Nepal Fast Track Project

TA 7135-NEP

Mission by Traffic Expert
REVISED DRAFT REPORT

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Abbreviations

AADT	-	Average Annual Daily Traffic
ADB	-	Asian Development Bank
DOR	-	Department of Roads
EOI	-	Expression of Interest
EWH	-	East-West Highway
FS	-	Feasibility Study
GON	-	Government of Nepal
HV	-	Heavy Vehicle
LV	-	Light Vehicle
MOPPW	-	Ministry of Physical Planning and Works
PCU	-	Passenger Car Unit
PPP	-	Public Private Partnership
OD	-	Origin-Destination
NR	-	Nepal Rupee
TA	-	Technical Assistance
TRP	-	Tribhuvan Highway
VOT	-	Value of Time
WB	-	World Bank

Introduction and Background

Background to project

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. Although road transport is the dominant mode for moving passenger and freight traffic in Nepal, road density is low resulting 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. During the 2006 Country Programming Mission of the Asian Development Bank (ADB), the Government of Nepal (GON) requested technical assistance (TA) to carry out feasibility studies and preliminary design of a preferred alignment from Kathmandu to Pathlaiya. This TA was carried out in 2007/2008.

2. The existing road from the Terai to Kathmandu is composed of the Tribhuvan Highway (TRP) from Birgunj, a dry port near the Indian border, north to Hetauda, then west to Narayanghat, north to Mugling and then east on the Prithvi Highway (PRM) to Naubise rejoining the TRP to Kathmandu. The route is sealed with asphalt concrete or double bitumen surface and generally passable to traffic all year round, although there are some closures during the monsoon season on the Narayanghat-Mugling road due to landslides. This corridor is connected to the east Terai and eastern Nepal via the EWH at Pathlaiya, between Birgunj and Hetauda. The length of the existing road from Pathlaiya to Kathmandu is stated in the feasibility study (FS) as being 256km, taking from 5 to 8 hours depending on vehicle type and conditions. At present, the majority of traffic uses this route.

3. There is one main alternative to the above mentioned route that consists of the continuation of the TRP from Hetauda north to Kathmandu via Bhaise, Bhimpedi, Kulekhani and Sisneri. This route is 91km in length but is paved for only part of its length and is considered to be dangerous due to the poor alignment through mountainous terrain and is also prone to landslides during the monsoon season. This route is used mainly for local traffic and convoys of jeeps that carry passengers from Kathmandu to Hetauda and further south in about 3 to 4 hours.

FS 2007/2008

4. In March 2007 the ADB signed a consultancy contract with Oriental Consultants Co. Ltd. of Japan, in association with two Nepalese firms, to carry out the TA for the North-South Fast Track Feasibility and Preliminary Design. The study was carried out in two stages. The first stage required the consultant to analyse all the work done to date and to study alternate alignments, presenting the recommended alignment for consideration by the GON. After acceptance by the GON of the recommendations the consultant remobilised and carried out further investigations and preparation of preliminary designs for the preferred alignment. The consultant submitted the Final Report on 5 May 2008.

Call for Expressions of Interest

5. On 3 June 2008 the Ministry of Physical Planning and Works (MOPPW) published a call for expressions of interest (EOI) to prequalify firms for the design, construction and operation of the toll road on the basis of a Public Private Partnership

(PPP). Three firms expressed interest in the project. Only two of these were subsequently deemed responsive to the EOI call and shortlisted for the proposal stage.

Assessment of PPP Process by Castalia (WB) 2008

6. As a result of concerns expressed in various quarters about the project the GON and the World Bank (WB) requested Castalia Ltd., a firm which designs and develops public private partnerships to improve infrastructure service delivery, to advise if and how a PPP structure for the project can be achieved. Castalia reviewed the FS outputs and the current legal, regulatory and institutional frameworks in Nepal in the context of PPP. In December 2008 they presented a report addressing the key issues and containing strategy alternatives and associated action plan for the GON to enter into a PPP for the implementation of the project.

7. This included specific comments on the traffic forecasts:

(i) Based on international experience, traffic forecasts for toll roads are generally about 23% too high.

(ii) Accurate forecasts are generally correlated to the level of toll road experience in the country.

(iii) High tolls are not likely to attract forecast traffic.

(iv) Stated Preference survey for the FS indicated that most users would not pay the proposed tolls.

