26531531	31	60.98	34.9	62.7
Kathmandu- Pathlaiya Road via Nijgadh					
Kathmandu	1,299,296	4.4	69.53	60.1	84.9
Makwanpur	449,924	43	55.75	45.5	70.2
Bara	667,607	26.9	60.72	21.3	51

Poverty Line = 7696 NRs per capita per year in 2003 price.

175. The proposed project will bring both direct and indirect positive impacts to the area. Although, development in transport sector provides some direct employment opportunities during the construction phase, however, it contributes more indirectly. The provision of transport services, including the construction and maintenance of transport infrastructure, generates demand for labor (often unskilled labor) and provides income-earning opportunities for the poor. If a transport project generates jobs for the poor who are otherwise unemployed or under-employed, it contributes to the reduction of poverty. In many developing countries, the construction aspect of transport sector development is often viewed equally as important as the service aspect of the sector in promoting economic growth. The process of poverty reduction is embedded in a broad range of socio-economic activities to which transport services provide intermediate inputs.
176. There will be both short term and long term positive impacts of the proposed Project. The short term positive impacts include, access to markets for agricultural produce; access to the villages by government health officials and service providers; availability of temporary unskilled jobs for villagers; and opportunity to provide food and restaurant services for construction workers. On the other hand, the long term positive impacts include, access to long distance transport services (mobility from India to China TAR); access to long distance markets (buying and selling through regional trade); easier access to health facilities and medical treatment; increased access to agricultural extension services, including veterinary services for livestock; increased access to education; increased opportunity for the development of tourism; and diversification of income sources. Poverty analysis and social assessment will help in identifying both qualitative and quantitative benefits of the project as major cause of poverty reduction in the project area.

4. Indigenous People

177. There is significant presence of indigenous people (IP) in the districts covered by

the road alignments as well as in the project affected areas. IPs (called mainly Janajatis or Nationalities in Nepal) constitute about 37.2 % (8.4 million) of Nepal's total population. Government has declared 61 (later reduced to 59) groups as Janajatis¹⁶. Given the wide variation in the socio-economic and political conditions of the IPs in Nepal, they have also been categorized into 5 main groups. Some of the IP groups' socio-economic conditions are more advanced than the mainstream population, and it was a reason for categorization based on socio-economic condition. According to this classification there are 10 'endangered groups', 12 'highly marginalized groups', 20 'marginalized groups', 15 'disadvantaged groups', and 2 'advanced groups'.

178. Screening revealed that that there are no IPs belonging to endangered and highly marginalized groups in the project area. The main IPs present in the road corridor are: Newars, Tamangs, and Tharus. Due to migration of IPs, there are also other groups present in the project area. The IPs in the project area are not alienated from the other groups, rather they are mainstreamed with the general population and share socio-cultural and linguistic ties with the mainstream people. It is evident that there will not be any adverse impact on IPs in terms of threat to their way of life even though a few of them may lose a part of their land and structures. Benefits will accrue evenly to all sections of the population regardless of group. On the other hand, IPs will benefit from the road project. Therefore, the project has been categorized as C as far as IP issues are concerned. In case of any adverse impacts on IPS, adequate mitigation measures should be provided in the resettlement plan.

5. Gender

179. Women's socio-economic condition in the project area is worse in comparison to their male counter parts. This is, in a way, a general situation in Nepal. Women in the region are largely involved in household work, cultivation and other agricultural activities. Women's literacy rate in the project districts is less as compared to that of the male. There are also other kinds of discriminations in that women bear a heavy burden of farm work. Agriculture is now totally dependent on women as male undertake both seasonal and temporary migration. Wage rates are said to be low for women. Alcoholism in males was also said to adversely affect women and children. Because of these entrenched gender discriminations there are possibilities that women could also be adversely affected if proper measures are not taken during the project. They need to be protected and proper measures need to be taken. Therefore, gender participation should be ensured during the project preparation and efforts should be made to see how the project would impact women positively. It is evident that availability of better roads and safe connectivity with better transport services will benefit the women of the area. Their mobility will be augmented both in terms of access to social services, higher levels of schooling

¹⁶ The detail characteristics of Janajatis as defined are: distinct collective identity; own language (other than Nepali), religion, tradition, culture and civilization; own traditional egalitarian social structure (which is distinct from mainstream *varna* or caste system); traditional homeland and geographical area; written or oral history that traces their line of descent back to the occupants of the territories before their annexation to the present Nepali frontiers; having 'we' feeling; has had no decisive role in the politics and government of modern Nepal; who are the indigenous or the native people of Nepal; and, who declares itself as 'Janajati'.

and better health facility etc. Additionally, during the project implementation, efforts should be made by the project authority so that women will receive preferential treatment for employment in the civil works with proper safeguards for the safety of their health. The Executing Agency should ensure that affected women are consulted and invited to participate in group based activities in order to enable them to gain access and control over resources. Further, during RP implementation, NGOs should ensure that affected women should receive adequate compensation and assistance.

6. HIV/ AIDS Issues

180. Human trafficking and HIV/AIDS problems are fast growing and a major problem in the highways especially in Indo-Nepal and Indo-China cross-border areas. The community people in the alignment area are not well aware of existence of HIV/AIDS in their communities since the road passes through mostly village and forest area. The risks associated with the improved highway network, such as increased incidence of HIV/AIDS and human trafficking, should be mitigated by raising awareness among high-risk and other vulnerable groups. There should be an awareness program on HIV/AIDS and the key areas of activities should include orientation and sensitization of project personnel on HIV/AIDS; raising awareness of HIV/AIDS among contractors and construction workers by distributing referral information and condoms; by launching public awareness campaign to change the behavior of high-risk groups, using the media, information, education, and communication materials; visiting high-risk groups (e.g., truck drivers and helpers, sex workers, road-side construction workers at key spots (road-side restaurants, brothels, rest areas, hospitals, and clinics) and change their behavior providing information on the nearest services for testing, counseling, and treatment.

C. Project Risks

181. The Project is being carefully formulated to mitigate risks, however the construction of the project road will be in difficult terrain and operation of the road will require new techniques. Possible risks are set out below.

1. Construction Risks

182. The project is being designed to reduce potential technical, economic, financial and social risks. The main technical risks are associated with the design and construction of the large bridges and tunnel and the risk of land slips and slope failures in unstable terrain. To minimize risks, international consultants have reviewed the preliminary design of tunnels and major bridges and specialists should also be included in the consulting services to review detail design of the bridges and the design and construction methodology of the tunnels. There is still a risk however, that further detail geological investigation will reveal adverse geological conditions which may increase cost and/or change the alignment.
183. Generally these risks have initially been minimized by geological and topographical investigation during preliminary design and will be further investigated during detail design. This has included drilling and other geological investigation at tunnel and major bridge sites.
184. Tunneling is an underground activity where complete geotechnical conditions generally are not foreseen at the design stage. Unanticipated changes in underground conditions during implementation often lead to changes in cost and construction schedules.

185. The stability of the excavated faces generally depends on the quality of rock mass and influence of groundwater. With high overburden, rock bursts can occur. In limestone areas, caverns, occasionally holding groundwater, can be encountered. In specific ground where folding develops in younger shale deposits, emission of gases can cause serious difficulty in tunneling.
186. Even without these risks, misjudgment of rock mass and quality can lead to cost and time overruns unless extensive testing is carried out during detail design.
187. The alignment goes through areas of steep rock slopes where there is a risk of landslides both during construction and later during the operation period. Testing and careful inspection has been carried out and the alignment relocated where necessary. This has meant in places the use of high bridges, which has increased the project cost.
188. There have been some problems on expressways in other developing countries with early pavement damage from overloaded vehicles. This overloading is also prevalent on Nepal roads and enforcement is lax. The preliminary pavement design has taken account of some overloading. To further minimize risk weigh bridges at each toll plaza have been included in the design and cost estimate to allow strict enforcement of overweight vehicles.
189. To minimize construction risks the prequalification of contractors should focus on their financial and technical capabilities in handling similar works. During the construction period, monitoring and contract management information systems should be set up and implemented, with the assistance of international supervision consultants, for timely identification of technical problems and implementation of corrective measures.
190. The implementation of the road will require substantial land acquisition and resettlement. On some recent infrastructure projects in Nepal delays in completing resettlement has led to delays in project implementation.

2. Operation Risks

191. To minimize operation risks it will be important to have a fully trained operation organization for both tunnel and toll systems and to establish a good monitoring and information system including advance variable message warning signs. A dedicated traffic police unit is also desirable for the new road.
192. The financial risk associated with the construction and operation of the project road will depend on the actual level and composition of traffic, the construction costs, the ability of the commercial management, and the tolls charged. Traffic volumes on toll roads in neighboring countries have been low in the early years of operation leading to financial returns less than expected. Forecasts in the PPTA allowed for this by ramping down traffic forecasts in the first years of operation. To control the financial risks, it has been recommended that Government create a commercial business environment for toll road operations.
193. Social risks have been identified and appropriate mitigation measures will be recommended in the Resettlement Plan and the EMDP. These will be discussed further in those plans.
194. A major risk of delay to the project lies with the transitional stage of Nepal's political situation at present. It is hoped that this risk will be minimized now that successful elections have been completed. In particular Government decisions,

involving new legislation, will be required to set in place the organizational structure to successfully implement and operate the project road.

DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Indicators/Targets	Monitoring Mechanism	Assumptions And Risks
<p>Impact</p> <p>Sustainable economic growth and poverty reduction in Nepal and the project area</p>	<p>Gross domestic product (GDP) are forecast to increase per annum during 2010-2020 at 4% to 5%</p> <p>Per capita rural income in Project area will increase from NRs 7,400 in 2007 by 5% p.a. to 2016.</p> <p>Poverty incidence in the Project area will be reduced from 33% in 2007 to 25% in 2016</p>	<p>Nepali Statistic Yearbook</p> <p>District and National Statistic Data</p> <p>Statistics offices at national and district level. Poverty Alleviation and Development Offices</p>	<p>Assumptions</p> <p>Political situation stabilizes</p> <p>Infrastructure investment implemented as planned</p> <p>Complementary activities are implemented</p>
<p>Promote cross-border trade with India and China</p>	<p>Value of trade through Birgunj (India) and Tatopani (TAR China) to increase by a minimum of 7% p.a. for 10 years</p>	<p>Statistics compiled by custom border trade officials</p>	<p>Assumptions</p> <p>Nepal/India improves conditions hindering border trade; Road improvements in TAR and India leading to border proceed as planned</p>
<p>Outcome</p> <p>An efficient, safe, reliable, and environmentally sustainable road transport system developed in the project area</p>	<p>Traffic volume for the North South Fast Track road to be 10,000 passenger car units (pcu) in 2014, rising to 21,000 pcu in 2024 and 38,000 pcu in 2034</p> <p>Travel time for the Kathmandu to Pathlaiya trip reduced from 6 hours before project to less than 2 hours after project</p>	<p>Collection of actual traffic data on the new road through auto-monitoring system by the road operator at toll gates.</p> <p>Traffic counts and travel time survey for the new road and existing roads by operator and DoR</p>	<p>Assumptions</p> <p>Assumed economic growth rates of over 4% p.a. continue.</p> <p>Transport operators and drivers realize the benefits of using the new road.</p> <p>Kathmandu outer Ring Road complete by 2014</p>

2 Appendix 1

Design Summary	Performance Indicators/Targets	Monitoring Mechanism	Assumptions And Risks
	<p>Travel distance is reduced by 150 km from Kathmandu to Indian border after the Project.</p> <p>The road accident rate is reduced from 0.7 per million pcu-km on the existing roads to 0.35 on the project road by 2016</p> <p>An estimated saving of 38 million liters of petrol over a 20-years projection period, and a marked improvement in air quality along the exiting roads.</p>	<p>Project Completion Report</p> <p>.Accident statistics from the Nepal Police HQ and DoR</p> <p>Measurements by MoPE.</p>	<p>GoN demonstrates the capacity to implement the Project</p> <p>The project road safety audit and program is effectively implemented</p>
<p>The rural poor will have improved income-earning opportunities and social activities</p>	<p>Reduced bus fares and freight rates on project road by 10% by 2016.</p> <p>The percentage of transport expenses of total expenses increases from an average of 9.1% in 2007 to 12% in 2017 in the project area.</p> <p>Income from non-farm sector increases from 15% of total income in 2007 to 30% by 2017</p> <p>The number of international tourists to Nepal increase from 0.5 million in 2007 to one</p>	<p>Monitoring of fares and rates by DOT</p> <p>Household survey by consultants</p> <p>Household survey by consultants</p> <p>Statistics from Ministry of Tourism and Civil Aviation</p>	<p>Operating cost savings realized by commercial vehicle operators are passed on to road users</p> <p>Transport services improve shortly thereafter the improvement of road access</p>

Design Summary	Performance Indicators/Targets	Monitoring Mechanism	Assumptions And Risks
	million by 2017		
Road transport services improve in productivity, availability & affordability	<p>Bus network coverage, service & frequency between Kathmandu and the project area increases</p> <p>Freight Transport rates initially lowered and then rise by less than the Nepal CPI for 5 years</p>	<p>Number of licensed bus routes and frequency, from RTA</p> <p>Actual rates charged for freight between Kathmandu and Hetauda and Birgunj</p>	<p>Risks</p> <p>Transport administration officials fail to permit additional route licenses.</p>
<p>Outputs</p> <p>1. Road infrastructure and associated equipment and facilities improved in the Kathmandu-EW highway corridor</p>	<p>Road capacity between Kathmandu and E-W Highway increased to 25,000 pcu per day at opening in 2014 by building a 76-km high class road with a connection to Hetauda</p> <p>Vehicle operating costs in 2014 for a car reduced from a total of NR 11,512 on the existing roads between Kathmandu and Pathlaiya to NR 1,940 on the project road</p> <p>Safety audits implemented during design and construction.</p> <p>Equipment procured and installed, toll collection, communications, traffic management and vehicle weigh bridges.</p> <p>Welfare of those affected</p>	<p>Project Completion Report (PCR)</p> <p>Direct measure of vehicle operating costs by DoR</p> <p>Progress Reports (PRs) and PCR.</p> <p>PAM, PRs and PCR</p> <p>Regular monitoring by an independent institute</p>	<p>Risk</p> <p>Construction of tunnel and high bridges may be delayed because of lack of expertise in Nepal</p> <p>Assumption :</p> <p>Recommendations of the safety audits are implemented by DoR or road operator.</p> <p>.</p> <p>Assumption</p> <p>Economic conditions continue</p>

4 Appendix 1

Design Summary	Performance Indicators/Targets	Monitoring Mechanism	Assumptions And Risks
<p>2. Corporate governance promoted in toll road operations in Nepal.</p> <p>3. Private sector participation encouraged in the project road</p> <p>4. DoR and domestic consultant capacity strengthened in tunnel design/construction, asset management, , toll road operations and</p>	<p>by land acquisition and resettlement are re-established to at least the same level as before land acquisition</p> <p>Poor and minority households are better off</p> <p>Environment at the project site protected and adverse environmental impacts minimized by implementing mitigation measures</p> <p>The welfare of minorities protected and the Project's adverse impacts minimized</p> <p>Control of HIV/AIDS and health risks for construction workers and service providers</p> <p>Autonomous toll road operator established with clear financial goals and separate financial reporting.</p> <p>BOT or operation and maintenance concession awarded</p> <p>60 person months of international training will be provided for DoR/MPPW staff.</p> <p>On-the-job training of domestic consultants will</p>	<p>engaged by DoR or RMC during resettlement implementation, at completion and 2 years after</p> <p>Village Surveys</p> <p>Environmental monitoring reports, PAMs, and PCR</p> <p>PAM, and PCR</p> <p>Review Missions</p> <p>Midterm review missions and PCRs.</p> <p>PCRs</p> <p>A report by international consultants on the capacity building component.</p>	<p>to improve which enables APs to restore their living standards and vulnerable groups to improve their living standards</p> <p>Commitment of DoR supervision consultants, road operators and contractors to implementation of mitigation measures</p> <p>Assumption</p> <p>Government approval will be given in a timely manner.</p> <p>Risk</p> <p>Few private firms are interested in toll road operations in Nepal.</p> <p>Assumption</p> <p>Consultants are recruited in a timely fashion and perform well in providing training to DoR.</p> <p>Trainees apply what they have</p>

Design Summary	Performance Indicators/Targets	Monitoring Mechanism	Assumptions And Risks
<p>commercialization.</p> <p>5. Asset Management. Upgrading of operations, maintenance and management systems.</p>	<p>be provided by the international consultants.</p> <p>Implementation of a 'whole life' asset management plan for the project road by expressway company including asset management training</p>	<p>PCRs.</p> <p>Annual road condition reports by expressway company</p>	<p>learned.</p> <p>Assumption</p> <p>Commitment by DoR and road operator to implement plan and training.</p>
<p>Activities with Milestones</p> <p>1. Implementing and supervising road works.</p> <p>2. Installing Equipment</p> <p>3. Implementing Resettlement Plan</p> <p>4. Establishing a road maintenance management system</p> <p>5. Providing Consulting and training services</p>		<p>Civil works contracts or concession awarded by February 2010 and completed by February 2014.</p> <p>Equipment procured by December 2012.</p> <p>Resettlement completed by February 2010.</p> <p>An action plan prepared by December 2010</p> <p>Design Consultants recruited by August 2008 and supervision consultants by March 2010 and completed by February 2010 and March 2014 respectively.</p>	<p>Funding to be decided</p>

Sector Analysis

A. Sector Profile

1. Nepal's transport infrastructure consists mainly of roads and civil aviation. Roads carry about 90% of all passengers and freight within the country. A key part of Nepal's road system is the 7,917 km Strategic Road Network (SRN). The national highways consist of the East-West Highway (EWH) and north-south highways linking major towns that serve much of the population. The EWH goes from Gaddachauki at the west border with India, to Kakarbhitta at the east border with India, runs the length of the country in the Terai, and is connected through north-south links to Kathmandu. Sections of the Tribhuvan highway are also vital, they provide north south connections to the network from Birgunj at the southern border with India, the country's most important trade border, to Kathmandu.
2. Although road transport is the dominant mode in the transport sector for moving passenger and freight traffic in Nepal, road density is low at 0.12 km of road per km² and 0.7 km per 1,000 population and is less than that in neighboring countries¹. This is mainly due to the nation's complex topography and insufficient resources, resulting in a lack of road access for about 4 million Nepalese. This problem is particularly acute in remote areas and is a contributing factor to rural poverty.

