

Government of Nepal
Ministry of Physical Planning and Works
DEPARTMENT OF ROADS

ROAD NETWORK DEVELOPMENT PROJECT

Asian Development Bank Loan No. 1876 – NEP(SF)

ENVIRONMENTAL, HEALTH AND SAFETY REPORT **EHS No. 34**

FINAL REVIEW OF
ENVIRONMENTAL, HEALTH AND SAFETY ISSUES IN THE
DOLALGHAT - CHAUTARA ROAD REHABILITATION

NOVEMBER 2007

Roughton International

in association with

Montgomery Watson Harza

and

ITECO Nepal Full Bright Consultancy ICGS

1 Environmental Situation

1.1 Background

The Dolalghat-Chautara road starts from the junction on the Arniko Highway at km 59+150 from Kathmandu. The junction is about 2 km north of the Indrawati Bridge at Dolalghat. This is an old road opened to traffic some 30 years ago. It was a standard old-style feeder road, which had been sealed for the first 9 km and had a mixed gravel/earth/rock surface on the remaining section. Some portions of the road lack lined side drains.

The road passes through degraded sal (*Shorea robusta*) forest to relatively good quality plantation forest of pine (*Pinus roxburghii*, *P. patula* and other exotic pine species) at around Pokhare, Irkhu and Melchour, and through mixed forest (with katus and chilaune, *Castanopsis* and *Schima*) on the ridge leading to Chautara bazaar.

The Contract's environmental baseline study was conducted on 9 October 2004, before the mobilisation of the Contractors (see EHS Report No. 8). At that time, the overall environmental conditions were described as appearing to be fairly good, with no major environmental issues observed.

Contracts were awarded in early 2005, and the Contractors mobilised by June of that year. Environmental, Health and Safety Monitoring studies were conducted in June 2005, June 2006 and August 2007. These are reported as EHS Reports No. 9, 16 and 29 respectively.

By the time of the last monitoring visit, the DBST had been completed (i.e. from 0+000, at the junction with the Arniko Highway, to 23+400, near Chautara Bazaar) and bio-engineering work had also been reported as complete. All the Contractors had demobilised, though they were still covering the works under the Defect Liabilities Period (DLP).

1.2 Key Environmental Issues

Overall, the environmental conditions of the road appear good, although there are still some significant issues that must be resolved. These are discussed below in the following sections.

A number of issues can be resolved during the remaining DLP, but others can only be undertaken subsequently. These latter works, mainly a small but important amount of bio-engineering and future small scale slope repairs, will have to be undertaken by the Division Road Office (DRO) after the Sites have been handed back to the Department of Roads by the Contractors. For this reason, it is recommended that this Final Review Report be included in the handover documents so that the DRO is made fully aware of the Consultants' recommendations.

2 Roadside Slopes

2.1 Side Tipping

The areas of side tipping of spoil along much of the road length (which was noted in earlier EHS Reports) is now generally covered with plants – either planted or natural. In the latter case, the plants are primarily naturally occurring herbs which are only seasonal and although they flourish in the monsoon they die afterwards, leaving the tipped areas barren during the dry season. In addition, they do not have root systems that will withstand erosion. It is

considered, therefore, that bio-engineering must be introduced in areas where there is not a cover of established trees to try to avoid the possibility of valley side mass failures.

Serious recent side tipping has occurred because of emergency clearance of landslide material in the 2007 monsoon around the gully at about km 0+500. The gully itself is now heavily choked with debris and in heavy rain this could turn into a debris flow that could result in damage to property downstream. This debris has to be removed by the Contractor under his maintenance obligations during the DLP.