Decision by GON to Issue New Call for Expressions of Interest

8. It is understood that the GON will issue a new call for EOIs as soon as it is considered practical to do so. It is not clear if the existing short-listing process is to be cancelled or just left dormant.

ADB TA to Assist GON with Setting Up Project

9. The ADB set up a Staff Consulting TA to facilitate detailed PPP financial structuring of the project. The feasibility studies and preliminary design developed under the PPTA 4842 (Oriental Consultants), and the study results by WB assistance (Castalia) on the modality of transactions will be reviewed and provide the basis for the TA together with related Government's decisions on the matter.

10. The four staff consultants have extensive experience in (respectively) financial modelling, traffic modelling, BOT contracts, and engineering. Best and proven international practices will be taken into account.

11. This report is the major output of the assignment by the Traffic Expert.

Mission of Traffic Expert

12. The task undertaken by the Traffic Expert was to review the FS undertaken by Oriental Consultants with a focus on the traffic forecasts and to provide a revised set of traffic and revenue forecasts for the proposed project road.

13. Two missions to Kathmandu were carried out as part of this task. The first from 14 March to 19 March 2010 was a data gathering mission to obtain historic traffic data to provide a basis for developing a field work campaign. This work was undertaken from the offices of the MOPPW working in liaison with the Joint Secretary (Foreign Cooperation), Mr Kamal Pande, the Project Manager for the Fast Track Project, Mr S. M. Shrestha and the Department of Roads (DOR). The second mission involved

organising and carrying out the field work campaign from 29 March to the 6 April 2010. This field work was undertaken by the Traffic Expert with assistance from two staff from MOPPW and was based in Hetauda.

14. The remainder of this report presents the work undertaken during the mission including the following:

(i) A review of the feasibility studies and preliminary design developed under the PPTA 4842 (Oriental Consultants), with particular focus on the traffic forecasts.

(ii) A description and analysis of the field work campaign undertaken.

(iii) A description of the modelling undertaken to develop a revised set of traffic forecasts for the proposed project road.

(iv) Presentation and analysis of the revised set of traffic forecasts.

(v) Conclusions and recommendations.

15. A third mission to Nepal was undertaken in May 2010 to present and discuss the report conclusions.

16. This report presents the outcomes of the Review of the Feasibility Study.

Review of Feasibility Study

General Methodology

17. The FS carried out by Oriental Consultants Co. Ltd in 2007 and 2008 involved investigation of a number of alternate alignments for the proposed Fast-Track corridor, undertook a selection process and then carried out preliminary designs and revised traffic forecasts, toll revenue forecasts and financial and economic analysis for the preferred option.

18. The preferred alignment from the FS is that following the Bagmati river valley and continuing south to the existing Simat Khola road and then on to join the EWH to east of Pathlaiya. The links from Simat Khola to Hetauda and from Nijgadh to Pathlaiya on the EWH would be upgraded. The proposed corridor would initially be a two-lane road, upgraded when traffic volumes warrant it to a four-lane road of Class 1 Asian Highway standard.

19. As stated in the FS, the proposed preferred corridor option would result in significant benefits in terms of reducing travel time and vehicle operating costs between Kathmandu and the Terai and Indian border as well as increasing road capacity on this corridor. The FS concluded that the project would result in a saving of 152 kilometres and over four hours of travel time with average traffic on the project road rising from about 9,000 passenger car units (pcus) per day in 2014, the assumed opening year, to over 34,000 pcus per day in 2024. The units used for the output were estimates of Average Annual Daily Traffic (AADT) in passenger car units (pcus).

20. The general methodology adopted for the FS for determining forecast traffic flows on the project road includes all the general steps required for this type of study.

21. The FS forecasts were based on traffic surveys undertaken in two phases. For Phase 1, these studies consisted of (i) manual classified traffic counts at six locations, and (ii) origin-destination interview surveys at four of the same locations. For Phase 2, surveys consisted of (i) manual classified counts at two repeated locations and two new locations, (ii) origin-destination surveys at one repeated location and one new location, and (iii) Willingness to Pay survey through Road Side Interviews for private vehicles and from transport operators for freight vehicles. While the survey results from the manual classified counts are described in summary in Supplementary Appendix 6 of the FS, the level of detail does not allow for any type of review of this base data. In addition, there is no discussion or reporting on the origin-destination survey results except regarding the number of surveys undertaken. This is a key detail

lacking in the report that reduces the transparency of the modelling process undertaken. The Traffic Expert did however obtain the raw data from ADB as part of the study mission in Nepal and was reviewed as part of this study. It should also be noted that transport strikes were causing disruption during the survey periods and that "allowances" were therefore made during the analysis and development of the origin-destination matrices. It is not clear or specified in the report what the nature of these allowances were. The reporting of the manual classified counts created some confusion by reporting some locations with "some local motorcycle trips", other locations "without local motorcycle trips" and it is assumed the remained with all local motorcycle trips.