1. Transport Planning and Coordination

3. The National Planning Commission sets overall development objectives and coordinates the investment programs of external agencies and individual government agencies. The Ministry of Physical Planning and Works (MPPW) has prime responsibility for planning, formulating policies, and managing all land transport facilities, including roads and bridges. The Ministry of Local Development is responsible for district roads.
4. Within MPPW, DoR is responsible for network planning, design, construction, and maintenance of the country's strategic road network; and municipalities are responsible for urban roads. The Department of Transport Management (DoTM) within the Ministry of Labor and Transport Management, is responsible for regulating road transport, including vehicle registration and licensing. The Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR), within the Ministry of Local Development (MoLD), is responsible for coordinating and facilitating the rural infrastructure development process throughout the country and for providing technical guidance and support at the local level.
5. DoR is headed by a director general who is assisted by deputy directors general in charge of DoR's various administrative and technical branches. Administration of ADB-financed road projects is carried out by a DoR division, the Project Directorate (ADB), headed by a project director. Currently, DoR has 268 engineers, 261 overseers, and 1,862 technical and administrative support staff.
6. Substantial efforts have been under way through partnerships between the Government and various external funding agencies, as part of ongoing projects, to

¹ India 0.9 km/ sq.km, Bangladesh 1.5km/ sq.km

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help DoR improve its road management capacity, planning and monitoring capability, and environmental and traffic safety practices. The results are encouraging, especially for improvements in planning and implementation. DoR has been able to develop and improve its basic capabilities to better manage the road capital and resources allocated to the sector. However additional support is still needed in these areas as well as for strengthening DoR's maintenance capability. The construction of the Project Road, with the 1.3km road tunnel will require new skills in operation and management, although it is suggested (Appendix 13) that this should be the responsibility of a new corporatized Road Management Company.

7. The Ministry of Finance through the Roads Board Nepal (RBN) and DoR provides funds for the maintenance of SRN. Whilst DoR is the sole implementing agency for SRN, since the establishment of the RBN in December 2002, RBN approves the annual road maintenance plan of DoR and controls the budget out of the funds it receives. DoR remains the planning and implementation agency for maintenance and uses other funds, such as direct allocation by HMGN and through projects funded by ADB and WB.

2. Road Network and Traffic

8. The National Road Network is made up of National Highways, Feeder Roads, Urban Roads, District Roads and Village Roads. The National Highways together with the Feeder Roads form the Strategic Road Network (SRN) of the country. The Strategic Road Network is the backbone of the National Road Network. The construction and maintenance of the Strategic Roads is the responsibility of the Department of Roads. District Roads, together with Village Roads, forms the District Road Network. As at 2006, the National Road Network had a total of 17,782 km roads, comprising 4,545 (25 percent) National Highways, 3,372 (19 percent) Feeder Roads, 2,260 km (13 percent) Urban Roads and 7,650 km (43 percent) District Roads.
9. Although the SRN makes up 44 percent of the National Road Network, it plays the most important role in movement of men and materials. The Strategic Roads have high traffic volumes in comparison to District Roads. Traffic studies carried out during the project indicate that the existing road will reach capacity in the next 3-5 years. It is estimated that by the time the project road is completed, it will carry about over 10,000 passenger car units (pcu). At present the Strategic Road Network consists of 15 National Highways and 51 Feeder Roads.
10. Feeder Roads form the major connections from the strategic National Highways to the district headquarters. There are, however, still 12 district headquarters with no road connection and a further 14 linked only with fair weather dirt roads or tracks.
11. About 31 percent of the road network remains unpaved and much remains impassable during the wet season.
12. Initiatives that have achieved success in rural (district, local) road development are the "green roads" funded by Deutsch Gesellschaft für Technische Zusammenarbeit (GTZ) and "food for work" funded by Swiss Development Corporation (SDC). The Rural Access Programme (RAP), funded by DFID, also provides a similar approach. Using a participatory planning process, those projects aim to improve access of rural communities by improving the mobility of rural people through low cost roads, tracks, trails, and footbridges which connect to the

district network. At the same time, those projects have provided employment opportunities to the rural communities. A key theme in the process is an environment- friendly and labor-based construction approach.

3. Vehicle Fleet

13. The registered motor vehicle fleet in 2006 comprised 528,570 units: 84,464 cars, jeeps, and vans; 14,859 buses, 6,685 mini and micro buses, 29,992 trucks and tankers, 33,865 tractors, 347,452 motorcycles and 11,323, tempos, and others. This represents an increase of nearly 100 percent since 2000; an average annual growth rate of about 12 percent, with the highest growth in motorcycles. About 49 percent of these vehicles are registered in the Bagmati Zone which includes Kathmandu. Except around Kathmandu, where cars are common, traffic is still dominated by buses and trucks, and, increasingly, motorcycles.
14. An important feature of road transport within Nepal is the relatively low traffic volume on most roads. Outside the Kathmandu Valley, the highest volumes are up to 6,000 vehicles per day (vpd) on the main route to the Indian border. On key links in the Terai, however, volumes are 500-2,000 vpd, with flows of 100-300 vpd on the main hill roads. Roads at the extremities of the network may have traffic volumes of less than 25 vpd.
15. The vehicle fleet, especially the truck fleet, is aging and often underpowered. This leads to congestion and delays to other traffic, as well as heavy vehicle emissions. It is important that the design of the Project Road takes into account the fleet composition and age.

4. Road Transport Services

a. Road Passenger Services

16. Except for one company operating out of Kathmandu all operators of road passenger services are privately owned. The bus transport industry is regulated by Department of Transport Management (DoTM) at all levels. All bus operators need to be registered, either as an individual or as a company. Buses owned by both individuals and companies are checked every 6 months for road worthiness. Tourist buses are registered separately and are limited to carrying only tourists, although this is in fact not strictly adhered to. In 2006 there were 14,859 and 4,919 registered buses and mini-buses respectively.
17. There is some franchising of buses but more often a single bus may have more than one owner, typically, however two buses per owner is the norm.
18. For all weather standard roads, DoTM designates the bus routes using that road and issues route permits to use the route. There are no conditions on these route permits; whilst DoTM controls the number of operators on each route it carries out no scheduling. This has led to an over-supply of buses using some routes to the extent that the number and schedule of trips per day carried out by each operator is controlled through operator associations or syndicates.
19. Maximum fares for a particular route are set by DoTM on a route basis and take account of road pavement type and existing peak bus loadings. Changes in bus fares are not responsive to changes in operating conditions.

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20. Bus fares are clearly related to road and terrain conditions. If roads are allowed to deteriorate, bus fares will likely increase, and conversely, if roads are improved or new road links added, fares will likely reduce. A general relationship between terrain and road condition and bus and freight charges applies.
21. There is a network of bus routes connecting almost all the towns and district centers in the Project area, which provide services to most of the villages on the routes. Nevertheless, many villages with poor or no road access still have no direct bus service. On the poorer roads pickups or trucks often provide an informal bus service. Popular on the low standard gravel road connections from Kathmandu to Hetauda in the Project area are 4 wheel drive vehicles which carry up to 8 passengers and serve villages along the route. There are also medium and large size bus services from Kathmandu to Hetauda and beyond to Birgunj along the existing highway in addition to services to major towns along the route. Typical fares for the major bus routes in the project area are 1.11 NRs per km between Kathmandu and the Indian border and 1.33 NRs per km between Kathmandu and Hetauda, while the jeeps trip between Kathmandu to Hetauda on unsealed roads is 3.7 NR/km.
22. There appears to be little barrier to market entry. Loans are readily available, although vehicle costs are relatively high and all engines and chassis are imported from India with substantial duties and taxes.
23. Proposals for new services come from the operators or VDCs, and DoTM makes no attempt to provide overall planning for the route network. DoTM does not keep records of annual bus kilometers, or of operator revenues, so no assessment of profitability can be made, however bus operators report that their businesses are barely profitable because of the oversupply of operators and the recent significant rise in fuel cost, which has not yet been reflected in any fare increases.

b. Road Freight Services

24. Commercial vehicles must be licensed by DoTM to operate in a commercial trucking operation. Route permits for freight traffic are of two types, one for a specific route and the other for all over the country. All route permits must be renewed every four months. DoTM also approves maximum freight rates.
25. The road freight transport industry, which carries over 90 percent of freight traffic, is dominated by private operators who are mostly owner-drivers. Most of these operators are members of transport associations, although there are a growing number of independent operators. Shippers usually contact the associations who allocate trips for their members. The independent operators also compete for loads and tend to keep the market competitive.
26. A general relationship between terrain and road condition and freight charges applies. Freight rates reflect the condition of the road and imply rates on the unpaved sections of road in hilly or mountainous terrain of NRs 15-25 per ton-km, compared with around NRs 3-6 per ton-km on the paved sections in flat terrain. Although there is stronger control over freight by truck owners' associations in the east and central regions, the general link between road condition and freight rates, which has underpinned the increase in trade volume, is seen in all areas.
27. Typical fares for the major freight routes in the project area are 4.5 NRs per ton-km between Kathmandu and the Indian border and 4.98 NRs/ton-km between

- Kathmandu and Hetauda. Given that the Project road will reduce the distance by about 150km then some other method of determining freight rates other than on a kilometer basis must be devised for the Project road so as not to deter truck traffic from the road.
28. The majority of trade exported from and imported into Nepal is carried by truck transport, of this 50 percent of all trade with India and other bilateral trade crosses at the Birgunj crossing point. It can be assumed that most of this would use the Project road.
 29. DoTM traditionally seems to have concentrated on revenue collection rather than transport management. Budget provisions, organizational structure and annual work plans of DoTM are not oriented towards research, studies, analysis of routes, vehicle composition, vehicle weight, traffic signs, speed limits, route fare, and clean energy vehicles. DoTM is part of the Ministry of Labor and Transport Management and it would appear that the area of Labor reform still dominates the work of the Ministry to the detriment of transport management.
 30. This lack of management of the transport sub-sector is effecting the efficient operation of both passenger and freight transport, with oversupply on many routes and lack of competition on others. Whilst in general, market forces do provide competition, a more structured management of the sector is required. This will become more important with the introduction of a new high class connection to the Terai.
 31. According to the existing Vehicle Transport Management Act 1992, DOTM is responsible for control of checking overweight vehicles. The Road Board Act 2002, however, permits RBN use of the road-funds for enforcement of excess axle-loading. To date, DOTM has not conducted axle-load checks despite significant overloading on the national highways. According to DOR 2004 data, 49 percent of medium and large trucks and 13 percent of small-trucks on national highways exceed legal axle-loads.

5. Government's Sector Plan

32. Since the 1970s, the Government's main objective in the road sub-sector has been the completion of SRN as well as integrating the country. Improved access and reduced transport costs are expected to stimulate economic development, particularly in agriculture. This will help reduce regional disparities.
33. The main objectives of the Tenth Plan (2002-07) in the road sub-sector were to develop and manage the road transport network to support the socio-economic development efforts and to promote private sector participation in the construction of new road networks and their maintenance. The major strategies to be adopted in this regard include increased participation of the private sector in road construction and maintenance, enhancing institutional capacities of both the Department of Roads and the private sector to ensure cost effective sustainability of the road network, and transferring to DDCs the responsibility for rural roads.
34. To encourage increased private involvement in the road sub-sector, legislation has been enacted for the implementation of BOT and BOOT policies. A framework is being established for improved road maintenance; the Roads Board Nepal is fully operational and financed by a fuel levy, vehicle taxes and toll revenue. Measures to build capacities of the Department of Roads and the private sector are being

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- undertaken. At the end of the Plan period, 1,025 km of additional road are planned. An additional ten district headquarters are to be connected by road, taking the number of District HQs having road connections to 70. Private sector will increasingly participate in the construction and maintenance of roads.
35. The National Transport Policy document was approved in 2002. The policy introduced a major institutional change, the establishment of a Road Transport Authority by merging DoR and DoTM, in order to make the road transport sector self-governing and self-reliant, however, as yet no time frame has been nominated. In addition, a long term road development master plan was prepared covering the Tenth to Thirteenth Plan periods.
36. A Three Year Interim Plan (TYIP) for 2007/08 to 2009/10 was approved by the Government in 2007. The TYIP places emphasis on reconstruction and infrastructure delivery to address the country's development aims and to help people attain appreciable changes in their livelihood. The three year plan aims to connect all the remaining 12 district headquarters by road in addition to upgrading and carrying out periodic maintenance of about 4,000 km of strategic roads. It envisages construction of more than 600 km of new roads and upgrading of more than 2,300 km of existing roads every year of the TYIP period (Table A2.1).
37. The progress during the three year plan needs to show at least 70 percent improvement over that of the 10th plan period because the quantitative targets of the TYIP are equal to or even more than that of the 10th five year Plan period.

6. Maintenance

38. The RMP includes for the first time a long-term plan for road maintenance including periodic, rehabilitation and upgrading. It was estimated that about NRs 3 billion (\$40 million) would be required each year for road maintenance, including periodic, rehabilitation, reconstruction and upgrading; about 50 percent of the requirement was expected to come in the short term from donor funding.
39. The Ministry of Finance through the Roads Board Nepal (RBN) and DoR provides funds for the maintenance of the SRN. RBN was established as an autonomous body in 2003 in order to manage the collection and expenditure of revenue for repair and maintenance of all road networks in Nepal. The first Executive Director was appointed in 16th November 2003, accordingly, the Board has only four full years of operation.
40. The RBN formulates an integrated annual maintenance plan every year on the basis of an annual maintenance plan prepared by DoR and DoLIDAR, and allocates budget to them who then implement maintenance works for roads under their jurisdiction.
41. The RBN funding is sourced mainly from fuel levies (50.6%), vehicle registration fees (37.4%), and tolls (12.0%). These are used to maintain all roads. DoR has the mandate to provide for routine, recurrent, emergency, and periodic maintenance for all SRN roads. Total allocated budget for RBN in FY 2007/08 was NRs 907 million a rise of over 80 percent over 2006/07. However, under-funding of road maintenance is expected to continue for the next 4-5 years until the fund revenue substantially expands due to increased economic activities or a change in its mandate. Until then, the Government has to provide budget support for SRN

and other road maintenance directly through DoR and DoLiDAR and through donor grants.

42. The Government has given priority to routine and recurrent road maintenance of SRN over recent years. Three roads in Nepal are tolled. At least 70% of the tolls will be exclusively used for routine and recurrent maintenance of tolled roads. Tolling has to be approved by the Government through RBN.
43. The transport sector is analyzed in more detail in **Supplementary Appendix 4**.

Table A2.1 Roads Sector Policy Reform Plan, Three Year Interim Plan 2008-10

Initiative	Program	Activities
<p><u>Poverty Impact</u></p> <p>Connection of district headquarters.</p> <p>Improve accessibility of highly populated settlements in Terai and hills with administrative, industrial and trade centers.</p> <p>Expansion of mid hill east west highway and Improvement of rural people's access to transport services</p> <p>Employment and income generating opportunities to rural people will be increased by improving access to facilities and services through the development of local infrastructures.</p>	<ul style="list-style-type: none"> • New roads will be constructed to connect 12 remaining district headquarters with the strategic road network and those already constructed roads will be upgraded. • Priority will be given to the constructions of bridges in already built roads and in those roads under construction. • East West Postal road in the Terai and north south roads connecting East West highway with major cities, towns and customs posts will be upgraded. • Construction and maintenance of roads connecting important hydropower, irrigation, tourism etc projects with strategic road network will be jointly implemented with the projects. • Construction, improvement and upgrading of feeder and district roads will be continued for gradual development and expansion of mid hill east west highway. • Expansion and required maintenance of local road network will be carried out according to the Priority Investment Plan • Only projects prioritized by District Transport Master Plan (DTMP) will be implemented 	<ul style="list-style-type: none"> • New road construction projects to link district head quarters. • Projects for upgrading existing roads connecting district head quarters. • Terai Road Construction Projects • Road upgrading programs under the Road Connectivity Sector I Project. (ADB TA-4247). • Road upgrading programs under the Road Sector Development Project. (the World Bank). • Road upgrading programs under the Road Network Development Project. (ADB Loan 1876, Grant 3785). • Mid Hill Highway Construction Project. • Central Level Prioritised Road Construction Projects. • Bridge Construction Projects • Decentralised Rural Infrastructure and Livelihood Program (DRILP). (ADB Loan 2092) • Rural Access Improvement and Decentralisation Project

		<p>(RAIDP). (World Bank)</p> <ul style="list-style-type: none"> • Rural Access Program (RAP). (DFID) • District Road Support Program (DRSP). (SDC -Swiss) • Road repair and maintenance program of RBN. • Establishment of Rural Road Maintenance Fund
<p><u>Regional Trade Linkages</u></p> <p>Expansion of transport linkages with India and PRC. Enhanced capacity of inland customs depot.</p>	<ul style="list-style-type: none"> • In the process of road network developments in the South Asian Region, Mahendra Highway will be developed as the Asian Highway and Regional Trade Route. • Besides recently identified north south trade and transit routes, important other new routes from northern Himalayan region of the country to the border markets in the Tibet Autonomous Region of PRC will be identified and roads will be constructed. 	<ul style="list-style-type: none"> • Galchhi-Trishuli-Syaprubeshi Road Construction Project (ADB Grant 0051). • Preliminary Design of Kathmandu-Terai Fast Track Road (ADB TA 4842-NEP). • Tanakpur Link Road Construction Project. (India) • Road construction projects under Sub-regional Transport Facilitation Project (ADB Loan 2097). • Makali Highway (Darchula-Tinker section) Construction Projects. (India)
<p><u>Urban Development</u></p> <p>Expansion of transport facilities and services in Kathmandu Valley and other parts of Nepal.</p>	<ul style="list-style-type: none"> • To provide for rapid urbanization in Kathmandu road networks will be constructed/improved which provide for easy to manage, safe, environmental friendly and frictionless transport services. • Legislation will be passed and implemented to allow for proper management of road construction in the urban areas. • Arrangements will be made to locate infrastructures such as sewage, water supply, telephone, electricity etc at the side of road RoW. 	<ul style="list-style-type: none"> • B P Koirala Road (Sindhuli-Bardibas) Construction Project (JICA) • Kathmandu Urban Road Development Project (JICA)

	<ul style="list-style-type: none"> • Development of disabled friendly road infrastructures will be continued. 	
<p><u>Asset Management</u></p> <p>Transport facilities will be improved for safer and reliable services through the protection of road assets.</p>	<ul style="list-style-type: none"> • Statistical management system will be improved to allow for regular management of road assets. • National level Road Statistics Management System based on GIS will be established and operated by integrating statistics of strategic and local road networks. • Periodic repair and maintenance plan for road networks will be prepared and implemented. • Road repair and maintenance fund collection will be strengthened by the identification and integration of financial resources. • Responsibilities of operation and maintenance of urban and local roads will be transferred to the respective local authorities. • Policy of awarding time based maintenance contracts will be implemented by making changes in the prevailing contracting system for construction and maintenance of roads. 	<ul style="list-style-type: none"> • Regular Road Repair and Maintenance Programs. • Periodic Road Repair and Maintenance Programs. • Emergency, Main and Special Road Repair and Maintenance Programs. • Repair and Maintenance programs of Road Board Nepal (RBN).
<p><u>Road Safety</u></p> <p>Extension of alternative means of transport.</p> <p>Improved Road safety measures.</p>	<ul style="list-style-type: none"> • Accessibility of rural areas to development infrastructure will be increased through the development of safe alternate transport methods such as waterways, ropeways etc which are also important for tourism development. • Private investment in infrastructures development such as waterways, ropeways etc made more attractive through improvement to regulations and procedures. <p>Improvement to road safety management systems to control road traffic accidents.</p>	<ul style="list-style-type: none"> • Feasibility Studies of Alternative Means of Transport (Water Ways, Train, Rope Way etc.). • Studies and Research Programs for Road Safety.