2.2 Landslides

Minor slip failures in the cut slopes were seen at intervals throughout the road length, with the resultant debris damaging the road surface and blocking the drains. Fifty-six (56) individual failures were identified (see table below):

Frequency of Mountain Side Slope Failures by Chainage

Km	No.	Km	No.
0-1	13	12-13	1
1-2	2	13-14	3
2-3	5	14-15	2
3-4	2	15-16	1
4-5		16-17	
5-6	2	17-18	5
6-7	2	18-19	5
7-8	1	19-20	5
8-9		20-21	1
9-10	1	21-22	
10-11	2	22-23	
11-12	2	23-24	1

Obviously the existing failures need to be rectified before the road starts to suffer excessive damage. It is understood that the landslip volumes have been measured and the Contractors have already been instructed to remove the debris. However, it is also clear that many more failures will occur in the next few years, since the widening of the road to meet the national standard for feeder roads has unavoidably destabilised the slopes along most of the road length. Because of the steepness of the natural hill sides and to reduce Project costs, the cut slopes have been left at angles that mat not sustainable under future monsoon conditions. The consequences such situation are:

- further slope failures, though most should be minor;
- loss of further land and vegetation, mostly of forests, above the road through failures;
- physical damage to the road surface by falling rocks, with possible additional damage due to rock particles being ground in by vehicle tyres;
- scour below the road by runoff from blocked side drains; and
- damage to valley side slopes from debris disposed of by maintenance gangs in places other than official tipping sites.

The Division Road Office will need to be informed of this problem and the need for appropriate action to be taken should slope failures occur.

The most significant problems are in the first 3 km of the road where the side slopes are steepest, and the largest failures may generate enough debris to block the road completely. A further unsatisfactory area is near the ridge top between km 17 and km 20, where the road

is cut into a series of weak materials. The most serious individual failure, however, appears to be at around km 2+600, where a small failure has pushed out a masonry revetment breast wall and blocked a foot path which climbs up the slope. A small retaining wall (about 10m³ of gabion) should be incorporated at this location. It is considered, however, that this is the only location on this road section where an additional wall is required.

Long term resolution of the other sites requires mainly slope trimming and bio-engineering works. It is considered to be impractical to carry out these works during the Contracts' DLPs and so, if possible, these should be undertaken by the Division Road Office before or at the start of the 2008 monsoon season,. There is, however, probably no point in undertaking slope trimming works to the very steep, rocky slopes in the first few kilometres of the road. In such circumstances it is considered to be more appropriate to wait for slips to occur and to clear up the debris as and when required.

While the future possibility of landslides is not necessarily serious, the Project, due to the need for extensive road platform widening and as a consequence of the limited budget available for slope remedial works, has undoubtedly, in areas, made the situation worse than that previously existing. Accordingly the relevant slopes, if left untreated, represent an unmitigated environmental hazard.

2.3 Valley Side Erosion and Subsidence

Debris tipped below the road at about km 17+400 is eroding badly. This needs particular attention to resolve and additional bio-engineering works are recommended. A potentially more serious problem is occurring at about km 20+500, where the road crosses a saddle (low point) in the ridge. One side of the formation is subsiding. Whilst this problem may be the result of inadequate compaction of new fill in the embankment, there may be a deeper failure underneath. The indicated solution is the provision of a small gabion retaining wall below the road (foundation conditions appear to be inadequate for a stone masonry wall).

2.4 Slope Retaining Walls

There are very few slope retaining walls (as opposed to walls retaining the road itself) along the road section. One masonry breast wall at km 2+190 is appropriate, but it has not been backfilled and is, therefore, currently serving no function other than to collect material falling from the slope.. It is recommended that this wall be backfilled and then the surface treated with bio-engineering works.

3 Water Management

3.1 Drainage

Generally the drainage provisions appears to be good throughout the road length. One drain at km 4+000, near a hairpin bend, has been undercut so that the outfall over hangs and is now making a serious gully. Instead of leaving the outlet just at the road edge, protection works should be extended to a satisfactory discharge point lower down the slope. This work has already been identified and instructed by the supervision staff.

A few other culverts and catch pits were found to be blocked, the most serious among them at kms 14+120, 15+000 and 15+170. It was also reported in August 2007 that 12 out of 17 culverts had been blocked on Contract DC-3. Again the need for unblocking the culverts has been identified by the supervision staff and instructions issued to the Contractor to undertake the necessary remedial works.

3.2 Covered Drains in Bazaars

Covered drains have been provided under the Contracts in almost all the built-up areas along the road section. These represent a significant environmental enhancement although such drains have a tendency to fill with accumulated rubbish and hence there will be a continuing maintenance obligation to ensure that the drains remain clear.