22. Traffic data was expanded from a 12-hour period to 24-hour period based on factors developed by vehicle type from the 24-hour count sites. Traffic data was also adjusted for daily variation based on a full week count and seasonal variations based on data provided by DOR to provide estimates of AADT.

23. The FS forecasts included making estimates of:

(i) Base traffic flows on the existing network for the base year (2008).
(ii) Normal growth of existing traffic for the expected opening year and future year time horizons
(iii) Diverted traffic that chooses to use the project road instead of the existing route for the opening year and future year time horizons.
(iv) Generated traffic, which is additional traffic arising as a direct result of the project road.
(v) Induced traffic resulting from other projects or developments that take place as a result of the new road, such as the proposed international airport in Nijgadh.

This is in keeping with standard best practice method. However, the details of the assumptions for each element of the traffic forecasts are evaluated in detail in subsequent sections.

24. The FS consultants adopted the use of a spreadsheet based traffic model called TRAFOR to undertake the traffic forecasts. The model revised by the Traffic Expert was provided by ADB with the file name "Trafor__Phase2.5(airport).xls". This model is based on standard modelling principals and as a base is in principal appropriate for use in this type of study. The key inputs into these models are an origin-destination (OD) trip matrix for a defined zone system and a road network. For the FS, the OD matrices developed for the model were 24-hour trip matrices (in pcus) for passenger trips and freight trips for a 15 zone system that was subsequently compressed to a seven zone system during analysis. The network consists of the two alternate existing routes from Pathlaiya to Kathmandu as outlined previously and the proposed Alternative 3B project road.

25. The OD matrices were based on the survey undertaken for the FS. However, the methodology for developing the OD matrices from the survey data is not explained in the FS and could therefore not be reviewed. Also, it is not clear exactly what vehicle types are included in each matrix. It appears that the passenger matrix includes cars, some non-local motorcycles and buses while the freight matrix includes all goods vehicles. It is unclear where jeeps and utility vehicles are included. This mix of modes, particularly those that have widely varying fuel and toll costs such as between motorcycle, car and bus should ideally not be aggregated within the assignment process. In addition, it is highly questionable as to whether motorcycles should be included at all given that motorcycles are used for local trips as opposed to long distance travel. It is also not considered reasonable that public transport (buses) be included in an analysis with private transport, as buses run on fixed routes as opposed to a route choice based on time or distance. It should also be noted that a factor of 1.19 labelled "sensitivity" has been applied to the base origin-destination trip matrices with no mention or justification of it in the model or FS report.

26. The zone systems used were reviewed and considered reasonable. These

zone systems were adopted for the revised traffic modelling task and are therefore outlined late in this document.

27. The base network in the TRAFOR model consists of seven links with the key input data being the link length and average speed. The link data for the base network is outlined below:

(i) Link 101 –Kathmandu to Mugling, 100 km, 50 kph;
(ii) Link 102 –Mugling to Narayanghat, 40 km, 40 kph;
(iii) Link 103 – Narayanghat to Hetauda, 75 km, 50 kph;
(iv) Link 104 – Hetauda to Pathlaiya, 27 km, 45 kph;
(v) Link 105 – Pathlaiya to Nijgadh, 17 km, 45 kph;
(vi) Link 106 – Kathmandu to Kulekhani, 51km, 25 kph;
(vii) Link 107 – Kulekhani to Hetauda, 40km, 25 kph.

28. The basic network input data was checked during the survey campaign and project mission (outlined in subsequent sections of this report). Key errors in the TRAFOR base data were identified. The average measured speed during the project mission on Link 1 from Kathmandu to Mugling was 29 kph as opposed to 50 kph and on Link 103 from Narayanghat to Hetauda 60 kph as opposed to 50 kph. This significantly impacts on the output from the TRAFOR model and will be explained in more detail in subsequent sections. In addition, the distance of Link 106 appears to be incorrect. Based on responses from drivers during the OD interview surveys, the route taken from Kulekhani to Kathmandu is via Pharping. This route from is 24 kilometres in length compared to that in the TRAFOR model of 51 kilometres and results in the conclusion that this traffic is not going to enjoy any distance related cost savings and is therefore not likely to use the new project road.