<p><u>Institutional Strengthening</u></p> <p>Institutional capacity will be improved in order to ensure planned results through program implementation, monitoring and evaluation.</p>	<ul style="list-style-type: none"> • Institutional reform and strengthening of DoR will be carried out for fast and transparent services through a decentralized management system. • Log frame will be compulsory in the preparation of annual plans, monitoring and evaluation of projects. • Allocation of budget for monitoring and evaluation will be made mandatory in preparing project implementation plans • Capacity of institutions related to road construction and operations such as local governments, construction companies and consultants will be enhanced for completion of projects on time within the budget limit within accepted standards. 	<ul style="list-style-type: none"> • Institutional Strengthening Programs for project implementation, monitoring and evaluation. • A research and development unit will be established within the DoR for research and capacity development of institutions related to road construction and managements.
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\$US Million

Item	10 th Plan					11 th Plan		
	2002-3	2003-4	2004-5	2005-6	2006-7	Total	2007-8	2007-11
Revenue								
Government Allocation	7.82	17.68	16.07	29.69	47.89	119.16	71.02	
Domestic Loan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Foreign Loan	68.72	32.71	14.75	34.86	39.07	190.11	43.94	
Foreign Grant	29.57	21.70	48.48	16.85	26.55	143.14	25.89	
Total	106.11	72.09	79.30	81.40	113.51	452.41	140.84	NA
Expenditure								
General Budget								
1. Staff	2.64	2.83	3.64	4.29	5.21	18.61	5.30	
2. Routine maintenance	0.44	0.58	0.24	0.00	0.00	1.26	0.00	
Total: General	3.08	3.41	3.88	4.29	5.21	19.87	5.30	NA
Development								
1. New Construction	14.02	31.46	39.30	46.94	19.28	151.00	52.32	96.48
2. Reconstruction, Rehabilitation & Maintenance	15.52	12.78	26.15	35.15	61.62	151.23	64.54	423.58
3. Bridges	7.56	5.80	8.79	6.60	10.57	39.31	11.13	0.00
4. Miscellaneous	10.49	4.22	5.31	5.18	7.02	32.23	7.37	9.28
Total: Development	47.59	54.26	79.55	93.88	98.49	373.76	135.35	529.34
Total	50.66	57.67	83.43	98.17	103.70	393.63	140.65	529.34

2 Appendix 3

NRs Million

Item	10 th Plan					11 th Plan		
	2002-3	2003-4	2004-5	2005-6	2006-7	Total	2007-8	2007-11
Revenue								
Government Allocation	536	1,220	1,077	1,930	3,041	7,804	4,474	
Domestic Loan						0		
Foreign Loan	4,711	2,257	988	2,266	2,481	12,703	2,768	
Foreign Grant	2,027	1,497	3,248	1,095	1,686	9,553	1,631	
Total	7,274	4,974	5,313	5,291	7,208	30,060	8,873	NA
Expenditure								
General Budget								
1. Staff	181	195	244	279	331	1,230	334	
2. Routine maintenance	30	40	16			86		
Total: General	211	235	260	279	331	1,316	334	NA
Development								
1. New Construction	961	2,171	2,633	3,051	1,224	10,040	3,296	6,030
2. Reconstruction, Rehabilitation & Maintenance	1,064	882	1,752	2,285	3,913	9,896	4,066	26,474
3. Bridges	518	400	589	429	671	2,607	701	
4. Miscellaneous	719	291	356	337	446	2,149	464	580
Total: Development	3,262	3,744	5,330	6,102	6,254	24,692	8,527	33,084
Total	3,473	3,979	5,590	6,381	6,585	26,008	8,861	33,084

External Assistance to the Road Sector

Asian Development Bank Loans

Loan Number	Projects	Length (km)	Completed/Expected Completion Date
0274	Hetauda - Narayanghat Road (upgrade)	78	1981
	Feeder Roads	116	1993
0806	Road Improvement	198	1995
0982	Second Road Improvement	686	1997
1377	Third Road Improvement	269	2001
1876	Road Network Development Project	410	2007
1450	Rural Infrastructure Development Project (RIDP)		
2092	Decentralised Rural Infrastructure and Livelihood Program (DRILP)		2011
2097	Subregional Trade Facilitation Project	44	2044

Technical Assistance

TA Number	Projects	Length (km)	Completed/Expected Completion Date
4842	North – South Fast Track	117	2008
1863	Road Improvement	198	
1027	Second Road Improvement	135	1994
1704	Third Road Improvement	269	2001
2969	Fourth Road Improvement		1998
4347	Road Connectivity Sector I Project	250	2005
1863	Rural Infrastructure Development Project (RIDP)		
3625	Second Rural Infrastructure Development Project (SRIDP)		
0764	Transport Sector Profile Study	1987	

Grant Assistance

Grant Number	Projects	Length (km)	Completed/Expected Completion Date
3785	Road Network Development Project	410	2008
0051	Road Connectivity Sector I Project	250	2011

2 Appendix 4

Other Development Bank/Agencies Assistance

Development Agency/Country	Grants	Length (km)	Completed/Expected Completion Date
China	Naubise-Pokhara	174	1974
China	Narayanghar-Mugling-Gorkha	61	1982
China	Pokhara-Baglung	71	1994
China	Kathmandu Ringroad	27	1974
China	Syaprubesi-Rasuwadadi	16	2006
China	Mustang-Lomathang-Ghoktang		
China	Kathmandu-Kodari	113	
Germany	Malekhu-Dhadhing	17	2001
Germany	Bhainse-Hetauda	11	1998
Germany	Simikot-Hilsa		
India	Tribhuvan Highway	114	1956
India	Kathmandu-Trisuli	68	1963
India	Kathmandu-Godawari	15	
India	Kathmandu-Sundarjal	7	
India	Sunali-Pokhara	181	1972
India	Kakarbita-Dhalkebar	258	1974
India	Butwal-Kohalpur	236	1985
India	Kohalpur-Mahakali	204	1993
India	East West Terai Postal Road		
India	Kathmandu-Dachhinkali	17	
India	Dhalkebar-Janakpur-Bhittamod	30	1970
India	Rupediah-Kohalpur	30	
India	Jogbani-Dharan	60	
India	Kathmandu-Dachhinkali	19	
India	Soharatgarh-Taulihawa	9	
Japan	Banepa-Sindhuli-Bardibas	158	2009
Switzerland	Lamosangu-Jiri	110	1984
Switzerland	Arniko Highway Maintenance Project	96	2001
Switzerland	Road Resealing	26	2005
Switzerland	Road Maintenance and Rehabilitation Project	1,111	1999
Switzerland	District Road Support Program (DRSP)		
UK	Dharan-Dhankuta	55	1984
UK	Damak-Belbari (rehabilitation)	23	1997

UK	Jogbani-Dhankuta (rehabilitation)	100	1997
UK	Kakarbita-Damak (rehabilitation)	49	2001
UK	Rural Access Program (RAP)		2008
UK	Butwal-Narayanghat	115	1975
UNCDF	Bardibas-Jaleswor	42	2001
UNCDF	Janakpur-Dhanushadham	16	2001
UNCDF	Nepalgunj-Guleria	32	
USA	Hetauda-Naryanghat	78	1967
USA	Raxaul-Bhainse (upgrade)	71	1967
USA	Dhangadhi-Dadeldhura	135	1979
USA	Rapti Integrated Road Project	201	1986
USSR	Pathlaiya-Dhalkebar	109	1972
WB	Rural Access Improvement and Development Project (RAIDP)	1050	2010

Development Agency/Country	Loans	Length (km)	Completed/Expected Completion Date
WB	Multi-modal Transit and Trade Facilitation Project		
WB	Birgunj-Kalैया	6	1998
WB	Birgunj-ICD	3	1998
WB	Road Maintenance and Development Project (RMDP)	1083	2007
WB	Pilot Labour Based Rehabilitation Project (PLRP)	275	1999
WB	Road Improvement Project (RIP)		2001
WB	Road Maintenance and Rehabilitation Project (RMRP)		1997
WB	Road Sector Development Project (RSDP)		2011
WB	Lamahi-Tulsipur	38	
WB	Road Maintenance and Development Project, Sector wide Road Improvement Project, Study of Priority Investment Plan (PIP)		2007
WB	Study of Priority Investment Plan (PIP)		1997

km = kilometer UK = United Kingdom, UNDP = United Nations Development Program, USA = United States of America, UNCDF = United Nation Capital Development Fund, WB = World Bank.

Source: Ministry of Physical Planning and Works, Nepal.

Technical and Design Summary

Alignment

The proposed road consists of a main line from Kathmandu to Nijgadh on the East West Highway (EWH) (76km) with upgrading of the EWH to four lanes for 18 km from Nijgadh to Pathlaiya, and a two lane access controlled connector from km 48 on the main line to Hetauda. The main line has been designed as a four lane road, although, at the request of Government and ADB, two lane design has also been shown on the drawings.

Design Standards

1. Since the project road will be a part of the Asian Highway (AH) and its aim is to provide a high-class connection between Kathmandu and the Terai with high traffic volumes, a higher road standard than that normally used in Nepal is proposed. The proposed standard is AH Class 1 road with minor modifications.
2. Based on road class and terrain conditions, the design speed is proposed as shown in Table A5.1. The proposed design speed is the minimum design speed; most sections of road are actually designed for a higher travel speed where conditions permit and the average road driving speed should be above the design speed.
3. The geometric design follows or betters the AH standard. For plain (flat) terrain the minimum horizontal radius adopted is 250 m and for mountainous and steep terrain the minimum horizontal curve radius adopted is 150 m, which is above the minimum radius required for vehicle speed of 50 Km/hr. Grades have been maintained at 4 percent or less. Recommended AH design standards are shown in the Table A5.1 and A5.2.

Cross Sectional Elements

4. Where possible the designs standards above were exceeded and the lowest design speed is 60kph, although in most sections it is 100 kph. The total right of way follows the GoN standard of 50 m, however, in some road sections with steep rock side slopes at interchanges and at road facilities this width has been increased as the terrain or design requires.

Pavement

5. Since a substantial percentage of the estimated traffic flow will be heavy vehicles, an Asphalt Concrete pavement is proposed, as is normal in Nepal. The pavement structure thickness has been calculated based on the estimated cumulative number of axles in the design life and CBR tests taken along the alignment. The thicknesses adopted for various road sections are discussed in detail in the design report (**Supplementary Appendix 2.**)

**Table A5.1. Design Standard for Two Lane Road
Asian Highway Class 1**

Terrain	Plain	Rolling	Mountainous/Steep
Design Speed (km/hr)	80	80	50
No of Lanes	2		
Cross Section			
Pavement Width	7.0	7.0	7.0
Shoulder Width (m)	2.5	2.5	2.0
Formation Width (m)	12.0	12.0	11.0
Pavement Cross-fall (%)	2.0	2.0	2.0
Shoulder Cross-fall (%)	3-6	3-6	3-6
Right of Way	50	Min 50	Min 50
Horizontal Alignment			
Min Radius of Curve (m)	210	210	80
Superelevation (%)	10	10	10
Vertical Alignment			
Maximum Grade (%)	4.0	4.0	4.0
Bridge Loading	HS20-44		

**Table A5.2. Design Standard for Four Lane Road
Asian Highway Class 1**

Terrain	Plain	Rolling	Mountainous/Steep
Design Speed (km/hr)	80	80	50
No of Lanes	2 x 2		
Cross Section			
Lane Width	3.5	3.5	3.5
Shoulder Width (m)	2.5	2.5	2.0
Median Width	3.0	3.0	2.5
Formation Width (m)	22.0	22.0	20.5
Pavement Cross-fall (%)	2.0	2.0	2.0
Shoulder Cross-fall (%)	3-6	3-6	3-6
Right of Way	50	50	Min 50
Horizontal Alignment			
Min Radius of Curve (m)	210	210	80
Superelevation (%)	10	10	10
Vertical Alignment			
Maximum Grade (%)	4.0	4.0	4.0
Bridge Loading	HS20-44		

Cross Drainage Structural Design Standard

6. Cross road drainage is through culverts and bridges. The pipe culverts, slab culverts, box culverts and bridges have been designed in compliance with the GoN specifications.
7. Bridge design has followed GoN specifications where applicable. HS 20 – 44 or Indian Road Congress (IRC) Class AA loading standard is adopted for the design of the structures. Flood frequency of 1 in 100 years is adopted for bridges, 1 in 50 years for culverts and 1 in 20 years for side drains. Considering the importance of this road the flood frequency has been increased over that generally used in Nepal.
8. Since the Project Road is located in seismic zone IV and V (IRC) it requires anti-seismic measures to be included in the design of cross drainage structures. The preferred main line alignment from Kathmandu to Nijgadh has 51 major bridges over 50m and a total length of bridges of 9,061m.
9. Most bridges will be simple span RC on piers and spread footings, however higher bridges with longer spans will be pre-stressed T girder superstructure. There are seven high level long bridges which have been given special consideration. It is proposed that these be constructed as pre-stressed concrete box girder balanced cantilever bridges (**Supplementary Appendix 2**).

Tunneling Component

10. There is no previous experience of design or construction of road tunnels in Nepal. The selected alignment includes one 1.3 km tunnel. The design, therefore, has paid particular attention to this component.
11. There is no existing design standard for tunnels included in either the Nepal or Asian Highway Standards. Most design standards for road tunnels in developed countries are similar and, as Japan has extensive experience of tunneling, and as the geology and geotechnical condition of Japan is very similar to that of Nepal, the design of the tunnels has been based upon the Standard of Japan Highway Public Corporation (JHPC).
12. The proposed road width of the road in the tunnel is 9 m, including shoulders, with a walk way on one side, 75 cm wide and 2.0 m high, for maintenance of the facilities. No pedestrian walkway is required as pedestrian and other local traffic will not be allowed on the toll road. Thus, the total width of the tunnel is about 11 m and height is about 7.5 m. For the four lane option twin tube tunnels are proposed.
13. Typical Standard cross sections for each 2 lane tunnel and the cross section for each portal area are shown in the design drawings. (**Volume 4**).
14. The proposed method of excavation for tunnels is rock breaker and backhoe, without using blasting, by adopting micro-bench-cut excavation method for the fractured soft rocks which are predominant in the tunnel area.
15. Tunnel supports have been designed in accordance with the estimated rock mass quality by applying empirical design methods produced by JHPC to the geotechnical survey results. Because of the similarity in geology and ease of application of the rock classification system one standard support pattern has been

used (see **Supplementary Appendix 2**).

16. Tunnel ventilation design is required when the length of the tunnel is longer than 500-1,000 m, depending on traffic volume and will be required for the project tunnel. An illumination system has been included in the tunnel design.
17. Traffic safety emergency facilities requirements are based on the length of the tunnel and traffic volume. This is determined based on probability of accidents and fires from past experience in tunnels worldwide. Suitable facilities have been included in the design and cost estimates.

Materials and Labor

18. Construction materials, such as boulders, stones, gravel and sand are locally available at a reasonable distance. Suitable sites have been identified and quantities estimated. Other materials, principally bitumen, steel re-bars and cement would be imported.
19. Tunnel and toll equipment and spare parts would be imported, other equipment could be available in local market.
20. For construction of road and small/medium bridges most skilled and all unskilled labor is available in Nepal, but for the construction of tunnels and the extra large bridges skilled labor would need to be imported.
21. For the preliminary design initial evaluation only has been carried out of construction material sources and quantity within or close to the alignment or elsewhere. A more specific materials source study and analysis will be required in the Final Design.

Quantity Estimates

22. Quantity estimation of earthworks cut and fill were estimated from the surveyed cross sections quantities, as were quantities of retaining structures, and minor drainage. The quantity of pavement works were calculated based on the thickness adopted in design and the pavement cross section.
23. The lengths of bridge spans were estimated from the longitudinal section and geological survey. All bridges have spread footings and the dimensions estimated from the superstructure design and geological surveys. Quantities were estimated based on the typical cross sections of each bridge type.
24. Lengths of the tunnels and quantity of estimation were estimated from the profile and the plan of the alignment long section and geological surveys.

Unit Rates

25. Unit Rates of the major cost items were developed based on local district standard rates for labor and materials², where applicable, and adjusted for first quarter 2008. There has been a general increase of 6.7 percent in construction costs since early 2007 (the base for feasibility costs). Per meter cost of small bridges were based on the prevailing rates of similar bridge works in Nepal., for larger bridges, especially those types where there was no Nepali experience, rates from other countries have been used, adjusted where possible for imported materials. Rates

² The 'Norms for Rate Analysis (2003)' updated 2007 (DoR).

for items not included in the standard rates (tunnels, toll works etc.) were estimated based on rates in India or PRC, adjusted for Nepal transport costs and taxes etc.

Cost Estimate

26. Based on the quantity and the unit rates the cost of major items was calculated using the DoR standard rates where applicable, for Makawanpur, the district through which the majority of the road alignment passes. Cost of special equipment was estimated using overseas rates adjusted for Nepal. Cost for minor miscellaneous works and overheads were estimated on a percentage basis of the earthworks, pavement and drainage cost, based on other work. Consulting services costs were estimated for both international design and for international/domestic supervising engineering organizations. Costs of land acquisition and resettlement were not available for the Final Report and were estimated as three percent of direct costs after consultation with ADB resettlement consultants.
27. An allowance of five percent of total cost was added for physical contingencies to cover the cost of minor adjustment of alignments and variations in the lengths of bridges and tunnels etc in final design.
28. Based on the above methodology the total direct costs of the project were estimated and are set out in **Appendix 10**.
29. A detailed description of the derivation of the preliminary cost estimates is provided in **Supplementary Appendix 6**.