3.3 Cascades

Another example of an excellent water management facility introduced by the construction works is where the run off water from the road above the hairpin at km 10+000 is led down a cascade and across several other sections of roadway, to a safe discharge point. A long cascade below the road in the sal forest at about km 4+600 is also a good feature, although the check dams below the outfall need some repairs.

3.4 Check Dams and Drifts

At km 2+100 a well-designed masonry check dam with a central spillway has been introduced. Below this is an excellent concrete drift, though it is slightly spoilt by the poor gabion mattress below, which has already started to be undercut and needs repairs.

4 Bio-engineering Works

There is mixture of quality in the bio-engineering works. For instance, the brush-layering and planted grass lines have established well as from km 0+000, being very good at km 4+000. At one or two sites between km 14 and km 15, where there is some good brush layering work. However, moving closer to Chautara, fewer cuttings or grass slips have survived and some sites are currently very sparse. Although the bio-engineering works have been reported as complete and the nurseries abandoned, there is still a need to refill those areas where the mortality rate of the plants is high. This will need to be done in the next monsoon season which is outside the DLPs for the Contracts. The mechanism for implementing these works will need to be discussed and agreed with the Contractors.

The valley side slope from km 9+800 to km 10+000 was treated with brush layers which appear to be quite stable after two monsoons, although the layers have not grown all that well. It is probably not necessary to do additional works at this location but it will be necessary to revisit after the next monsoon to check on the continuing acceptability of the work.

Notwithstanding the overall acceptability of the bio-engineering, it is considered that further work is required in a number of locations. This cannot now be achieved under RNDP funding, since the timing of the remaining DLP relative to the seasons means that bio-engineering works cannot be undertaken before the road is handed back to the Division Road Office. It is recommended, therefore, that the DRO undertakes the works tabulated below, during the 2008 monsoon.

Further Bio-engineering Works Required

Chainage	Site characteristics	Problem	Suggested Remedial Works
2+190	Retaining (breast) wall on the mountain side.	No backfill behind wall.	Backfill and compact fill behind breast wall to an even grade. Plant with kans in diagonal lines at 0.5 metre spacing.
4+600	Two valley side slopes on either side of a long masonry cascade, treated with brush layers.	The brush layers have not performed well. The ground material is very stony and dry, and in retrospect brush layering may have been inappropriate	Horizontal lines of grass planting using kans, at a spacing of 0.5 metre.
4+500 to 5+500	Rato mato (red clay loam residual soil) on either side of the road.	Bare surfaces and eroding soil will constantly cause sediment to accumulate in road drains and gullies to form that threaten the road pavement structure.	Trees be planted in all micro-sites that are exposed to strong sunlight. In shady areas, babiyo grass should be planted in contour lines at 0.5 metre spacing.
9+300	A former tipping site treated with bio-engineering works.	Further tipping since the bio-engineering works were implemented has led to damage. As a result, there is a strong chance of serious future erosion.	Grass line planting to avoid damaging the slope again. - horizontal lines of, kans at a spacing of 0.5 metre.
10+100	Bio-engineering site on the valley side, on a debris slope below a hairpin.	Poor quality brush layers of simali and Jatropha. The surface is not well protected and needs additional work.	Grass line planting to avoid damaging the slope unnecessarily - horizontal lines of kans at a spacing of 0.5 metre.
17+400	Valley side slope with a cover of tipped debris.	Unprotected debris is eroding, and this threatens to eventually undermine the road.	Brush layering with simali . The layers should be spaced at 0.5 metre intervals.

5 Land Use, Road Neighbours and Road Users

5.1 Quarrying of Stones and Soil from Mountain Side Slopes

At the time of this final assessment, the quarrying of stones or red soil from roadside slopes by locals was seen at km 7+400, km10+200 and km 22+500. It is recommended that the Division Chief take action, with the assistance of the CDO and DFO, to stop this damaging practice.

5.2 Forests and Trees

The earlier concern, expressed in previous reports, that the quality of forests adjoining the road will deteriorate after Project completion, has not so far come about. The forests still look good, and there is no major evidence of illegal tree felling. Pine logs were stacked beside the road at km 12+700, ready for transport to a veneer factory, but not in quantities to raise concerns about excessive exploitation.

Perhaps this situation has arisen due to the fact that the forests along this road section are looked after by well-established local forest user committees.