Normal Traffic Growth

29. Various methods of calculating normal traffic growth were investigated by the FS consultants. The method adopted was the use of elasticities of demand with respect to real GDP growth. Given the data available at the time this appears reasonable. GDP growth was assumed as 4% in 2008 rising to 5% in 2014 and remaining at that rate for the evaluation period. Data was obtained as part of this mission from the ADB Nepal Resident Mission on current GDP with the 2009 estimate being 4% growth and the 2010 forecast being 4.1%. The data used in the FS is considered to still be valid although a more conservative estimate of future GDP growth would be to maintain the existing level, which is also more consistent with historical data. Elasticities of demand for passenger and freight vehicles used were based on other international studies. While these varied significantly depending on the study the following were adopted for the FS.

Table 1: Elasticities Adopted for the FS

Period	Car	Bus	Freight
2007-13	1.4	1.6	1.4
2014-23	1.4	1.6	1.4
2024-33	1.4	1.5	1.3

Source: Oriental Consultants, 2008

30. On top of this GDP related growth, the FS included higher growth of 4% pa up until 2014 on the cross-border traffic associated with the counting stations at Birgunj and south of Pathlaiya. This is discussed further in subsequent sections.

The resulting growth rates used in the FS are outlined in the following table.

Table 2 : Estimated Percent Growth of Normal Traffic from FS

	Passenger	Freight	Passenger	Freight
Period	**Normal Growth**		**Low Growth**	
2007-13	6.6	6.2	4.5	4.2
2014-23	7.5	7.0	6.0	5.6
2024-33	7.25	6.5	7.25	6.5

Source: Oriental Consultants, 2008

31. As part of this study, the Traffic Expert obtained historic traffic data for the period from 2001 to 2009 from DOR in order to both provide input into the revised modelling process and to provide a basis for checking and revising traffic growth forecasts. The results at 12 locations in the study area were analysed with the outcome in terms of observed traffic growth varying greatly between sites and depending on the number of years taken for the analysis period. The results of the key sites analysed are outlined in the table below.

Table 3 : Observed Traffic Growth (excluding motorcycles and rickshaws)

Location	Period	% Growth
Pathlaiya South	2001 – 2009	8.7%
	2007 – 2009	5.1%
Pathlaiya North	2001 – 2009	8.9%
	2007 – 2009	-2.1%
Pathlaiya East	2001 – 2009	7.5%
	2007 – 2009	-6.4%
Hetauda West	2001 – 2009	4.6%
	2007 – 2009	4.6%
Average of four sites	2001 – 2009	7.4%
	2007 – 2009	0.6%

Source: DOR / Traffic Expert

32. As mentioned, the results highlight varying, even negative, rates of traffic growth at the key sites in the study area. The average growth at the above four sites indicates growth between 2001 and 2009 of 7.4% per annum and between 2007 and 2009 of 0.6% per annum for all vehicles excluding motorcycles and rickshaws. It could therefore be said that longer term growth between 2001 and 2009 supports the growth rates used for the FS while the more recent trend in traffic growth between 2007 and 2009 does not. This will be addressed as part of the revised traffic forecasts.

33. The additional international growth for cross-border traffic was put forward at 4% per annum until 2014. This was based on higher than average growth, stated as 12 percent between 1998 and 2007, at count stations south of Pathlaiya. It is unclear what vehicle types this growth included (higher growth has been more associated with motorcycles than freight for example), however a study of recent growth at the station south of Pathlaiya reveals that traffic growth excluding motorcycles and rickshaws (considered local traffic) has had annual growth of 8.7% from 2001 to 2009 but has slowed recently to 5.1% between 2007 and 2009. This growth is consistent with traffic growth assumptions at other sites in the study area and as such additional growth due to cross-border traffic has not been included in the revised growth rates for this study.

34. Revised growth figures have been used for the modelling task associated with this study and are outlined in subsequent sections.

Diverted Traffic

35. Diverted traffic is traffic that shifts from its existing route between two points to a new route should the cost of doing so be less expensive. This cost, called the generalised cost, includes time savings, distance (vehicle operating cost) savings and any toll cost.