Limitations to Preliminary Design

30. The design centerline is based on the preliminary design topographic survey. As such the cross sections were taken at 50m intervals. It is likely that some modifications to the road geometry design may be necessary during detail design after detail survey at closer intervals is carried out.
31. Pavement thicknesses will also vary slightly during the detail design/construction stage. It is recommended that subgrade CBRs be checked and pavement thickness design be adjusted during detail/construction stage.
32. The geotechnical investigation, whilst covering most of the major structures was limited because of both limited resources and also the inaccessibility of the sites for drill rigs. In some cases geological conditions have been assumed based on survey at nearby sites. During detail design phase additional geotechnical investigation will be required for each site. This could lead to some change in design and quantities.

Areas Requiring Further Investigation

33. The time for preliminary survey and design of the selected alignment was compressed into four months. Given the remote area of the project and the difficult terrain the topographic and geotechnical surveys took 3 months to complete, thus preliminary design was started before the surveys were complete. The alignment corridor was defined based on feasibility surveys and existing topographic maps and the preliminary design surveys carried out within this corridor. Therefore only minor realignment was possible when the surveys were plotted and analyzed.

34. After examining the digital terrain model it was found that many of the valleys and gullies which required bridge crossings were deeper and wider than indicated on the topographical maps. This has meant that there are now many more major bridges than was originally anticipated in the early stage of the design, in particular there are seven high/long bridges in the section of road between Km 29-45, with an estimated total cost of over \$143 million.
35. The original alignment was selected in part because it had only minor tunnelling requirements. Given Nepal has no experience in construction, maintenance or operation of road tunnels this was considered to be a major factor in selecting the preferred alignment. The preliminary design alignment has one tunnel 1.3km in length with an estimated cost of \$55 million.
36. Given the high cost of the major bridges it is recommended that in detail design, for comparison, an alternative alignment be investigated between Km 27-32 including a 3km long tunnel with the northern portal emerging lower down the Dhedre River than the existing alignment. The advantages of this alignment would be:
- The elimination of four major high/long bridges with an estimated total cost of \$70 million;
 - The reduction in size and depth of two high/long bridges because the valley crossing would be lower down the valley; and
 - An overall saving of two kilometers in length of the road.
37. The disadvantages of the alignment would be:
- An increase in tunnel cost, estimated at an addition \$70 million;
 - A greater risk of encountering unsuitable material during tunnel excavation leading to possible realignment, addition internal support and higher cost;
 - The probably need for vertical ventilation in the tunnel (not included in the above estimate);
 - The need for a higher level of tunnel maintenance, operation and safety requirements during the life of the road with consequent increase in costs; and
 - The need for a higher and more extensive level of training (mainly overseas) for Nepalese staff involved in the operation and maintenance of the tunnel.
38. Just prior to the completion of the preliminary design we were advised of a small hydro scheme which had been approved for construction on the Bakaiya river at about 65km. It would appear that the location of the head-works would almost coincide with a crossing of the Bakaiya River by the Project road and that the road would make three crossings of the penstock pipe/channel leading from the head-works to the power station. Further investigation is required in detail design and a small realignment of the Project road may be necessary.

Regional Trade

1. Because of geography, Nepal's external trade was limited in the past but there has for many decades been trade with neighboring countries. This has traditionally flowed at two levels:
 - local level trade conducted by people living in the border area on both sides,
 - national trade flowing through specified routes and markets controlled and supervised by government
2. International level trade has gradually increased and Nepal now trades with both India and PRC and, through India, with other countries.
3. The Birgunj – Kathmandu- Kodari corridor is the only corridor currently available for transit traffic from India to PRC (TAR). The existing route via Mugling and Narayanghat is not only torturously long but also is subject to frequent closure/disruption during the monsoon season. Therefore, a new high class connection from Pathlaiya to Kathmandu will have significant benefits for bilateral, international and transit trade flows.
4. Nepal has entered into various transit and trade agreements with other South Asian countries and the South Asia Association for Regional Cooperation (SAARC) was launched in 1985 (Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan and Sri Lanka), to promote the welfare of peoples in South Asia and to improve the quality of life through accelerated economic growth, social progress and cultural development within the region. One charter objective of SAARC is the "acceleration of economic growth amongst member countries". The South Asia Free Trade Area (SAFTA) Agreement came into force in January, 2006 and is being implemented through, in part, a trade liberalization program which will reduce existing tariff rates.
5. In 1996 Bhutan, Bangladesh, India and Nepal formed the South Asian Growth Quadrangle (SAGQ) under the umbrella of SAARC with the objective of accelerating sustainable economic development. In 1997 SAGQ countries requested ADB to facilitate this initiative and the South Asia Sub-regional Economic Cooperation (SASEC) program was commenced in 2001³ .
6. SASEC is more focused on enhancing existing transportation facilities and improving the operational efficiency of the transport sector to facilitate the trade and the movements of goods and people across borders. This includes: addressing transport "bottlenecks" on road links, development and improvements of Customs Stations; construction of new access roads and enhancements of the existing access roads that connect the main highways to the Customs Stations; harmonization of the different standards in roads and rails between the participating countries; and revitalization of the Asian Highway Concept to facilitate road connectivity to all SASEC countries.
7. With the implementation of SAFTA Agreement and SASEC, intra-regional and sub-regional trade is expected to grow at an accelerated rate.
8. In March 2004, Nepal became a member of the World Trade Organization (WTO). Nepal has committed to a timetable of legislative reforms required to comply with WTO rules on trade related domestic regulations. New legislation is required on the

³ RETA 5936: the Identification and Prioritization of Sub Regional Projects in South Asia

valuation of imports for customs and taxation purposes which will increase the transparency and predictability of customs offices for imported goods.

9. Nepal faces a challenge in terms of compliance with WTO commitments and will need to strengthen its competitiveness in agriculture, services and manufacture production and productivity, and create a better policy environment for development of tourism, agriculture, services and manufacturing, to attract foreign and domestic private investment.
10. The value of Nepal's total trade in FY 2006/2007 was NRs 256.7 billions with exports of NRs 59.0 and imports of NRs 197.6 billions, a trade deficit of NRs 138.6 billions. Exports were constrained by a prolonged phase of general strikes, industrial closures, and political turmoil during the whole period of the fiscal year.
11. Despite its growing trade deficit, Nepal traditionally has a balance of payments surplus due to remittances from Nepalese working abroad. In FY 2005/2006, Nepal recorded a balance of payments surplus of NRs 25.6 billion, however, the surplus reduced to only NRs.5.9 billions in 2006/7 due to substantial increase in the overall deficit in the balance of goods, service and income and grants, although there was increase in the workers' remittances.
12. There are nine official border crossing points with PRC and 22 with India for bilateral and international trade. Among the 22 official border crossing points with India, Birgunj, south of the Project road, is the most important and busiest for bilateral and international trade, accounting for about 52 percent or NRs 133.5 billion of the total trade value.
13. Of the nine official border crossing points with PRC (TAR) Tatopani is the most important and busiest border crossing. The value of Nepal's total trade through Tatopani Customs in FY 2006/07 was NRs. 4.5 billions which was about 24 percent of the total value of country's total bilateral trade with PRC, a reduction of 50 percent from 2005/06
14. Although there have been substantial improvements in physical and non-physical conditions of the Birgunj and Tatopani Customs there are still many choke points hindering the smooth flow of exports and imports of goods. Whilst removal of the above constraints will substantially speed up transport of border trade flows, full advantage of the improvements will not be fully utilized unless the travel distance and time from the border to Kathmandu is reduced by the introduction of the project road.
15. Whilst the GoN has identified nine routes with potential as trade transport corridors between India and the PRC via Nepal, only the corridor Birgunj – Kathmandu – Tatopani (Kodari) is open at present. A second corridor from Birgunj to Rasuwagadi which is under construction⁴ could also facilitate increased transit traffic when complete.
16. India's exports to the PRC in FY2007 amounted to \$35 billion, an increase of 71 percent over the previous year. Similarly, India's imports to PRC also rose by 70 percent, reaching \$20.8 billion in FY2007. The total bilateral trade went up rapidly from nearly \$2.0 billion in FY2000 to above \$35.0 billion, accounting for 35 percent of India's total trade in FY2007. The share of India's exports to the PRC in total exports

⁴ The section Galchii to Syraprubesi is being constructed under ADB 'Transport Connectivity' Project.

grew from 1.5 percent in FY2000 to 16.4 percent in FY2007. During the period from FY2000 to FY2007, the growth in India's trade with the PRC significantly outpaced the growth rate of total trade. India's exports to the PRC recorded a more than ten fold rise and imports a fourteen fold rise. Clearly there is an opportunity for Nepal to promote transit trade through Nepal and take advantage of the tremendous growth in trade between the two countries by entering into tripartite negotiations, completing a high class road link and developing additional infrastructure and other necessary systems adequate to attract and divert some of the present sea trade between India and PRC through Nepal.

17. Further details of the extent and impact of regional trade are set out in **Supplementary Appendix 5**.

Road Safety

1. Despite the slow pace of road-development in Nepal, road-safety in the country is particularly serious because of the significant loss of life from road-accidents.
2. This road-safety study for the Project reviewed the existing trends in road-accidents in Nepal; carried out a safety audit of the preliminary design of the project road and developed road-safety awareness/education programs to be carried out in conjunction with the Project.

A. Road Safety Trends in Nepal

3. Nepal's fatality-rate of 113 for every 10,000 registered vehicles in fiscal-year 2006-07 is very high, even when compared to corresponding statistics in neighbouring countries. The rate is high even in the most remote and sparsely motorized regions of Nepal. The bulk of all road-accidents, however, occur within the Kathmandu Valley as this region carries a significant portion of the national traffic.
4. Although reporting of fatal accidents in Nepal is complete, based on past research data there is wide-spread under-reporting of non fatal road accidents by the Traffic Police, particularly those regarding minor injury or property damage. In rural areas heavy vehicles are involved in most road accidents but, in urban areas, motor-cycles and buses accidents predominate. Driver recklessness is the main factor in accidents; pedestrian involvement in accidents is also significant. Based on an average cost of road accidents assumed for the Project analysis, the total economic loss due to road accidents in Nepal in 2006 was equivalent to about 0.48 percent of the GDP.

B. Road Safety Audit Of Project-Road

5. A safety audit was carried out of the initial preliminary design and reviewed the road alignment and layouts of the tunnel, interchanges, toll plazas, service areas and axle-load control station areas and bridges. Based on the estimated traffic volumes there are no safety issues because of capacity constraints within the design period of the Project provided that the Project road is either built immediately to four lane or upgraded by 2018.
6. Countermeasures have been recommended at potentially hazardous locations including low radius curves, constrained locations owing to the combined effect of the horizontal and vertical alignment, etc, and these have been incorporated into the preliminary design. There are no visibility constraints at the tunnel or its portals, however the lighting approaching tunnel exits should be carefully monitored such that it blends in with the outside brightness. Tunnel facilities proposed for tunnel operations were reviewed as these have a significant impact on road safety. An effective and close networking between the Toll-Operator, Traffic Police and emergency services is essential and a series of measures have been proposed, including provision for a Safety Officer, daily safety inspections and an incident reporting procedure during road operations.

C. Awareness Campaigns For Road Safety

7. The following campaigns and education programs are recommended for the Project:
 - Drivers' Education – Safe Driving Code for Access-Controlled Road & Tunnel
 - Roadside Community Awareness Campaign
 - Pedestrian Awareness Campaign for School-Children in East West Highway (EWH) Section
 - Awareness Campaign for Heavy Vehicles in EWH Section
 - Road & Tunnel Safety Publicity through Television
 - Road & Tunnel Safety Publicity through Newspaper
8. The tentative cost for all the road-safety components above including awareness campaigns and road safety countermeasures is NRs 500 million (US\$ 8.0 million). This cost does not ongoing safety-awareness needs and the costs are in addition to those already included in the existing road cost estimate.

D. Long-Term Measures to Achieve Tunnel and Road –Safety

9. Long-term measures for tunnel and road safety include, prompt and regular maintenance of the Project road and safety-facilities; prompt monitoring of traffic operations and incidents. On the engineering side, daily safety inspections, regular safety-audits with emphasis on safety-structures, hazardous/critical locations, tunnel and ITS installations are recommended.
10. A long-term education program on code-of-behavior for road-users is crucial as traffic operations on the Project road will be complex involving high-speeds and new concepts. Strong enforcement of traffic rules in tunnels and along the road, with stiff penalties to traffic violators, is necessary. In this aspect, it is recommended that a dedicated Traffic Police unit should be formed for the project and that it should be well equipped and adequately staffed at all times. A system of introducing a toll-free number for emergencies is also recommended so that road-users can assist in identifying incidences or road-accidents along the Project road by using either the emergency telephone or mobile phones. The number should be well publicized at frequent points along the road.

E. Recommendations

11. It is recommended that road-safety audits be conducted again during detail design and during construction and regularly thereafter to monitor these present recommendations.
12. As Nepal has no experience with tunnel and toll-road operations, there should be a strong emphasis towards training through regular safety-drills on the Project road on a sustained basis. A strong coordination and collaboration between the Toll Operator, Traffic Police and emergency services should be in place for effective traffic and incidence management.

13. For efficient traffic and incidence management, adoption of various ITS technologies, particularly variable message signs, automatic toll-collection, weather monitoring system and speed cameras, etc, should be promoted. **(Appendix 8).**
14. Amendments to the existing Vehicle and Transport Management Regulations to incorporate traffic-rules in road-tunnels; development of a national ITS standards; development of the Major Transport Terminal in Kathmandu as part of the proposed Kathmandu Outer Ring-Road Project or through another agency including private-sector collaboration, and introduction of tunnel-safety rules in the syllabus for the written examination for driving licenses, etc, should be initiated.

ITS AND ASSET MANAGEMENT

A. Intelligent Transport System

1. Intelligent Transport Systems (ITS) is a term that is used widely (and loosely) to encompass a wide range of technological solutions applied to the transport sector to improve the performance of the transport system. These improvements include safety and traveler information (speed signs, warning signs, etc), enforcement (over-speed, over-weight, non payment of tolls, etc), monitoring (traffic speeds, over-weight, traffic counting, etc), and toll and revenue collection (e.g. electronic tolling). The relative emphasis placed on ITS for these functions varies from place to place, depending on factors such as specific need, local technological skills and ability to reliably construct and maintain a relatively high technology system, and budget considerations for both construction and on-going maintenance. In Nepal ITS has not yet been developed and there are no immediate plans for an ITS strategy.
2. With the construction of a high class, high speed road, it will be important to introduce ITS facilities to maintain safe travel, to quickly identify situations as they arise, and to inform or warn the traveling public of those situations or changed conditions and regulations.
3. Recommendations for ITS facilities for the project have been developed (Table A8.1) and can be implemented in most cases during the project. The ITS features of the Project will include (i) one traffic control center; (ii) advanced toll payment system; (iii) variable message displays to provide road users with information about speeding, and enforcement; (iv) emergency telephones along the whole alignment and a dedicated emergency phone number; (v) surveillance technology; (vi) detection of black spot locations and property damage; (vi) monitoring of speed limits, congestion, and overloaded vehicles; and (vii) coordination of emergency service agencies. About 0.75 percent of the Project cost will be allocated to procure ITS equipment, and training in its use will be included in capacity development component of the project. (**Supplementary Appendix 9**).

B. Asset Management

4. Asset management must be developed to ensure the sustainability of the Project Road. Maintenance for the major highways in Nepal is carried out by DoR with funds partly provided directly from the Ministry and partly through Roads Board Nepal(RBN), based on a budget prepared by RBN. An analysis of existing funding and future needs indicates a serious shortfall in funding when the project road opens.
5. Initially little major maintenance will be required on the project road, except for rectification of construction deficiencies and slope failures, maintenance costs may well be within funding limits. As the road ages, however, maintenance costs will undoubtedly rise, and the road management company (RMC) will likely come under increasing budget pressure. In these circumstances the current maintenance programming arrangements are unlikely to be satisfactory. It is recommended, therefore, that control of maintenance of the Project road be under

2 Appendix 8

the RMC, using funding directly from toll revenue, after operation costs and debt servicing have been paid⁵.

6. Although highway maintenance and repairs in Nepal are undertaken in accordance with national specifications these do not specifically include any consideration of preventative maintenance, which is a particularly cost effective form of maintenance. It is recommended that the RMC or BOT concessionaire introduce efficient maintenance programming practices and develop improved staff skills.
7. The TA has prepared an asset management development plan, which, if adopted, will establish a computerized database system and promote the use of modern equipment, and provide a training program to enhance employees' skills. (Table A8.2 and **Supplementary Appendix 9**).

⁵ If the road is funded through a BOT concession then the concessionaire would be responsible and fund all maintenance activities.

Table A8.1 ITS Recommendations

Item	Recommendation	Comment
VMS Displays		
Fixed location variable message signs	20-30 km apart on average	Every 20-30 minutes (depending on speed), with particular attention to location near 'high risk' locations
Fixed location variable speed signs	20-30 km apart on average	Every 20-30 minutes (depending on speed), with particular attention to location near 'high risk' locations
Mobile VMSs	3-4	Able to be rapidly deployed in case of major incidents / lane restrictions, etc
Video Surveillance		
Fixed location video surveillance.	On average around 3 km apart, subject to sight lines Cameras with variable focal length. Cameras able to be rotated / raised / lowered Cameras to provide full coverage within tunnel / on major bridges / at interchanges	To cover as much as possible of the project road. Later extension to full coverage. Could also later be integrated with vehicle speed, weight and toll payment monitoring and enforcement at selected locations. Tunnel cameras should adjust for variable brightness.
Weather Monitoring		
Visibility	In locations where roads are subject to fog	Would update preceding VMSs. Should be taken in to account in determining location of VMSs
Wind speed and direction	In location where roads are subject to high cross winds	
Speed Monitoring and Enforcement (Future)		
Fixed location	At each overhead VMS gantry	Speeding vehicles photographed.
Variable location	By Police, focusing on high speed / high risk areas	
Vehicle Weight Monitoring and Enforcement		
Fixed location	Loaded trucks weighed at each entrance point.	Overweight vehicles photographed or apprehended.