In addition, the Project has compensated private landowners for loss of fodder and trees, so no disputes with the locals were recorded.

5.3 Property Access

Off-road access lines have been well laid out at various points. A foot path that crosses the road at several points (e.g. km 2+600 and km 3+500) and passes close to it at others, between km 2 and km 6, has been well provided with steps on the cut and fill slopes, concrete paving in some lengths and slab bridges over the drain.: this is considered to be as excellent example of ancillary works provision.

5.4 Resting Place

A traditional chautara (resting place) around a splendid bar tree (*Ficus bengalensis*) has been provided beside the road at km 5+500. This is an extremely pleasant enhancement.

5.5 Chautara Bus Park

The bus park was gravelled by the Contractor, apparently at his own expense. DBST paving would have obviously been preferable but cost considerations precluded this level of enhancement. Nevertheless, the current situation is a distinct improvement from the pre-existing earth surface. It is noted that improvement works of this nature are really tasks for the relevant Municipality rather than the Department of Roads.

5.6 Contractors' Work Yards

These appear to have been tidied up to an adequate standard, presumably because they were all on rented private land. Some scrap metal needs to be removed from the yard at km 2+150.

5.7 New House Construction in Bazaars

At the time of the final assessment visit, it was observed that there was a significant level of new house construction in the small bazaars located along the road corridor. Whether this is a response to the enhanced road conditions or whether it results from other factors will take some time to ascertain. Nevertheless, it indicates the importance of the road and its proximity to housing units being perceived as environmentally acceptable by the local population.

6 Traffic Operation

6.1 Delineator Posts

Delineator posts have been erected and painted in distinct colours. However, some of them have been broken and many have become misaligned or uprooted and/or pushed down the slope by vandalism. The posts are 1.6 metres in length and are designed to be inserted in the soil to a depth of about 500 mm. This makes the delineators relatively easy to displace by accident or, more often, by misbehaving locals. The posts are for guidance of traffic and are designed to be displaced if hit by a vehicle in an accident. It would appear that it would be preferable to provide a greater depth of embedment to minimise the possibility of vandalism whilst not detracting from their functionality to be displaced under impact.

6.2 Safety Barriers.

Some good safety barriers have been provided along the road section. The best example is a gabion barrier at km 9+950, on the lower side of a hairpin bend, which is well laid out and strong enough to absorb the impact of a vehicle. An exception is the hairpin bend at about

km 18+500, immediately above the small bazaar of Irkhu, where a barrier is considered to be necessary to enhance safety.

6.3 Lower Side Road Edges

Protection is inadequate on many of the lower road edges. This is a result of cost savings in the Project design and is understandable even if undesirable. It is, however, an environmental issue because there is a danger of failure of the road edge when two heavy/large vehicles pass. The Consultants have already identified the worst locations, proposed appropriate remedies and gained DoR approval. This action is to be commended.

6.4 Traffic Safety

Although there is very low traffic on this road (on average eighteen daily buses in each direction between Chautara and Kathmandu, plus government and private vehicles, estimated not to exceed 15 per day), accidents do happen. For example, in July 2007 a passenger bus came off the road and rolled down the hill while overtaking another vehicle.

Drivers and pedestrians are not yet used to the increased traffic speed on this road, so it is recommended that warning signs for limiting speed be posted at key locations and, if these proved to be ineffective, then speed restriction devices (e.g. rumble strips or even road humps) should be considered.