36. The generalised cost is calculated using data on the difference in time, distance and toll costs between the route options available. Weighting factors are applied to each of these to indicate their relative importance and propensity to change routes. The consultants in this case used formulae with factors (known as diversion curves) based on a 2000 ADB study of toll roads in the People's Republic of China. These curves were adjusted by the consultant based on perceived cost surveys with drivers and owners. The exact process followed to determine the revised curves is not outlined in the FS and neither is the formulae used. The formulae have been however extracted directly from the TRAFOR model and is as follows.

Diversion = exp(x1)/[1 + exp(x1)*100]

Where x1 = cd*DifL + bd*DifTm/60 + ld*DifToll*7.8/63

Where cd = distance factor
DifL = difference in distance between route options
bd = time factor
DifTm = difference in time between route options
ld = toll factor
DifToll = difference in toll between route options

This methodology seems reasonable albeit with no justification for any change in the factors used.

37. It should be noted however that the diversion curve formulae result in trips between origin-destination pairs that travel further on the project road than the existing route having positive diversion to the new road. Given the proposed high level of toll and the justification that these are based on savings in perceived vehicle operating costs (savings in fuel costs), this implication in the formulae used is that people use the new route and pay the proposed toll even with no saving or even an increase in the distance travelled. These two assumptions are therefore not consistent. A conservative and consist analysis should only include trips with a distance saving. The impact of this assumption on forecast travel volumes in the TRAFOR model is significant and is outlined later in this report.

38. A second concern with the methodology used for the diversion is that an average toll per kilometre has been used, derived in a complicated manner by converting from the proposed tolls, to average tolls per pcu kilometre and back to an average toll for all vehicle types for each origin-destination pair. This complicates the calculation that ends up having no relationship to the actual toll that would be paid and also overly simplifies the toll portion of the generalised cost in the diversion curves. For example, for travel between zones 1 and 2 the toll used in the model for all modes is NR1,580, while in fact the proposed toll for cars would be NR800 and for Medium Trucks NR1,300. This has been corrected in a revised run of the TRAFOR model as well as revised for the modelling task undertaken for this project as described in subsequent sections of this report.

39. A third concern is that the TRAFOR model requires the user to identify the routing between each OD pair. What has been overlooked in the FS is the potential for

vehicles travelling between Kathmandu and the south via the northern section of the project road, the Hetauda connector and then south via the TRP. It would appear that this route has not examined as the revised modelling for this study has concluded that the route via the Hetauda connector would in fact be the preferred route. This was tested in the TRAFOR model and is also the case.

40. In summary, the following errors have been found in the TRAFOR model that impact on the results.

(i) The assumed speeds for two sections of the existing route network were inconsistent with that measured during survey.

(ii) The assumed length for one section of the existing route network is incorrect.

(iii) Errors were found in the spreadsheet formulae such that the percentage diversion was incorrect.

(iv) An oversimplified assumption using an average toll for all vehicles for the trip diversion as been used. This value was calculated in an overly complex manner resulting in unrealistic values being used in the model that do not reflect the actual toll being paid.

(v) Assumptions inherent in the diversion curves used result in inconsistent results with trips travelling further via the new route regardless of an increase in distance (fuel cost).

(vi) Trips were included in the analysis that would not pay a toll under the proposed system, that is, between Hetauda and the towns to the north (south of Kathmandu) such as Bhanse and Kulekhani.

41. The TRAFOR model was corrected for the first four points above and the results extracted to provide data on the different scenarios including and excluding trips with distance saving or those tolled (point v above). These results are outlined below.

Table 4 : Revised Base Year Traffic Forecasts using Updated TRAFOR Model

Scenario	Revised Model (pcu)	Original Model (pcu)
All Trips	10,641	12,515
Tolled Links Only	10,178	Not reported
Tolled Links with Distance Saving	7,191	Not reported

Source: Traffic Expert (ALG)

It should be noted that the link description errors and the formulae errors actually have the effect of off-setting each other to a degree. However, the results of the consistency check, whereby only trips with a positive distance saving use the project road, result in a significant drop in the base traffic volumes, from 12,515 pcus in the report to 7,191 pcus, a reduction of 43%.