Table A8.2. Asset Management Action Plan

Item	Recommended Measures
1. Almost Immediate	
1A	For the RMC to commit to introducing an asset management system that will achieve asset management outcomes equal to world best practice
1B	For the RMC to develop an organizational structure that recognizes the importance of high quality asset management practices and skill levels.
1C	For the RMC to introduce on-going asset management staff training program(s).
1D	For the RMC to procure (or develop) an appropriate asset management database and asset management system (software and hardware) capable of recording key data, comparing asset condition with asset 'trigger' points and capable of providing high quality information for the effective management of the maintenance activities. (Preliminary work will be required to specify the system to an appropriate level of detail).
1E	For the RMC to define the Project road in terms of asset classes and asset types, for data analysis and reporting purposes.
2. Short Term (before road opening)	
2A	For the RMC to develop and introduce a systematic yet dynamic asset monitoring regime, consistent with the data storage capability of the asset database and management information needs, taking in to account national requirements and standards.
2B	For the RMC to identify suitable road maintenance contractors for varying levels of work.
3. Medium Term (within 2 to 3 years after road opening)	
3A	For the RMC to incorporate preventative maintenance plans within its overall asset management system.
3B	For the RMC's maintenance budget to be based on an optimum maintenance regime, rather than on the current formula method.
3C	For the company to share data with other international expressway and high class road companies and organizations responsible for highway and road maintenance to further improve maintenance practices

PUBLIC CONSULTATIONS

Public consultations were held by various stakeholders throughout both Phases of the Project. Further consultations are being held during the environmental, social and resettlement surveys. The list below therefore is only those public consultations conducted during preliminary survey and design.

Location	Date	Participants	No. of participants	Purpose	Main Issues Discussed/Concerns
Various	June 2007	VDC, villages	60	Explanation of highway environmental effects	Purpose of EIA, general project information, possible environmental effects
Kathmandu	May2007	Government and other stakeholders	35	Alignment Alternative selection	Discuss/select selection criteria and weighting of alternatives
Kathmandu	July 2007	Government and other stakeholders	55	Presentation of Feasibility Report	Discussion of recommendations and design criteria
Various	Jan/Feb 2008	VDC, villages	100+	Explanation of purpose of road and alignment by road survey teams.	Location of access and underpasses

DETAILED COST ESTIMATE**Four Lane Road**

	NR million			US\$ million			FX %	Share %
	Foreign	Local	Total	Foreign	Local	Total		
Earthworks ^a	4,331.5	6,233.1	10,564.5	60.4	86.9	147.3	41%	37%
Pavement	1,345.1	2,731.0	4,076.1	17.5	35.6	53.1	33%	8%
Structures	15,720.6	15,720.6	31,441.2	213.9	213.9	427.8	50%	38%
Tunnels	2,759.1	689.8	3,448.9	37.1	9.3	46.4	80%	6%
Slope Stabilization	0.0	777.9	777.9	0.0	10.5	10.5	0%	0%
Roadside facilities	77.8	200.0	277.8	1.0	2.5	3.5	28%	0%
Miscellaneous	25.8	496.1	521.9	0.4	7.1	7.4	5%	0%
Equipment	206.4	36.4	242.8	2.6	0.5	3.0	87%	0%
Overheads	0.0	546.8	546.8	0.0	7.3	7.3	0%	1%
Land	0.0	1,689.0	1,689.0	0.0	25.6	25.6	0%	3%
Consulting	876.1	2,628.2	3,504.3	11.3	37.7	49.0	23%	6%
Subtotal	25,243.8	31,847.3	57,091.1	344.0	437.3	781.3	44%	100%
Contingencies:								
physical ^b	1,252.5	1,566.2	2,818.7	17.1	21.5	38.6	44%	5%
price ^c	1,287.4	6,280.4	7,567.8	17.3	84.7	102.0	17%	13%
Subtotal	27,783.7	39,693.9	67,477.6	378.4	543.5	921.9	41.2%	
IDC (For)	9,952.9		9,952.9	133.1		133.1	100%	17%
Total in current prices	37,736.6	39,693.9	77,430.5	509.0	543.5	1,055.0	48.0%	137%

a. Environmental protection costs are included under civil works

b. Physical contingencies are computed at 5%

c. Price escalation is computed as 0.8% for per year for foreign exchange and at 5.4 % for 2008, 5.1% for 2009, and 5.0% thereafter. (ADB estimates)

d. Assumes total costs borne by foreign loan at 5% per annum (Supplementary Appendix 8)

Source: PPTA Consultants estimates (See Supplementary Appendix 3 and 8 for further details).

DETAILED COST ESTIMATE
Two Lane Road^a

	NR million			US\$ million			FX %	Share %
	Foreign	Local	Total	Foreign	Local	Total		
Earthworks ^b	2,486.4	3,578.0	6,064.4	34.6	49.8	84.5	41.0%	16.7%
Pavement	672.5	1,365.5	2,038.0	8.8	17.8	26.6	33.0%	5.3%
Structures	10,482.6	10,482.6	20,965.3	142.8	142.8	285.6	50.0%	56.4%
Tunnels	1,379.3	344.8	1,724.1	18.6	4.6	23.2	80.0%	4.6%
Slope Stabilization	0.0	761.9	761.9	0.0	10.3	10.3	0.0%	2.0%
Roadside facilities	54.9	211.5	266.4	0.7	2.7	3.4	20.6%	0.7%
Miscellaneous	22.3	439.6	461.9	0.3	6.3	6.6	4.8%	1.3%
Equipment	109.2	22.4	131.6	1.4	0.3	1.7	83.0%	0.3%
Overheads	0.0	273.4	273.4	0.0	3.7	3.7	0.0%	0.7%
Land	0.0	1,689.0	1,689.0	0.0	25.6	25.6	0.0%	5.1%
Consulting	572.3	1,916.5	2,488.7	8.1	26.8	34.9	23.2%	6.9%
Subtotal	15,779.5	21,085.2	36,864.7	215.3	290.7	506.0	42.5%	100.0%
Contingencies:								
physical ^c	783.9	1,036.4	1,820.3	10.7	14.3	25.0	42.8%	4.9%
price ^d	736.0	4,030.4	4,766.3	9.9	54.5	64.4	15.4%	12.7%
Subtotal	17,299.3	26,152.0	43,451	235.9	359.5	595.4	39.6%	
IDC (for) ^e	6,626.5		6,626.5	88.8		88.8	100.0%	17.6%
Total in current prices	23,823.4	26,254.4	50,077.8	323.3	360.8	684.2	47.5%	135.2%

a Includes essential earthworks for upgrading but only single carriageway bridges and tunnels (Except high long bridges).

b Environmental protection costs are included under civil works

c. Physical contingencies are computed at 5%

d. Price escalation is computed as 0.8% for per year for foreign exchange and at 5.4 % for 2008, 5.1% for 2009, and 5.0% thereafter. (ADB estimates)

e. Assumes total costs borne by foreign loan at 5% per annum (Supplementary Appendix 8)

Source: PPTA Consultants estimates (See Supplementary Appendix 3 and 8 for further details).

IMPLEMENTATION SCHEDULE - PRE CONSTRUCTION ACTIVITIES

	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
I. Project Processing																		
A. Selection of Design Consultant	█																	
B. Review and Approval of Design													█					
C. Appraisal									█									
D. Deadline for SEIA Circulation								█										
E. Planned Loan Approval														█				
II. Civil Works																		
A. Detail Design		█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
B. EIA & EPP update for changes													█					
C. Preparation of PQ Documents						█	█											
D. Review/Approval of Docs							█											
E. Issuance PQ Questionnaires								█										
F. Submission of Questionnaires									█	█								
G. Evaluation of Questionnaires											█	█						
H. Review/ approval PQ Report												█						
I. Preparation of Bid Documents									█	█								
J. Review/Approval Bid Docs											█	█						
K Issuance of Bid Documents													█					
L. Notification to the Bank													█					
M. Receipt of Tenders													█	█	█	█	█	
N. Bid Opening and Evaluation																	█	
O. Review/Approval Evaluation																█	█	
P. Award of Contract																		█
Q. Submission Contract to ADB																		█
R. Prepare Mitigation MR Sced																		█

Note: Assumes some funding by ADB.

INDICATIVE CONTRACT PACKAGES

No	Chainage Length		Cost Mill		Contract Remarks	
	Km	KM	NR	\$US	Type	
C1	0-10.0	10		1,949	30.8	ICB Civil work
C2	10-18.0	8		3,753	59.3	ICB Civil work
C3	18-22.0	4		1,354	21.4	ICB Civil work
C4	22-29.5	7.5		4,142	65.5	ICB Civil work
C5	29.5-32.0	2.5		6,275	99.2	ICB Tunnel/Bridges
C6	32-37.0	5		7,922	125.3	ICB Civil work/Major Bridges
C7	37-48.0	11		5,854	92.6	ICB Civil Works
C8	48-55.0	7		4,524	71.5	ICB Civil work
C9	55-64.0	9		2,275	36.0	ICB Civil work
C10	64-76.0	12		4,512	71.3	ICB Civil work
CH1	0-21	21		1,361	21.5	LCB Civil work
CEW1	0-18	18		1,703	26.9	LCB Civil Work
M1				56	0.9	LCB Toll Plazas
M2				12	0.2	LCB Service Areas
M3				17.25	0.3	LCB Signs/Road marks
B1				19.3	3.0	LCB Fencing/Guard Rail
L1	0-52			10.9	0.17	LCB Landscaping
L2	52-76			5.0	0.08	LCB Landscaping
LHC	0-18			0.5	0.008	LCB Landscaping
LEW	0-18			0.5	0.008	LCB Landscaping
E1				119	1.9	IS Monitoring/Communication
E2				222	3.5	IS Tunnel M&E
E3				4	0.1	IS Weighbridges

CH1 = Hetauda Connection CEW1 = EWH Highway Upgrading.

MONITORING OF SOCIOECONOMIC AND POVERTY IMPACTS⁶

A. Flow of Project Benefits

1. The construction of the toll road will lower transport costs and reduce travel time and thus, once completed, the Project will improve the quality of transport services. Better road infrastructure and services will encourage villagers and minority people with access to the road to go to markets, use educational and health facilities more frequently, and avail themselves of increased agricultural extension services, and will also encourage agricultural services to the areas of road access and the Terai. These benefits, which accrue directly to road users and villages close to road access points, are the Project's direct effects.
2. Over time, improved road access will expand economic activities in the area and gradually lead to structural changes in production and consumption patterns and in the labor market. Lower transport costs reduce the costs of traded farm inputs, thereby raising agricultural productivity and profitability. Cropping patterns change with better road access to the major cities, as farmers shift to higher-value crops because of easier access to markets and new farming technologies. Road improvement helps increase non-farm job opportunities and the potential for increased wages. Better roads reduce transaction time and costs, thereby spurring commercial activities. The construction of the road will also promote the development of local tourism since tourists are more willing to visit with improved transportation. In turn, higher incomes boost local people's demand for transport and the movement of local goods and services. These benefits trickle down to local people over time and even the very poor, who use roads less often, also benefit from the new road through more and cheaper goods and services and increased economic opportunities. These are the Project's indirect effects.

B. Monitoring Framework

3. A standard monitoring framework and a set of monitoring indicators have been designed to measure actual benefits (Table A13-1). These indicators have been chosen to measure key changes in village and household conditions, farm income levels and transport services that will provide a basis to assess actual flows of project benefits.
4. Monitoring will focus on villages' representative of communities in the project area and that capture the project's diverse geographical scope and ethnic character. Three villages have been selected: Thingan, Nijgadh and Pathlaiya. These villages are selected based on the diverse socio economic gamut in order to have a suitable representation of the project area.

⁶ The monitoring activities set out in this appendix assume that ADB are involved in the funding of the Project. Even if they are not involved it is recommended that Government fulfill this monitoring schedule.

Table A13.1: Monitoring Framework: Indicators and Mechanism

Timing of Benefits or Outcomes	Monitoring Indicators	Monitoring Mechanism
A. During Project Construction	Number of hired local labors by gender	Village survey
1. Employment of local labor (included in EMDP)		Contractor records
2. Prevention of HIV/AIDS, and other transmissible diseases.		Data from local disease control centers
B. Immediately Upon Project Completion		Local statistics
1. Reduced travel time	Travel time to district centers	Village survey
2.Reduced number of serious road accidents and fatalities	Number of serious road accidents and fatalities on exiting and new roads.	Data from local public security bureaus
C. Short-Term (within 1-3 years)	Traffic volumes on new road	Toll road records
1. Lower transport costs	Transportation expenses of total expenses	Village survey
2. Improved transport services	Bus and freight fares	DoT records and village survey
3. Changes in producer prices	Villages with bus services	
4. Increased economic and market activities	Bus frequency to villages	
5. Increased access to social services	Fertilizer prices	Village survey
	Vehicle ownership	DoT records and
	Frequency of visits to markets	Household survey
D. Medium-Term (within 3-5 years)		
1. Developed non-farm sector	Middle school dropout rates (boys, girls)	Household survey
2. Increased agricultural extension services	Frequency of visiting doctors	Village survey
3. Increased rural incomes	Income from non-farm sector	County statistics
4. Reduced poverty incidence	Number of small business enterprises	Household survey
	Number of tourists in the area	Village survey
	Cash crops (percentage of total crops)	Village survey
	Frequency of visits by agricultural technicians	Statistics/village survey
	New or renovated houses	Village level
	Rural income	
	Poverty rate	

Source: ADB, 2002, Technical Assistance for Socioeconomic Assessment of Road Projects, Manila.

Table A13.2: Baseline Data of the Monitoring Indicators

Indicator	Town/Village		
	Thingan	Nijgadh	Pathlaiya
Distance to township Center (km)	2	1	1
Villages with road access (%)	20	70	70
Villages with tap water (%)	60	80	85
Villages with access to telephone (%)	30	60	70
Villages with bus services (%)	20	70	70
Bus frequency to district center (bus service/day)	2	4	5
Fertilizer input (%)	30	40	50
Transport expenses compared to the total household expenses (%)	3	4	6
Frequency of visits to district markets (Number of Households/per month)	150	200	250
Frequency of visits to major town markets (Number of Households/per month)	230	340	350
Frequency of visits of doctors (number per 6 months)	3	5	7
Income from non-farm sector compared to the total household income (%)	25	32	36
Frequency of visits by agricultural technicians (no. per 6 months)	3	5	6
Number of new or renovated houses	50	78	123
Rural income (NR) per year	36,000	48,000	50,000
Rural poverty incidence (%)	41	33	31

Note. This data will be updated during the social surveys.

C. Implementation of Monitoring

5. DoR will be requested to concur with the monitoring framework and set of indicators for monitoring the project's performance. During project preparation, the baseline values for the indicators were specified to the extent available (Table A13-2) and will be further updated during detail design, where necessary. DoR⁷ will measure the indicators for project evaluation prior to and during project implementation at completion, and annually 3 years after project completion. DoR will hire an independent, qualified institute for 30 person-months for surveys, analysis, and reporting. Reports will be submitted to the Government.
6. The preliminary estimate for the cost of monitoring is \$153,000.
7. Some macro-level baseline indicators have been collected to evaluate the overall economic growth and poverty reduction impact of the Project (Table A13-3). Further indicators will be available from the social assessment report.

⁷ Or the Road Management Company when formed, or for BOT the independent supervising consultants.

Table A13-3: Baseline Data of Macro-Level Impacts in 2007

Category	Indicators	Kathmandu	Lalitpur	Makawabour	Bara	
Economic	GDP (million NR)	NA	NA	NA	NA	
	Per capita GDP (NR)	NA	NA	NA	NA	
	• Primary industry GDP (%)	NA	NA	NA	NA	
	• Secondary industry GDP (%)	NA	NA	NA	NA	
	• Tertiary industry GDP (%)	NA	NA	NA	NA	
Poverty	Rural income	NA	NA	NA	NA	
	(NR/capita/year) Villages	NA	NA	NA	NA	
	Poverty villages	NA	NA	NA	NA	
	Population	1,081,840	337,785	392,600	559,135	
	Population in poverty	NA	NA	NA	NA	
	Poverty ratio (%)	NA	NA	NA	NA	
Education	Middle school enrollment rate (%)	75.0	67.3	53.7	46.2	54.4
	Middle school dropout rate (%)	1.2	4.3	10.9	11.2	7.4
Health	Reported HIV/AIDS cases	NA	NA	NA	NA	990
Transport	National Roads	18.4	-	140	54	7,684
	All weather Roads	499	143	160	69	5,273
	Unsealed Roads	313	194	169	252	12,157
	Density (km/100 km ²)	210	85.8	0.19	0.29	11.8
	Villages with road access					
Transport	Inter-town bus routes					
Services	Villages served by bus					
	Truck Registrations					29,992

Note: Will be updated during the social surveys

ECONOMIC ANALYSIS

A. TRAFFIC FORECAST

1. The project road is a 76km section of new construction from Kathmandu to the East-West highway at Nijgadh. Also included is the upgrading of the E-W Highway from Nijgadh to Pathlaiya (18 km) and a connector road (18 km) from the project road to Hetauda. The major existing road from the Terai to Kathmandu makes use of National Highways (NH) from Pathlaiya, at the junction of the E-W Highway and the Tribhuvan Highway, from Birgunj on the Indian Border, north to Hetauda, then west to Narayanghat on the E-W Highway, north to Mugling and finally east on the Prithivi Highway to Naubise, rejoining the Tribhuvan Highway to Kathmandu. The highways are all sealed with asphalt concrete or double bitumen surface (DBST) are generally open to traffic yearlong, although there are some closures during the monsoon season on the Narayanghat-Mugling road because of landslides. The length of the existing road from Pathlaiya to Kathmandu is 256km and the trip takes from 5-8 hours depending on vehicle type and conditions. There are two other routes from Hetauda to Kathmandu; one follows the Tribhuvan Highway through Bhaise to Nabise, a road with severe grades and poor alignment with a rough pavement. This road has frequent closures in the rainy season because of landslides. The Tribhuvan Highway carries little traffic, is 135km long from Hetauda to Kathmandu and typically takes 4-5 hours. The second route leaves the Tribhuvan at Bhaise and goes through Bimphedi, Kulekhani, Chisari Pass and Pharping to Kathmandu. It used mainly by light four wheel drive passenger vehicles and small pickup trucks. The road is only sealed for part of its length, is susceptible to landslide in the monsoon season, and is very hilly and winding; however, it does provide a shorter and quicker route for this type of traffic. It is not suitable for medium/large buses or trucks. It is 91 km in length and the journey time from Kathmandu to Hetauda is about 4 hours in good weather.
2. The new road will provide a shorter, faster, safer route from the capital Kathmandu to the major border crossing with India at Birgunj and a new fast direct route from Kathmandu to the flat fertile plains of the Terai.
3. Quantifiable benefits from the new alignment are therefore mainly from road user cost savings. Although there will be a considerable toll differential, diversion to the expressway is expected to be substantial.
4. Traffic count data were collected from a number of sources to estimate base year traffic levels for each road section. These sources included traffic counts carried out specifically for this Study; manual classified counts, origin and destination (O&D) surveys and route choice surveys. The traffic count data was used to provide estimates of current traffic levels on the existing roads and to determine characteristics of vehicles and their loads for calculating road user savings and axle loadings.
5. Traffic on the existing road is heavy (9,800 pcu/day south of Hetauda including local traffic), and has a high proportion of long distance medium to heavy goods vehicles traveling from the Indian border to Kathmandu.
6. A traffic demand model was constructed and normal traffic forecasts for 2014 (the expected year of opening), 2024 and 2034 were developed based on GDP growth estimates and demand elasticities for passenger and goods trips of 1.5 and 1.4 respectively for the period 2008-14, dropping to 1.45 and 1.3 for the period 2024-34. Generated traffic, i.e. trips made as a result of the increased capacity provided by the expressway, were estimated using price elasticities of -0.7 and -0.8 for passenger and goods traffic respectively. Local traffic was

added to traffic on the main existing road in both the project and without-project cases proportionate to the intrazonal traffic on each road link. This was estimated from the traffic counts and O&D surveys.