2 ENVIRONMENTAL, HEALTH AND SAFETY ISSUES MONITORED

Identified benefit	Baseline extent and severity (quantified indicators)	Checked extent and severity (FINAL REVIEW)	Enhancement measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of enhancement or mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Chautara road: Part 1: Benefits and their enhancement										
Provision of a better, faster road to Chautara.	9 km of degraded black-top road and 14.4 km of rough, dusty gravel road before project.	23.4 km of high quality DBST black-top surface.	Provision of black-top road pavement throughout the length.	Consultants/DoR have included in detailed design. Site engineering staff are to apply.	By the end of implementation.	Later checks.	Checked and reported by consultant Environmental Specialist.	Satisfactory.	Effective.	No problem identified.
Upgrading of roadsides through bazaars, and Chautara bus station.	About 200 m drainage required at each of Sanga, Irkhu, Melchour bazaars; 1200 m ² of paving required at Chautara bus station, and 180 m ² at approach.	Covered drains and full width pavement have been installed at bazaar areas. Sub-base gravel laid at Chautara Bus Park.	Provision of drainage and pavements in the bazaar, and drainage and paving in the bus station.	Consultants/DoR have included in detailed design. Site engineering staff are to apply.	By the end of implementation.	Later checks.	Checked and reported by consultant Environmental Specialist.	Satisfactory.	Effective, except for the bus station, which was partially effective (but beyond the project's scope).	No problem identified.
Condition of forests neighbouring the road continues to be enhanced throughout the project.	Approx. 3+ km of road runs through good quality forest before project and equal length of road runs through poor quality forest or scrubland before project.	Situation unchanged: no impact observed. Minor extraction of pine logs appears to be at a sustainable level.	Liaison with the DFO. Strict contract clauses exclude any use of forests by contractor's personnel.	Contractors have responsibly abided by contract clauses. The site engineering staff have applied contract provisions.	Throughout project.	Regular.	Checked and reported by consultant Environmental Specialist.	Satisfactory.	Effective.	No problem identified.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (FINAL REVIEW)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of enhancement or mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Chautara road: Part 2: Hazards and their mitigation										
Quarrying of stone and red soil from roadside slopes, by DoR, local people and contractors not involved in road works.	Five quarrying sites (2+500, 9+600; 11+150 and 13+000; and 20+???) identified where quarrying is affecting the road before project.	Very small quarrying sites in road side slopes observed by local people at 7+400, 10+200 and 22+500.	Continue liaison with the CDO and DFO to stop quarrying from road side during the DLP.	DFO, supported by the DoR Project Manager and the Contractors' staff.	Throughout the DLP.	Regular.	Checked and reported by consultant Environmental Specialist.	No quarrying was actually observed, on the previous visits the DFO claimed to have stopped the problem. However, it seems not to be fully effective.	The project appears to have instigated partially successful support from the DFO in this matter.	DoR Project Manager to notify DoR Division Chief, to take over responsibility for trying to curb this problem.
Quarrying of materials for project works gives rise to erosion, slope instability or other environmental damage, or a risk of it happening.	No pre-project contractor's quarrying sites and no induced erosion or instability.	Materials almost all derived from the Sun Koshi, where the impact was negligible.	Strict environmental protection clauses were included in contract provisions.	The Contractor is responsible for compliance during implementation.	Throughout implementation.	Regular.	Checked and approved by consultant Environmental Specialist.	Satisfactory	Effective.	No problem identified.
Existing side-slope failures in both cut and fill slopes threaten the road and surrounding land.	Three slips at 2+200; 3+325-4+600; 4+600-5+000 respectively threaten road.	A number of side slips were observed through out the road length: see table in text.	The maintenance gangs are clearing debris. Appropriate bio-engineering and other slope protection measures to be used to rehabilitate sites.	The Contractor is responsible for compliance during implementation.	Works to be completed during the DLP	Regular.	Checked and reported by consultant Environmental Specialist.	Satisfactory.	Mainly effective.	No problem identified.
Bare fill slopes threaten erosion of the road edge and damage to surrounding land. Bare red soil areas between km 3+500 and 5+000 are especially problematic.	Bare fill slope sites extending to a total of approximately 1000 m2 with no significant erosion. Red soil areas remain the same.	Bio-engineering works have been used in most bare fill slopes. The problematic areas mentioned in the baseline have been rehabilitated.	Bio-engineering protection measures to be used to rehabilitate all bare surfaces and areas of roadside erosion, as provided for in project designs.	The Contractor is responsible for compliance during implementation.	In June-July 2008, following handover to the Division Road Office.	Regular.	Checked and reported by consultant Environmental Specialist.	Satisfactory.	Mainly effective.	DRO to implement further bio-engineering works as required, at the onset of the next monsoon. See schedule of sites in the text.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (FINAL REVIEW)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of enhancement or mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Chautara road: Part 2: Hazards and their mitigation										