Generated Traffic

42. Generated traffic is traffic arising from the lower cost of travel. The estimate of the number of generated additional journeys made was based on the reduction in travel costs (vehicle operating cost savings based on reduced distance and time) and price elasticities. The toll values used to calculate the travel costs were determined in the same way as for the diversion curves as previously outlined and in addition contained some errors. A revision of the values within the TRAFOR model resulted in an increase in the factors used for generated traffic. Price elasticity is the proportional change in the number of trips per unit change in price. If the elasticity is -0.1 and the cost of travel is

halved, 5 percent more trips are made. Again, in the absence of empirical data in Nepal, international studies in similar countries were used as a basis and again values from different studies vary widely. The values adopted by the consultants were -0.7 for passenger transport and -0.8 for freight. These seem reasonable given the scale of the potential time and distance savings and the resulting levels of generated traffic also appear reasonable although on the higher side. It should be noted that generated traffic consists of about 24% of the total traffic forecast on the project road forecasts for the FS.

43. It should also be noted that it was assumed that generated traffic would occur at opening and to grow at the same rate as normal traffic. At the same time however, it was also assumed that this growth would take some years to reach its full potential. It was assumed that 80 percent of passenger and 90 percent of freight generation would occur in the first year of operation, rising to 100 percent five years after opening of the new road.

Sensitivity to toll using the existing TRAFOR Model

44. A key test carried out using the revised TRAFOR model was on the sensitivity of the forecast traffic volumes to the level of toll. It should be noted that the base toll recommended in the FS is relatively high when compared to toll roads internationally and in particular in the region. Two toll plazas are proposed in the FS, one at the north of the project road south of the proposed connection with the also proposed Outer Ring Road and one at the southern end of the corridor prior to the interchange with the EWH at Nijgadh. The proposed system is an open system whereby a toll is paid on entering and leaving the toll plaza with trips entering or exiting at the Hetauda Connector only paying once if they pass the proposed toll plazas. The proposed tolls from the FS in Supplementary Appendix 8 are outlined in the following table.

Table 5 : Base Trip Toll Rates by Vehicle Type Proposed in FS (NRs)

	Vehicle Type							
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: Oriental Consultants, 2008

A sensitivity test on these base tolls using the revised TRAFOR model was undertaken. The results are outlined in the table below.

Table 6 : Traffic Forecasts versus Toll using Revised TRAFOR Model

Scenario	**Traffic at Proposed Toll (pcu)**	**Traffic at 75% of Proposed Toll (pcu)**	**Traffic at 50% of Proposed Toll (pcu)**
All Trips	10,641	12,441	13,786
Tolled Links Only	10,178	11,978	13,323
Tolled Links with Distance Saving	7,191	7,195	7,198

Source: Traffic Expert (ALG)

The results of this sensitivity test suggest that there is no sensitivity to the toll level if trips with a distance saving only are included in the analysis, rising from 7,191 pcus at the full base toll by just under 1% at half the proposed toll rate. The increase in forecast

traffic is higher when considering all trips, however, as previously mentioned this implies that people will pay the proposed high tolls even if there are no savings in vehicle operating costs. Sensitivity tests have also been carried out on the tolls using the new traffic model developed for this study.

Key Conclusions

45. The key conclusions from the review of the FS study are as follows:

(i) The overall methodology used was sound in that it included the standard methods for estimating traffic on the project road via a spreadsheet based model (TRAFOR), including normal base traffic with traffic growth, generated traffic and induced traffic.

(ii) A number of errors were found in the TRAFOR traffic model. These included the following:

- A discrepancy between coded link speeds and those identified during survey on the Kathmandu – Mugling road (50kph in the FS v 29kph in the field) and the Narayanghat – Hetauda road (50kph in the FS v 60kph in the field).
- A discrepancy between the coded distance used for the link between Kulekhani and Kathmandu and that identified from DOR data (52km in the FS v 24km from DOR data).
- The diversion curves used (adapted from ADB curves used in PRC) give results inconsistent with the philosophy behind the setting of the toll level, that is, that tolls are set based on a percentage of fuel cost savings. The curves used result in a diversion of vehicles that travel further to use the project road than via their current route.
- Average toll per km were used in the model that did not reflect the tolls proposed in the FS.
- Some of the formulae in the model were incorrect.
- Trips were included in the FS forecasts that would not pay a toll under the proposed system, for example, between Hetauda and Kulekhani.
- The FS modelling did not appear to consider the potential route to Pathlaiya via the Hetauda connector.

(iii) The net result of these errors was investigated by correcting them in the TRAFOR model. The revised model results show about 10,600 PCUs on the project road as opposed to 12,500 PCUs in the FS if one counts trips. However, if the only the trips with a positive distance saving are counted, that the TRAFOR model shows 7,200 PCUs on the project road.