7. Projected overall normal growth of passenger and freight traffic was 6.6 and 6.2 percent respectively from 2008-14, rising to 7.25 and 6.5 percent by 2024
8. Ramp up⁸ is often a factor on toll roads. Although not expected to be severe in this case – most drivers will see the new road as an awaited improvement to the network – factors of 90 and 95 percent for 2014 and 2015 respectively where applied to diverted traffic to the new road.
9. Of importance is the proposal to build a new international airport at Nijgadh, 17km from Pathlaiya on the East-West highway and close to the junction of the proposed new road alignment with the highway. A major requirement of the construction would be the provision of a fast high class road to Kathmandu. With the construction of the project road the construction of the new airport becomes more likely. Estimates were made of traffic generated by this new development using existing airport flows and projections of passenger and freight growth produced in the planning study for the airport. These were converted to passenger and freight traffic on the project road.
10. There are no railways in the project area and no navigable rivers.
11. Using results from the ‘perceived cost’ interview survey and diversion curves, the amount of traffic diverting from the existing roads to the new project road was estimated for a range of tolls (**Appendix 15**).
12. Using the base toll, the traffic on each of the new road links is shown in Table A14.1. Between 2014 and 2024 the average annual growth rate (ignoring ramp up) is 6.9 percent and from 2024 to 2034 it is 5.9 percent. (**Supplementary Appendix 6**)

Table A14.1: Average Annual Daily Traffic of Project Road

(passenger car units)

Link		2014		2024		2034	
		Pass	Freight	Pass	Freight	Pass	Freight
Kathmandu	Kulekhani River	3,643	6,580	8,445	12,953	16,550	22,185
River	Malta	3,003	6,542	6,807	12,829	13,352	21,944
Malta	Budne	2,959	6,529	6,693	12,802	13,128	21,875
Budne	Shripur	2,565	4,702	5,888	9,214	11,553	15,823
Shripur	Nijgadh ^a	1,788	4,578	3,873	8,969	7,588	15,187
Nijgadh	Pathlaiya ^b	964	3,538	1,961	7,141	3,949	13,404
Budne	Hetauda	632	1,950	1,420	3,836	2,787	6,605
Kulekhani	Connector	0	0	1,468	85	2,862	139

a. Hetauda connector

b. Upgraded E-W Highway. Excludes local traffic

Source: PPTA consultants' estimates

⁸ Ramp up is the propensity for some traffic not to immediately transfer from the existing road to the expressway. It often takes a few years for the full potential of expressway traffic to be realized.

B. ECONOMIC ANALYSIS

13. The proposed project will be implemented over approximately 5 years. The economic appraisal covers the construction period and 20 years' operation with construction from 2009 to 2013, and first year of benefits in 2014. The appraisal compares a project case (with the new road) with a without-project do minimum alternative, comprising limited investment on the existing routes from Kathmandu to Pathlaiya. A 12 percent discount rate is used throughout. Traffic will, in the without-project case, use the existing national highways, which will become increasingly congested and expensive to maintain as traffic increases. Some travel may not take place because of congestion and the resulting increased travel times and vehicle operating costs (VOCs). With the project, congestion on existing roads will be reduced and traffic on both the project road and the existing roads will benefit from faster, cheaper and safer travel. Additional trips will be generated as the economy responds to lower transport costs.
14. The Phase 1 evaluation was used to compare the different alternative route options. The Phase 2 evaluation compared the selected alignment only. Evaluations in both Phases were similar. The Phase 2 evaluation used first quarter 2008 prices. A shadow exchange rate factor (SERF) of 1.1 was used to convert border prices to domestic economic prices. With a financial exchange rate of US\$1 = NRs 63.25⁹, this gives a shadow exchange rate of NR 69.5. This is used to derive the economic cost of the principal tradable items. All other cost items were valued at domestic prices less taxes with the exception of (i) unskilled labor, (ii) fuel and (iii) the capital cost of vehicles. Unskilled labor is priced using a shadow wage rate factor of 0.67. The financial base cost of the four lane option plus land and physical contingencies is NR 59,946m and the economic cost NR 57,329m, implying a conversion factor of 0.96. For the option where the road is constructed initially at two lane and then upgraded to four lane by 2018 the financial cost (final four lane upgraded cost) is NR 60,180m and economic cost NR 57,550m, with the same implied conversion factor.
15. Expressway benefits to "normal" traffic (i.e. traffic that would have been present in the do nothing case) result from improvements in road and traffic conditions between the do nothing and project case and amount to savings in (i) VOCs, (ii) personal travel time for vehicle occupants (other than drivers and crew, whose costs are included in VOCs), (iii) road accident costs resulting from limited access and a good alignment and (iv) the value tied up in freight during transit. In addition there are the benefits of additional trips made solely as a result of the lower costs brought about by the project ("generated" traffic) and the gains to the expressway as a result of traffic being produced through new development projects arising because of the expressway construction.
16. The economic evaluation made use of the EcEval model to estimate travel costs and times on each link for each forecast year, with and without the proposed expressway. EcEval is a standard economic evaluation spreadsheet used in numerous ADB-financed PPTAs and is more suitable for high speed road evaluation with a disperse network than other models such as HDM-4.
17. The estimated economic internal rate of return (EIRR) of the immediate four lane project is 31.1 percent, well above the 12 percent threshold rate. This reflects the very high savings in distance and time on the new road. Using the 12 percent discount rate it has a net present value (NPV) of NRs 172,198m at 2008 prices. Of the total benefits, 90.8 percent are VOC

⁹ March 2008

savings to normal traffic, 7.6 percent savings in passenger time costs, 0.1 percent accident cost savings, 1.5 percent generated and development traffic benefits, and 0.1 percent savings in inventory costs in transit.

18. The estimated economic internal rate of return (EIRR) of the immediate two lane project, upgraded to four by 2018, is 35.87 percent; also well above the 12 percent threshold rate. The slightly higher EIRR of this option reflects the reduced initial investment in the 2010-2013 period. Using the 12 percent discount rate it has a net present value (NPV) of NR 177,569m at 2008 prices.
19. The results of sensitivity analysis confirm the robustness of the project's economic viability: changes in the key variables—construction costs, 1-year delay in completion, and benefits do not significantly affect the economic viability (Table A14.2 and A14.3). For the EIRR to fall to 12 percent, either (i) costs would have to be 5.3 times higher, or (ii) benefits reduced by over 100 percent lower or (iii) tolls over two hundred percent higher (than the central estimate used in the evaluation).
20. A Monte-Carlo risk analysis was used to estimate the frequency distribution of EIRRs. Each uncertainty factor (such as investment cost, traffic growth, accident savings etc) was varied at random within defined limits. The results of the risk analysis for the four lane option showed with these uncertainties, that (i) the mean EIRR for the whole project is 27.7 percent, (ii) the probability of the EIRR falling below 12 percent is zero percent and (iii) the maximum EIRR is 32 percent.

**Table A14.1 Economic Internal Rate of Return
(constant 2008 economic prices, domestic numeraire, NR million)
Four lane Option**

Year	Project Costs	M'nance Costs	VOC Savings	Time Savings	Generated Benefits	Net Benefits
2009	2,610.8	0.0	0.0	0.0	0.0	-2,610.8
2010	7,849.7	0.0	0.0	0.0	0.0	-7,849.7
2011	16,838.6	0.0	0.0	0.0	0.0	-16,838.6
2012	18,822.0	0.0	0.0	0.0	0.0	-18,822.0
2013	10,487.0	0.0	0.0	0.0	0.0	-10,487.0
2014	721.0	346.1	12,632.9	283.2	43.2	12,006.9
2015	0.0	358.9	15,418.5	420.7	64.3	15,667.6
2016	0.0	372.2	18,698.5	606.3	95.3	19,160.3
2017	0.0	386.1	22,524.4	853.8	141.0	23,275.8
2018	0.0	400.6	27,024.2	1,183.6	208.0	28,169.5
2019	0.0	415.6	32,307.0	1,620.5	291.4	33,970.6
2020	0.0	431.3	37,706.4	2,151.5	408.3	40,016.3
2021	0.0	581.6	43,899.0	2,834.7	572.1	46,921.7
2022	0.0	464.7	50,994.5	3,711.1	801.6	55,258.6
2023	459.0	482.4	59,117.7	4,832.9	1,123.1	64,369.9
2024	0.0	500.8	68,409.6	6,265.7	1,573.6	76,211.2
2025	0.0	519.6	75,526.8	7,202.5	1,701.6	84,422.4
2026	0.0	539.2	83,383.2	8,276.4	1,840.0	93,525.4
2027	0.0	559.5	92,055.4	9,506.8	1,989.6	103,617.9
2028	0.0	772.9	101,628.2	10,915.8	2,151.4	114,616.1
2029	0.0	602.7	112,194.9	12,528.4	2,326.3	127,217.0
2030	0.0	625.7	123,858.5	14,372.8	2,515.5	140,977.4
2031	0.0	649.6	136,732.7	16,481.2	2,720.1	156,237.8
2032	0.0	674.5	150,943.0	18,889.6	2,941.3	173,162.4
2033	0.0	700.5	166,627.9	21,638.8	3,180.4	191,933.5
2034	-19,728.9	0.0	0.0	0.0	0.0	19,728.9
NPV 12%	38,935.6	1,916.6	192,693.7	16,041.3	3,098.7	172,197.7
				EIRR		31.10

**Table A14.2 Economic Internal Rate of Return
(constant 2008 economic prices, domestic numeraire, NR million)
Two lane Option, with upgrading by 2018.**

Year	Project Costs	M'nance Costs	VOC Savings	Time Savings	Generated Benefits	Net Benefits
2009	2,367.4	0.0	0.0	0.0	0.0	-2,367.4
2010	5,162.9	0.0	0.0	0.0	0.0	-5,162.9
2011	10,707.9	0.0	0.0	0.0	0.0	-10,707.9
2012	12,056.7	0.0	0.0	0.0	0.0	-12,056.7
2013	6,265.9	0.0	0.0	0.0	0.0	-6,265.9
2014	461.2	346.1	12,531.4	272.5	36.8	12,147.9
2015	3,112.4	358.9	15,318.1	409.4	55.7	12,434.7
2016	6,896.4	372.2	18,600.8	594.5	83.9	12,142.8
2017	7,471.2	386.1	22,431.2	841.9	126.2	15,684.5
2018	3,047.6	400.6	26,937.7	1,171.7	189.1	25,004.4
2019	0.0	415.6	32,229.5	1,608.9	269.2	33,859.3
2020	0.0	431.3	37,642.1	2,141.0	383.2	39,916.3
2021	0.0	581.5	43,850.4	2,825.7	545.6	46,837.6
2022	0.0	464.7	50,964.6	3,704.3	776.8	55,197.1
2023	459.0	482.4	59,109.6	4,829.1	1,106.0	64,340.9
2024	0.0	500.8	68,427.1	6,265.8	1,574.7	76,229.8
2025	0.0	519.6	75,546.4	7,202.6	1,702.7	84,443.2
2026	0.0	539.1	83,405.1	8,276.5	1,841.2	93,548.6
2027	0.0	559.5	92,079.9	9,507.0	1,990.9	103,643.9
2028	0.0	772.9	101,655.6	10,916.0	2,152.8	114,645.1
2029	0.0	602.7	112,225.5	12,528.6	2,327.9	127,249.4
2030	0.0	625.7	123,892.7	14,373.1	2,517.2	141,013.6
2031	0.0	649.6	136,770.9	16,481.5	2,721.8	156,278.2
2032	0.0	674.5	150,985.7	18,890.0	2,943.2	173,207.4
2033	0.0	700.5	166,675.6	21,639.3	3,182.5	191,983.7
2034	-19,409.9	0.0	0.0	0.0	0.0	19,409.9
NPV 12%	33,255.1	1,916.5	192,466.8	16,008.0	3,050.0	177,568.7
EIRR						35.87

Table A14.2: Sensitivity Analysis

Scenario	2 Lane Road + Upgrading		Immediate 4 Lane Road	
	EIRR	Switching Factor	EIRR	Switching Factor
Base Case	35.9		31.1	
Sensitivity Tests				
(i) Capital Costs increase by 20%	32.7	5.9	28.4	5.3
(ii) Benefits reduced by 20%	32.0	13.4	27.9	13.4
(iii) Exclusion of time-saving benefits	35.0		30.3	
(iv) Exclusion of generated benefits	35.7		30.9	
(v) Capital costs + 20% and benefits – 20%	29.1		25.4	
(vi) Exclude airport traffic.	35.8		31.1	
(vii) Low GDP growth	30.9		26.7	
(viii) Case (v) + (vii)	24.5		21.4	

EIRR = economic internal rate of return, NPV=net present value.

.^a Switching value indicates the percentage increase in a cost item (or decline in a benefit item) required for the NPV to become zero.

Source: PPTA consultants estimate.

**Table A14.3 Sensitivity to Toll Rate Change
Four Lane Road**

EIRR%	Ratio of Base Toll									
	0.5	0.75	1.0	1.25	1.5	1.75	2.0	2.5	3.0	
EIRR%	32.7	31.5	31.1	30.7	29.1	24.5	19.1	11.4	<10	

TOLLS, FINANCIAL PROJECTION AND ANALYSIS

A Tolls

1. Collecting tolls is an equitable process for financing high class roads. Users of the toll road benefit directly from the tolls via an enhanced and improved road system, drivers that choose to use an alternative toll-free route to reach their destinations also benefit from the congestion relief on the existing roads.
2. It is proposed that users of the project road be charged tolls. It has been assumed that these would vary according to distance and vehicle category. A single set of charges per kilometer will apply for the whole road section from Kathmandu to Nijgadh. Tolls would not be levied on the upgraded Nijgadh- Pathlaiya section of the East West Highway (EWH), or on travel on the connection from Shripur (Budne) to Hetauda.
3. Only three sections of the national road network are tolled at present, all are part of the existing highway from Hetauda to Kathmandu. The toll rates for these sections are set by the Roads Board Nepal. These are set after road improvements are carried out and the toll rate is theoretically selected to take account of the reduction in vehicle operating costs on the improved road. Tolls are reviewed periodically but toll rate revision does not seem to follow any economic index but is influenced by political decisions.
4. It is proposed initially that the Project road will have an open toll system with main line toll plazas at Kathmandu just south of the interchange connection with the outer ring road, and at Nijgadh, just north of the interchange connection with the EWH. There would be no toll plaza on the Hetauda connection or on the Shripur Interchange ramps. The system can be easily changed to a closed toll system later, if required, when additional interchanges are constructed.
5. Toll setting is a compromise between financial and economic aims. For example, tolls may be set such that cash flows are sufficient to achieve adequate debt service covers and generate agreed returns to shareholders, but no higher. This approach minimizes demand distortion and maximizes the EIRR subject to meeting financial criteria. A potential problem with this pragmatic approach is that of timing: the economic value of a new road increases over time, while the project is at its most financially vulnerable immediately following opening.
6. Toll levels in other countries depend to a large extent on whether the toll road is public or private. For public toll roads the rates tend to not be economically set and do not necessarily depend upon the revenue paying for the road. Often the road is already built and paid for and the revenue is required for future expansion of the network. In this case tolls are often set low for full public acceptance of a new toll. Where the aim of the toll is to repay the cost of the road, however, the toll rate is set at an economic level.
7. For each one way trip from Kathmandu to Pathlaiya the average passenger vehicle cost saving would be over NRs 5,000 and the average freight vehicle cost saving would be over NRs 5,500. However operators and, in particular, private vehicle drivers do not normally recognize the true value of vehicle operating costs savings but only consider those savings that are obvious such as fuel and oil and time, the "perceived costs" of travel.
8. The perceived cost survey carried out during the TA gave some assessment of the effect of toll levels on travel choices, however, it is accepted that in these type of surveys transport operators and owner drivers will typically understate the amount they would be willing to pay to travel in the hope of influencing the final toll rates selected. Even so, the survey did show that freight and bus operators would be willing to pay toll rates approaching the base rates selected, whereas private motor cycle and car drivers would only be prepared to pay a nominal amount.
9. The new road will provide a distance saving of around 160 km for a trip from Kathmandu to Pathlaiya so there will be considerable fuel saving for each vehicle type. It is estimated that savings in fuel will range from 15 liters for a private car to 80 liters for a heavy truck, or NR 1,500 to 6,000 respectively (\$24 to \$95)

10. Based on the surveys carried out and the estimated fuel cost savings a recommended base set of tolls were established for the road for the purpose of the financial evaluation. Sensitivity test were carried out to examine the effect of raising or lowering the base rates. Assumptions in setting toll rates include:

- a single set of toll charges per kilometer will apply to the entire new road except as noted above. Nominal values in 2008 are shown in Table A15.1;
- existing roads will not be tolled, nor will the tunnels be tolled separately;
- Using the vehicle mix percentages measured in the traffic surveys these toll rates would give an average toll in 2014 (2008 prices) of 19.6 NRs per pcu-km for passenger traffic, 21.4 NR per pcu-km for freight traffic or 20.5 NR per pcu-km for the total traffic flow.

Table A15.1 Base Trip Toll Rates Assumed (NRs)

Trip	MC	Car	LB	MB	HB	LT	MT	HT
Rate/km	2.37	10.52	10.52	17.11	23.68	10.52	17.11	23.68
Kathmandu Plaza	100	500	500	800	1,100	500	800	1,100
Nijgadh Plaza	80	300	300	500	700	300	500	700

Source: consultants' proposals

B. Financial Analysis

11. The project financial evaluation and financial projections are in accordance with ADB's Guidelines for the Financial Governance and Management of Investment Projects. FinEval, a financial program designed specifically to evaluate toll road highways and expressways, was used to undertake the evaluation. It is assumed that the expressway will be operated by a financially autonomous entity responsible for both investment and operations. The evaluation period is the same as that used for the economic evaluation, while projections cover construction plus ten years' operations. The financial evaluation is at constant first quarter 2008 prices and the projections at current prices. The base case exchange rate is US\$1 = NR63.25, the parity in March 2008, and is not varied throughout the evaluation period.

Financing Plan

12. Financing for the Project road has not yet been determined. It is understood that Government may call for invitations for a BOT project. Based on this the financial analysis has been carried out for two scenarios (i) assumes an ADB loan of 4.6 percent of the project cost and a foreign loan for 55.2 percent of the project coat, both at an assumed 5 percent interest rate, a Government equity of 4.6 percent and a domestic loan for the balance at 6.25 percent (Rasta Bank long term rate), (ii) assumes just a foreign loan for 100 percent of the project cost. Table A15-2 shows the tentative Project road financing plans in NR and US\$ based on this possible funding. The financing plans assume an initial four lane road.

Table A15.2 Project road financing plan

Plan	Total amount required	Government Grant	ADB Loan	International Loan	Domestic Loan
Plan 1					
\$US mill	1,036.5	49.5	50	600	337
NR mill	76,043	3,652	3,659	43,916	24,816
%		4.6	4.6	55.2	35.6
Plan 2					
\$US mill	1,118	-	-	1,118	
NR mill	82,548	-	-	82,548	-
%				100.0	

13. The post-tax weighted average cost of capital (WACC) corresponding to the financing plan 1 in Table A15.2 and calculated according to current ADB guidance is 4.69 percent, that for Plan 2 is 4.5 percent.
14. Note that these financing plans are hypothetical at present as funding sources have not yet been decided by Government.

Financial Evaluation

15. The financial internal rate of return (FIRR) for the project road is based on estimated incremental revenues and costs resulting from the construction and operation of the expressway. The assumptions for calculating the FIRR (in addition to those outlined above) are as follows:
- (i) the base toll at 2007 prices is 20.5 NR per pcu-km;
 - (ii) tolls are indexed every five years, but eroded by retail price inflation between increases;
 - (ii) losses resulting from exemptions account for 10 percent of revenue in the first year falling to 5 percent by year three;
 - (iii) other income (from advertising, fuel sales, penalties imposed on overweight vehicles etc) amount to 5 percent of toll income;
 - (iv) ramp up is applied at 90 and 95 percent of full estimated traffic volume for 2014 and 2015 respectively;
 - (iv) FIRRs are calculated after business taxes and corporate income tax;
 - (v) capital costs include all incremental capital expenditures (civil works, equipment, land acquisition and resettlement, consulting services, and physical contingencies) as well as periodic maintenance costs, but price contingencies and borrowing fees are excluded;
 - (vi) operation and maintenance expenses include all incremental costs necessary for operating the road, but exclude depreciation provisions;
 - (vii) periodic maintenance is assumed to be necessary in 2021 and 2028 and equipment replacement in 2024; and
 - (viii) projected annual operating revenues are estimated in real terms based on the discounted weighted average toll rate and the traffic forecast. Real increases in toll rates are not assumed.
16. The base case FIRR for the immediate four lane option is 14.57 percent (pre-tax), 13.57 percent (after business taxes) and 12.91 percent after all taxes. For the two lane option with immediate upgrading to four lane by 2018 the FIRRs are 16.42 percent, 15.25 percent

and 14.26 percent respectively. Thus the FIRR exceeds WACC in all taxation cases – see Table A15.3 and A15.6.

Table A15.3: Base Case FIRR compared to the Project WACC

	Pre tax	Post business tax only	Post business tax and corporate income tax
FIRR: Four Lane	14.57	13.57	12.91
FIRR: Two Lane + upgrading	16.42	15.25	14.26
WACC (post corporate income tax)	-		4.69

17. Sensitivity analyses were conducted based on full indexation of tolls and on alternative toll scenarios. The results are summarized in Table A15.4 for the 4 lane option.

Table A15.4: FIRR under alternative toll scenarios (percent)

	Post business taxes	Post all taxes	NPV Revenue (@ 12%) NRm
FIRR, percent: full indexation	14.42	13.73	
Base case tolls x 0.50	9.27	8.78	32,481
Base case tolls x 0.75	11.50	10.90	42,595
Base case tolls x 1.25	15.25	14.27	63,833
Base case tolls x 1.50	15.59	14.80	66,059
Base Case Toll x 1.75	13.61	12.91	53,383
Base case tolls x 2.0	10.89	10.31	39,668

Source: consultants' estimates

18. Table A15.5 shows development of an adverse conditions scenario for the four lane option.

Table A15.5: FIRR under adverse conditions scenarios (percent)

	Post business tax only	Post business tax and corporate income tax	NPV Revenue (@ 12%) NRm
Base case (for comparison)	13.57	12.91	53,674
10% increase in costs	12.70	12.06	53,674
Opening delayed by a year	13.58	12.89	51,013
10% less traffic	12.61	11.95	43,307
Combined adverse conditions	11.80	11.20	41,812

Source: consultants' estimates

Annex A15-6: Financial Internal Rate of Return (Constant NR million)**Four Lane Road**

Year	Capital investment	Operating & maintenance costs	Average toll in CNY/pcu-km	Gross revenue	Business tax	Net cash flow	Corporate income tax	Net cash flow after corporate income tax
2009	2,730					(2,730)		(2,730)
2010	8,208					(8,208)		(8,208)
2011	17,607					(17,607)		(17,607)
2012	19,681					(19,681)		(19,681)
2013	11,684					(11,684)		(11,684)
2014		192.8	20.50	5,253	525.3	4,535		4,535
2015		201.1	19.52	5,714	571.4	4,942	46	4,895
2016		209.8	18.59	6,216	621.6	5,384	119	5,265
2017		219.0	17.71	6,761	676.1	5,866	192	5,674
2018		228.5	16.87	7,742	774.2	6,739	303	6,436
2019		234.2	26.16	10,388	1,038.8	9,115	565	8,549
2020		244.4	24.92	11,162	1,116.2	9,802	658	9,144
2021	182	255.0	23.73	11,994	1,199.4	10,358	760	9,598
2022		266.3	22.60	12,889	1,288.9	11,334	864	10,470
2023		278.0	21.53	13,850	1,385.0	12,187	966	11,221
2024	480	285.0	33.39	17,508	1,750.8	14,992	1,320	13,672
2025		294.0	31.80	18,690	1,869.0	16,527	1,445	15,081
2026		303.3	30.29	19,951	1,995.1	17,653	1,625	16,028
2027		313.0	28.85	21,298	2,129.8	18,855	1,761	17,095
2028		322.9	27.47	22,736	2,273.6	20,139	1,907	18,232
2029		328.8	42.62	30,940	3,094.0	27,517	2,658	24,858
2030		338.0	40.59	30,947	3,094.7	27,514	2,680	24,834
2031	182	347.6	38.66	30,954	3,095.4	27,329	2,704	24,625
2032		357.4	36.82	30,961	3,096.1	27,508	2,702	24,806
2033		367.6	35.06	30,969	3,096.9	27,504	2,726	24,778
2034	(23,160)	378.2	54.39	50,456	5,045.6	68,192	4,393	63,799
PV at 12%:	39,567.6	1,067.3		53,674	5,367.4	7,672	3,370.1	4,302
		FIRR pre income tax:		13.57%			FIRR post income tax:	12.91%

Financial Projections

19. The assumptions to be used for financial projects are set out in **Supplementary Appendix 8**.
20. Base case financial statements for Financing Plan 1 are set out in Tables 8.B1-1 to 8.B1-3 at the end of this Supplementary Appendix. For both plans profitability, though affected by high interest charges and high depreciation charges is strong; profit before interest and tax (PBIT) is positive in 2014, while net profit is positive in 2015, i.e. after one year of operation.
21. Cash flows are also satisfactory. A small amount of short term borrowings is required in the first two years of operation, however the annual debt service cover ratio (ADSCR) is satisfactory, exceeding 1.0 in 2016; the usual benchmark ratio of 1.2 is exceeded in 2017.
22. Such a result amounts to a conclusion that the project is financially viable. This was to be expected from the good FIRR. It could attract private sector support depending on how it was structured. All the debt is satisfactorily redeemed well before the end of the evaluation period.
23. Financial viability is summarized in Table A15.7.

Table A15.7 Base case financial viability

Parameter	Assessment
<u>Plan 1</u>	
Profit	PBIT > 0 in 2014; net profit >0 in 2015
Need for short term external financing	Small in 2014 and 2015
ADSCR ^a	0.74 on opening, >1.0 in 2016, >1.2 in 2017
Discounted return to equity	Dividends starting in 2020
Return on net assets ^b	23.6%
<u>Plan 2</u>	
Profit	PBIT > 0 in 2014; net profit >0 in 2015
Need for short term external financing	Small in 2014 and 2015
ADSCR ^a	0.72 on opening, >1.0 in 2017, > 1.2 in 2019
Return on net assets ^b	23.1%

Notes:

(a) ADSCR = (cash collected - O&M costs - taxes - essential capital expenditure)-long term debt service charge. Calculated on long term debt only.

(b) Profit before interest and tax÷net assets. The weighted average is an arithmetic average and takes no account of the time value of money. It is calculated over the period 2009-2024

(c) PBIT = Profit before interest and tax

1. Sensitivity tests

24. Sensitivity to the following was tested:

- NR appreciation;
- reduced traffic;
- investment and O&M cost overruns; and
- a combination of the above.

25. Sensitivity results are shown in Table A15.8 for the four lane option and Financing Plan 1.

Table A15.8 Results of sensitivity tests

Test	Year	ADSCR over 1.2	Return on net assets
Base case	2017		23.6%
a. NR appreciation of 10 percent	2017		21.9%
b. NR appreciation of 20 percent	2017		21.9%
c. Traffic reduced by 10 percent	2018		19.3%
d. Costs increased by 10 percent	2018		19.5%
All the above b+c+d	2018		17.4%

Source: consultants' estimates

2. Sensitivity to changed toll levels

26. Lower prices reduce financial performance if demand is less than perfectly elastic. As it is known that demand is relatively inelastic at low tariff levels, a sharp deterioration can be expected. Meanwhile, at high toll rates demand is price elastic. Drivers choose not to divert to the expressway and revenues fall. This is evident from the shape of the FIRR curve derived from Table 15.4. Table A15.10 summarizes the results. They confirm a sharp deterioration at toll rates below the base level, particularly in returns on assets and short term borrowings. At 1.5 x the base toll rate – the toll rate that produced the greatest FIRR (see Table A15.4) – performance is considerably better: short term borrowings are almost zero and debt service cover is good.

Table A15.10 Sensitivity to toll rates

Toll scenario	ADSCR >1.2	Return on net assets
Base x 0.5	2019	12.7%
Base x 0.75	2018	17.9%
Base x 1.0 (base case)	2017	23.6%
Base x 1.25 (max FIRR)	2016	28.8%
Base x 1.5	2016	30.0%
Base x 2.0	2019	16.6%

Source: consultants' estimates

PRELIMINARY ENVIRONMENTAL ASSESSMENT (February 2008)

SCOPE OF ENVIRONMENTAL ASSESMENT

1. The Project was reconfirmed as Category A Project¹⁰ in accordance with the *ADB's Environmental Guidelines (2003)*. An Environmental Impact Assessment will therefore need to be prepared including detailed ecological and forestry surveys. Rapid Environmental Assessment was undertaken in May 2007.
2. At the time of writing the Final Report the statutory Scoping Report and ToR under Environmental Protection Rules (1997 as amended) had been submitted but were not approved. Therefore any preliminary environmental review made at this stage including any findings and conclusions or reference to ecological and forest surveys, is of a very preliminary nature. The findings reported in this preliminary environmental assessment are based on walkover surveys made in May 2007 and February 2008 by the team without the benefit of the statutory Scoping Report and ToR or any detailed and environmental surveys or detailed plan and profile drawings of the alignment. The recommendations and conclusions are therefore also preliminary and based on observation, rapid ecological assessment and best professional judgment.
3. The environmental impacts are likely to be typical of other large road projects in less developed rural areas. The Project road traverses mainly hilly terrain in rural areas of Kathmandu, Lalitpur, Makawanpur, Bara and Parsa districts. The ADB loan would support the Government's road development program by construction a road over a predominantly new alignment from Kathmandu to Pathlaiya and the environmental assessments have covered the construction in the five districts in detail.

DESCRIPTION OF THE PROJECT AND ENVIRONMENT

4. The Project road comprises about 76km length of newly constructed road (Kathmandu to Nijgadh) and widening approximately 18km of the existing Mahendra Highway (Nijgadh to Pathlaiya). The new road will form the major north - south road from Terai to and from Kathmandu (about 112km) and there will be a spur road from about 55km south of Kathmandu to Hetauda. The roads will be access controlled and tolled. The Project road passes near to many village and market areas with significant human habitation and close to water resources and through open scrublands, forest areas and several landslide areas. Critically sensitive areas will be protected by a complex series of engineering and bioengineering controls and environmental mitigation measures within the 50m RoW.
5. Environmental impacts in the construction phase will result mainly from (i) new construction of the earthworks and blasting for road and tunnels within the ROW; (ii) creating and improving drainage in village and at other key areas; (iii) constructing causeways and bridges across more than 125 streams and rehabilitating numerous causeways and culverts; (iv) constructing geotechnical landslip stabilization works; (v) constructing bus and truck stopping areas; (vi) creating bioengineering, landscape and accessories; (vii) compensatory planting for forests (viii) consumption of local resources and (ix) nuisances and impacts from the work force and at work camps.
6. The whole length of the roads and hard shoulders will be surfaced with bitumen and typically about 25%-30% of the road lengths will also have other drainage and improvement measures installed. The new road alignment is expected to reduce travel

¹⁰ Category A projects are deemed by ADB's chief compliance officer to be environmentally sensitive for the purposes of (i) the 120 day rule, and (ii) the environmental management plan requirement could involve projects that are in environmentally sensitive areas.

times from Kathmandu to Terai by several hours with better traveling conditions and less wear a tear on vehicles. Thus fuel consumption per journey and consequent transport emissions can also be reduced.

7. The Project road starts near the Bagmati River in Kathmandu valley and runs more or less south towards more mountainous Siwalik areas along some flat areas and then into the steeper sided slopes of the Bagmati River valley. There are few other good roads in these areas but there are some fair weather earth surface road tracks that are plied by buses and other vehicles and many walking trails. There are short sealed sections and side drainage in some places. The Project road passes through flat agricultural land near villages, cultivated land in the alluvial river valleys, terraced fields in the hills and forests. Agriculture manufacturing and brick making are the main economic bases of the villages in the Bagmati district. Forestry, local fisheries and other craft based cottage industries are the next most common sources of employment in the areas of Makawanpur. As the road descends towards Nijgadh there are open areas of scrubland and some cultivated areas and more forest. There are continuous stretches of forest from about km40 to km52 and from km68 to km75 where a swathe of trees must be cut to create the road. In some flat areas all of the 50M RoW may not need to be cut, but there is still a significant requirement for off-site compensatory planting. In hilly areas the cut slopes may take a much larger area of forest but in either case the transfer of land to the DoR will require that the forest resources are enumerated and compensated for prior to construction.
8. Through the whole of the alignment there are more than 40 substantial settlements where significant potential environmental and social impacts may occur. In addition the ecological resources of the forests and rivers are a concern. However ecological surveys have shown that the areas either side of the road are in many cases disturbed, grazed by cattle and degraded in comparison to the deep remote forest hinterland. The traffic in future will not be excessive and overall the impacts can be managed with acceptable and minor residual effects.

ENVIRONMENTAL IMPACTS AND MITIGATION

9. Mitigation measures will be spelled out in the EMP which will be prepared taking into account the capacity of the DoR Geo-environmental unit. As of March 2008, DOR had three fulltime environmental staff members under its Geo-Environmental Unit.

Construction Impacts

Physical Environment

10. To minimize impacts associated with the extraction of raw materials selection criteria have been recommended with preference being given to target areas which will require less rehabilitation and contractors must present their plans in advance. Top soil will be stripped and set aside for rehabilitation. Borrow sites will be rehabilitated, including replacing the topsoil and planting cover vegetation.
11. Earthwork and rock crushing activities will be extensive and will inevitably increase dust and potential nuisances. Pavement works will generate gasses from hot-mix plant. The existing air quality of the project area is good and although most sensitive receivers are set well back from the alignment, mitigation measures are needed. Rock crushing, aggregate and asphalt plant and bitumen mixing facilities shall be located at least 500m from settlements and dust suppression shall be maintained by watering the construction areas. Deliveries of construction materials and removal of spoil materials will be transported in covered trucks and storage sites and worker camps will be away from human settlements. The mass balance of cut and fill shall be efficiently planned in advance to maximize the reuse of extracted materials and minimize the use of additional external rock based

mineral resources and the contractors will produce a materials management plan one month for agreement with CDGK one month before the start of construction.

12. Based on the likely construction methods some blasting will be required and professional judgment suggests that the separation distance from the construction areas to sensitive receivers may not in all cases provide sufficient distance for adequate dispersion of ground vibration and noise to avoid impacts. Likewise construction works near some settlements and schools will create noise and air quality impacts well above those experienced at present such that the acceptable environmental standards for air quality and noise will be difficult to achieve in the construction phase without good mitigation measures. A suite of vibration, noise and dust mitigation measures and a detailed EMP has been proposed to mitigate these construction impacts to acceptable levels. A safety plan and monitoring of vibration and noise during blasting have also been proposed. One way to reduce noise impacts from construction would be to use local hand labor methods as far as possible. However this may not always be practicable. Working at night should also be discouraged but may be essential in some cases such as in tunnel construction. Mitigation measures for all foreseeable construction have been proposed in the EMP to minimize noise vibration and air quality impacts. Equipment will be located to minimize nuisances and portable noise barriers will be used to limit noise at sensitive receivers such as schools and hospitals. For nearby schools, the contractor shall discuss with the school principals the agreed time for operating these machines and completely avoid machine use near schools during examination times.
13. No significant effect on groundwater is expected from construction or operation. However, construction works should not use the groundwater without prior permission from the local water authority. Where wells or standpipes fed from groundwater have to be disturbed or access to wells is blocked by construction activity, the contractor shall provide alternative or additional wells or standpipes with easy access.
14. To avoid contamination from fuel and lubricants, all vehicles and equipment used during construction will be properly maintained and refueled in dedicated areas. Refueling stations shall be bunded and used and maintained so as to prevent spillage of oil. Drip trays shall be used under equipment during maintenance. A waste management plan shall be compiled to control disposal of all waste including residues of lubricating oil.
15. Surface drainage and irrigation channels affected by road construction will be diverted and or re-provisioned before mainstream construction work begins to avoid disruption of water flows and maintain the irrigation pattern. Temporary diversions of irrigation channels must be constructed and approved before any construction of permanent culverts or other structures is commenced.

Biological Environment

16. The area for the Project is generally one with ecological disturbance due to development of settlements for human habitation, agricultural development or managed forestry. In addition there are large areas of barren hillside. There are no formally protected or sensitive ecological areas identified along the preferred alignment but the alignment is not devoid of residual biodiversity. Many common species of birds, mammals and other genera have been identified near to the alignment but no rare or endangered species that are directly affected. Nevertheless there are some residual areas of remnant biodiversity some areas where some formally protected species such as walnut trees and orchids are found in the alignment. These will need to be transplanted.
17. Unfortunately the removal of thousands of trees is inevitable due to the local terrain and extensive forest resources between Kathmandu and Terai. Whereas the alignment designers have sought to avoid forests as a design principle, clearing of many trees will be unavoidable so that the necessary design standards for gradient and alignment can be met. There are extensive areas of forest that must be replaced and generally slopes

should be re-vegetated and trees should be replanted as soon as construction work allows along a particular section, especially where in embankments or slopes are near landslide run-out areas. Planting during the rainy season will favor establishment and preliminary plans for new trees to be tended and watered until established must be worked out with the local forest authority at the detailed design stage.

18. The EIA will estimate the amounts of trees to be cut and compensated for but at the detailed design stage a more detailed tree census must be carried out to determine the compensatory trees planting in each forest authority and local community forest user group. Compensatory tree planting shall be in areas designated by the DoF in liaison with the local community forest user group or forest owner.
19. In both the forests and in other areas removal of trees can be minimized by keeping the contracted works areas in a narrow band along the alignment corridor. By fine tuning of the detailed designs the least disturbance to trees can be ensured, particularly with regards to good specimens and old and valuable trees.
20. To minimize impacts on fauna and flora, the following mitigation measures will be adopted. No temporary worker camps will be allowed within any forest and will be sited more than 500m from sensitive receivers. No workers will be allowed to enter the forest areas other than for purposes of construction in the appropriate areas. Rare and protected species such as orchids and walnut trees adjacent to the alignment shall be protected and transplanted in line with a programmed as agreed by the DoF in liaison with the local community forest user group or forest owner. No asphalt plants, mixing plants, or rock crushers will be sited within forest areas or within 500m of sensitive receivers. Specimen or religious trees should not be removed. Where communities have requested that certain specimen or religious trees should not be removed, the detailed designers will reexamine the opportunities for the alignment to be adjusted.

Operational Impacts

21. Environmental concerns related to the operation of the road involve noise, air pollution and water pollution. If further road widening of the alignment is planned at some later date, the Project and alternatives should be fully re-examined in an Environmental Impact Assessment Report.
22. The new road will attract modest traffic in the early years but traffic will increase as the country develops. Based on the traffic predictions for up to twenty years after completion, professional judgment suggests that the separation distance from traffic to sensitive receivers should provide sufficient distance for adequate dispersion of traffic fumes such that the accepted environmental standards for air quality can be met. Road traffic noise will increase in all locations near the new road but should be below recommended World Bank criteria (*subject to confirmation*) because the sensitive receivers will generally enjoy sufficient set back from the new road so that road noise can be attenuated.
23. Water pollution can be managed by controlling spill and leakage accidents. To minimize such pollution runoff should be channeled to sand filter catch box at the main river crossings. Elsewhere polluted runoff should be channeled a vegetative filter, such as a grassy area before going to the water bodies. Runoff from the new road must not be entrained into irrigation water systems.
24. For the planned alignment it is important to maintain trees planted along the roadside (bioengineering) as well as in the forests. Tree planting will compensate for the loss of trees and target areas should include degraded forest areas, such that long term there can be some enhancement and an increase in forest resources and habitat. Extensive bioengineering of slopes will be required and extensive planting of trees is envisaged on the slopes where erosion protection works needs to be installed as well as compensatory planting (25:1) in the forests. These measures will require significant planning and

assessment in the detailed design stages to determine the locations and extent of compensatory planting as well as regular slope maintenance throughout the operational phase. Future maintenance plans must ensure that all erosion control measures are functioning and that as many of the planted trees survive as possible and that those that die in the first three years are replaced.

25. The inclusion of warning signage, countdown markers and reduced speeds will contribute to a road safety. Vehicles should not generally be permitted to stop along the road. If stopping facilities are to be provided in the detailed design stages these should be located outside sector where the road passes through forested areas. Nevertheless the provision of some off road stopping facilities for emergencies, and with the acceptance of the local community forest authority, would reduce the chances of collision or fire in the event of a breakdown.

Alternatives

26. The alternative routes are limited by the terrain and have been investigated in Phase 1 studies. All alternatives would have involved much new road and tunnel construction and environmental disruption with some widened roads on alignments near to some major centers of habitation. All the alternative routes investigated (except the Project alignment) would have involved a faster stretch through the buffer area of the Parsa Wildlife Reserve (PWR). The associated impacts would cause further severance to wildlife habitats either side of the Tribhuvan Highway in the PWB buffer and faster traffic would cross migration routes for large mammals (including elephants and leopard) The associated impacts would be difficult to mitigate without slowing the traffic on the Tribhuvan Highway in the PWB buffer which is in direct opposition to the aim of the project. The preferred alignment is more easterly and can avoid the PWB buffer route although there are several forests affected near the Bagmati River, Simat Khola and Bakaiya Khola valleys.
27. Thus other routes, although constructible, would not serve the fast track objectives as well as the current alignment and would also present much greater construction and operational impacts for wildlife. The proposal for the Bagmati River / Simat Khola Bakaiya Khola valleys alignment should present a much more acceptable alternative without insurmountable impacts.

Institutional Requirements

28. Prior to implementation of the Project, DoR needs to comply with several environmental requirements, such as obtaining Ministry of Environment, Science and Technology clearance (approval under Environmental Protection Rules 1997, as amended). DoR will also need to update the EMP in response to any changes or fine tuning of the alignment at the detailed design stage and incorporate the revised EMP in the contracts and ensure that that contractors have complied with all statutory and contractual requirements.
29. The environmental impacts assessment will be prepared later. The alignment has been selected not to pass may pass through any national parks, wildlife sanctuary, world heritage site or other designated environmentally sensitive areas. But some substantial forest areas will be affected. The EIA has estimated the forest areas that will require compensatory planting but the estimates must be updated at the detailed design stage and incorporate the revised EMP and in the contracts to ensure that compensatory planting can be carried out in line with MFCS and community forestry requirements. The EIA process will be completed in line with ADB Guidelines and also ensure that all the GoN environmental requirements and those which have been approved will be funded by the Project. The final plans must be submitted to ADB prior to implementation. All environmental assessment documents should be properly kept as part of the project documentation and made available for ADB and public scrutiny, if requested.

30. In the event that detailed designs require a significantly different alignment in areas that have not yet been investigated in any sector, further detailed environmental impact studies will be required to assess the alternative route in order to avoid environmental impacts and to propose appropriate mitigation measures and reduce residual impacts to acceptable levels.

Public Consultation and Disclosure

31. Preliminary public consultations were conducted in March and April 2008 through the official statutory procedures at the local level. There was some initial general support for the packages and the details of the public consultations will be presented in the EIA in due course.

CONCLUSUION

32. Primary and secondary data are being used to make this preliminary assessment of the environmental impacts based on the preliminary designs. The potential environmental impacts will also be fully assessed in the EIA in a comprehensive manner but still based on based on the preliminary designs. This preliminary environmental review report has provided a picture of many of the potential environmental impacts associated with the Project, and recommended suitable mitigation measures. Further detailed assessment is required in the EIA.
33. The construction of the NSFT road along the prescribed alignment is potentially an acceptable option from the environmental and socioeconomic points of view, however many conditions are likely to be required in the contracts and to assure that environmental impacts can be controlled. The process to complete the EIA is appended to this report (see Annex 1). Environmental impacts associated with the Project need to be mitigated, and the existing institutional arrangements are available. Additional human and financial resources will be required by DoR to complete the review of EMP at the detailed design stage and incorporate the recommendations effectively and efficiently in the contract documents, linked to payment milestones. The EMP review can probably be completed with the existing resources in GEU but additional resources will be needed for construction phase monitoring. The mitigation and management plans that are proposed (EMP) in due course must be practicable
34. As a part of the national network, the road will bring benefits in terms of reduced travel times, improved travel comfort and all sectors will benefit if the condition for the public transportation and trucking fleet improves.

Annex A16.1 CONDITIONS TO PROCESS LOAN

1. If the project is part funded by ADB grant or loan the following review procedure shall be adopted by DoR, MPPW to comply with ADB's environmental safeguard policy **prior to construction.**

a. Progress the submission of the completed statutory EIA with MOEST and include any approval conditions in the EIA and EMP for the Projects.

b. Hire qualified consultants to conduct detailed engineering designs and prepare tenders for contractors.

c. Hire suitably qualified environmental consultant(s) to undertake the necessary review of the EIA and EMP and ensure that the EIA and EMP and all statutory environmental requirements (necessary permits to fulfill environmental protection rules, environmental approval, forest clearance, and water authority/utility clearance) for executing the Project are included in the contract tender documents.

d. DOR to undertake and guarantee that the Project will be notified early to MOEST to allow sufficient time for approval and not be executed unless necessary statutory approvals and permits have been obtained.

e. If the detailed designs require changes to the alignment / bridges / tunnels, submit the environmental screening and Rapid Environmental Assessment to the MOEST an ADB for review and determine if the environmental implications the project are significantly different due to the detailed designs.

f. If the environmental implications are found to be significantly different from the conclusions in the approved EIA report instruct the suitably qualified environmental consultant(s) to review the EIA and EMP in accordance with ADB and MOEST environmental requirements, DOR/MPPW will be given a chance to modify the Project to reduce the environmental impacts and re-submit the environmental screening check list of the modified projects to MOEST an ADB.

g. Prepare a revised EIA and EMP and summary (SEIA) for the Project (as modified) and submit to ADB and MOEST.

h. Identify additional environmental mitigation measures that need to be included in the revised EMP and include them into the contractor's contract document.

i. Submit the EIA and SEIA to ADB and MOEST for environmental confirmation and acceptance.

j. Ensure that the EMP includes requirements that the contractor is instructed to make provisions for effective and efficient execution of the environmental monitoring and management plan and auditing and reporting requirements, including all proposed mitigation measures to be properly implemented.

k. Ensure that EMP includes requirements the check that the contractor has made sufficient provisions to self monitor performance versus the environmental management plan, mitigation measures, complaints and event action (contingency) plans by making it a separate bidding item in the documents and in the contracts.

l. Ensure that that EMP includes requirements the check that the contractor has made provisions to undertake remedial action in line with accepted event action plans and so that close consultation with DOR and ADB can take place efficiently to handle unexpected environmental impacts.

m. Ensure that the EMP includes requirements that the detailed designers has made provisions to prepare the reviews of environmental assessment documents and environmental monitoring documentation in accordance with ADB Environmental Guidelines and MOEST requirements to facilitate reporting at a later stage and keep them readily available, for inspection by ADB, if required.

n. Ensure that the EMP includes requirements that contractors have made provisions

to report on and review environmental mitigation measures, environmental monitoring documentation in accordance with ADB Environmental Guidelines to facilitate reporting at a later stage and keep them readily available, for inspection by ADB, if required. The above shall be updated and amended if necessary to take account of unexpected or unpredicted environmental impacts.

2. The following review procedure shall be adopted by DoR, MPPW to comply with ADB's environmental safeguard policy **after construction has commenced**.
3. DOR, MPPW shall ensure that ADB is given access to undertake reassurance environmental monitoring for the Project, as and when required. However, DOR, MPPW shall be responsible for the impact environmental monitoring and the implementation of environmental mitigation measures for all subprojects.
4. The impact environmental monitoring needs to be systematically documented and documentation provided, as requested by ADB in a timely manner. Where unexpected environmental impacts are encountered, consultation with ADB shall take place at the earliest opportunity and mitigation measures shall be reviewed and implemented thoroughly to control impacts to acceptable levels. The action and the results shall be recorded in writing and included in the environmental monitoring report.
5. DOR, MPPW is responsible for ensuring that all environmental assessment documentation, including the environmental monitoring reports, are properly kept in a systematic manner and are readily accessible to ADB as part of DOR, MPPW project-specific records. A copy of the environmental monitoring reports and records of remedial action, in line with accepted event action plans, shall be kept in the project office.
6. All environmental documents are subject to public disclosure and documents must be made available to the public, if requested.

INSTITUTIONAL REQUIREMENTS AND CAPACITY BUILDING.

A. Project Management and Organization

1. The project road will be the first high class toll road in Nepal. The tolls suggested would raise a significant amount of revenue, a proportion of which would be required for operation and maintenance to keep the road asset in a good and safe condition and also for debt servicing. It will be important therefore for Government to provide a dedicated entity to implement and operate the new road.
2. Two main scenarios are considered as regards organization requirements:
 - Government implementation of the project by raising the necessary funding directly, either loan or a combination of loan and grant, and Government overseeing the implementation of the project ("**Direct Funding**"); or
 - Government award of a BOT concession agreement for the design, construction, maintenance and operation of the project road ("**BOT Funding**")

Direct Funding

3. If direct funding is the preferred option then the main questions for Government to decide are should any operating entity be:
 - A new section within the Department of Roads, with all revenue included in the DoR revenue and expenditure allocated by either DoR or MoF.
 - commercialized (given managerial and financial autonomy but remain a public sector entity and not subject to company law); or
 - corporatized (become a limited liability company subject to company law but with ultimate control remaining with an executive board with public and private sector directors).
4. It is argued in Supplementary Appendix 10 that funding for the project road will need to be raised from a variety of sources, probably a large proportion from the private sector. For a project to attract non-government money, it must be packaged and presented in a form that gives investors, be they private or institutional, comfort that their investment will be properly managed and will provide an acceptable financial return. An essential prerequisite to this is for the project entity to be established as a separate company with its own autonomous management and separate accounts.
5. The suggested organizational structure would start with the establishment of a Highway Board (HB) consisting of representatives of Government, local Government, commercial transport associations, professional associations, the business community and civil society, initially selected by Government.
6. The HB would set up a Project Management Office (PMO) to co-ordinate the finalization of the project, based upon the findings of the detailed feasibility study and preliminary design, and would also take responsibility for the financing plan. It would liaise with MoF and the finance section of DoR in the allocation of Government funds and would liaise with them and possible donors, to finalize the funding plan. The PMO would oversee the detailed design and, possibly, the implementation of the project; however a new management organization should be corporatized at an early stage as a step toward seeking additional investors in the project. After completion of the project, the operation, maintenance and debt servicing of the new road would become the responsibility of the new road management company (RMC). This company would then liaise with MoF, the appropriate Government Department, or a separate regulatory body to set toll levels before the operation of the project road.
7. The RMC should be established in accordance with company law. To be effective in delivering increased efficiency, corporatization needs to impose some private sector disciplines: financial autonomy, hard budgets, rewards earned through merit, etc. The terms and conditions of the RMC would be defined in an operating license issued by the

HB.

BOT Funding

8. If Government decides to invite proposals for BOT concessions for the Project road and if satisfactory proposals are received it is recommended that Government still set up a HB and RMC as set out in the Section on 'Direct Funding' above, to oversee the implementation and operation of the project road.
9. The RMC would be responsible for overseeing all aspects of design, construction, operation and maintenance of the road by the BOT concessionaire. The RMC should initially employ independent consultants with appropriate expertise and experience to assist RMC staff. Eventually RMC should have its own fully trained staff to carry out the work.
10. The RMC board should contain representatives, not only from Government, but also representatives of the major stakeholders who would benefit or be affected by the implementation of the Project road.
11. At the end of the operation period the road would be transferred to RMC for future operation and maintenance.
12. Further details of the suggested operating structures are set out in **Supplementary Appendix 10**.

Capacity Building

13. From the review of past experience and on-going projects supported by various donors, necessary areas of capacity building which are still required in the road sub-sector, and which are particularly relevant to the project, have been identified. The areas proposed for intervention focus on urgent requirements for realizing smooth implementation and operation of the project.
14. The new road will involve some sophisticated and modern techniques both in construction and operation. Some of the skills required are not available in Nepal at the present time. This will be particularly important as this will be the first road project in Nepal with a major tunnel and a sophisticated toll system and, therefore, if direct funding is the option chosen then a significant amount of capacity building and training will be required.
15. In this **direct funding** scenario a competent organization will need to be established for the operation and maintenance of the tunnel and toll works. This organization, which can be part of RMC or subcontracted to it, should be equipped with necessary personnel, maintenance vehicles, equipment and facilities for communication and information. Personnel need to be well trained for respective activities from the construction stage to understand what is being constructed and installed, and be trained for tunnel operation and maintenance, especially for emergency. Training should be carried out in a foreign country which has sufficient experience in this area.
16. As noted previously, if **BOT** is the selected scenario, Government, through RMC, will need to monitor ongoing operation and maintenance of the road and the tunnel by the BOT operator, and also monitor toll operations. Although initially this would be done by independent international consultants, RMC staff should be trained to take over these functions.
17. PSP is usually viewed only in terms of financing. If Nepal is to develop PSP in the transport sector then it must have a development program to expose its senior and mid-level staff to:
 - The opportunities and threats of, and potential benefits from, PSP, particularly in O&M;
 - Performance based highway operation and maintenance standards;
 - Negotiation and content of toll road BOT concessions; and
 - How "monitoring without supervision" operates and delivers what this and other projects might need.

18. The capacity building program, which could be included as part of this project, could take the form of seminars and workshops in Nepal led by international experts, but, to fully understand these new concepts, it will be essential for selected candidates to make visits and undergo training in overseas countries. A suggested program of international capacity building training is set out in **Table A18.1**.

Table A18.1 Capacity Building Program

Subject	Location	Months	Participants
Tunnel Design and Construction	Japan	3	6
Tunnel Operation and Management	Japan	2	3
Toll Road Operation and Administration	India/Malaysia	3	6
Intelligent Transport Systems	Malaysia/Australia	2	3
Private Sector Participation and BOT	Malaysia/UK	2	6