Tipping sites for excess spoil lead to instability of roadside land.	Not applicable.	The tipping site at 2+150 is satisfactory and is causing neither roadside instability nor disturbing the private property. Spoil has been dumped at 9+000.	Take the spoil away to be tipped at designated sites.	Contractors.	Throughout implementation. Problem at 9+000 to be resolved immediately.	Regular.	Checked and reported by consultant Environmental Specialist.	Satisfactory.	Mainly effective.	RE to instruct contractor to remove debris tipped at 9+000.
Improved road drainage leads to increased discharge at culvert and drain outfalls.	One culvert discharges into an active gully at 4+450.	Improved road drains have certainly led to increased discharge. However, a number of culverts have been blocked by locals, leading to the overflow of water on to the road and scouring the road edge at some places.	Clean the blocked drains.	The Contractor is responsible for compliance during implementation and DLP.	Immediately.	To be checked regularly and especially annually following monsoon rains.	Checked and reported by consultant Environmental Specialist.	Less satisfactory.	Less effective.	RE to check that all culverts are clean..
Increased danger to road users, pedestrians, vehicle passengers etc, from faster traffic speeds and greater traffic volumes.	14 injuries and 11 deaths reported among road users in the 5 years before the project.	After DBST the traffic speed had increased, and coupled with reckless driving the possibility of accidents has also increased. Buses are routinely overloaded.	Adequate warning signs, safety barriers and traffic calming measures (e.g. speed bumps in bazaars) are still necessary.	Despite the fact that the consultants included these provisions in detailed design, no traffic calming measures have been placed in bazaars. It can still be done by DoR itself.	Immediately	Regular.	Checked and reported by consultant Environmental Specialist.	Satisfactory.	Less effective.	RE to instruct contractors to re-set all tilted or fallen delineator posts. The problem will continue to rise, if no action is taken to reduce traffic speeds and to create general awareness.
Dust nuisance during the construction period.	All roadside households interviewed report a regular dust nuisance before project.	No dust nuisance is observed after DBST.	Strict measures for traffic control were included in the contract provisions.	Contractors.	Throughout implementation.	Regular.	Checked and reported by consultant Environmental Specialist.	Satisfactory	Fully effective.	No problem identified.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (FINAL REVIEW)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of enhancement or mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Chautara road: Part 2: Hazards and their mitigation										
Noise pollution during the construction period.	No roadside households interviewed report unacceptable traffic noise before project.	No excessive noise pollution had been reported during the construction period or on this visit.	Strict measures for traffic control were included in the contract provisions.	Contractors.	Throughout implementation.	Regular.	Checked and reported by consultant Environmental Specialist.	Strict contract clauses seem to have had the desired result.	Effective.	No problem identified.
Annoyance (noise and dust) from crusher plants.	Not applicable.	Not applicable.	Strict measures for crusher operation were included in the contract provisions.	Contractors.	Throughout implementation.	Regular.	Checked and reported by consultant Environmental Specialist.	Strict contract clauses seem to have had the desired result.	Fully effective.	No problem identified.
Labour and work camps disturb the local community and provide health and social risks.	Not applicable.	Not applicable.	Strict measures for camp operation were included in the contract provisions.	Contractors.	Throughout implementation.	Regular.	Checked and reported by consultant Environmental Specialist.	Strict contract clauses seem to have had the desired result.	Effective.	No significant problem identified.
Construction activities are dangerous to the workers.	Not applicable.	Not applicable.	Strict measures for worker safety were included in the contract provisions.	Contractors.	Throughout implementation.	Regular.	Checked and reported by consultant Environmental Specialist.	Not applied in almost all cases.	No evidence of contractors fulfilling their obligations throughout the construction period. Fortunately no major accident happened.	Site staff should keep repeating orders to the contractors on future projects. Consideration to be given to enhancing compliance by financial penalties.
Construction activities give an increased risk of traffic accidents.	Not applicable.	Not applicable.	Strict measures for traffic safety were included in the contract provisions.	Contractors.	Throughout implementation.	Regular.	Checked and reported by consultant Environmental Specialist.	Not applied.	No evidence of contractors fulfilling their obligations throughout the construction period. Fortunately no major accident happened.	Site staff should keep repeating orders to the contractors on future projects. Consideration to be given to enhancing compliance by financial penalties.

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**ENVIRONMENTAL, HEALTH AND SAFETY REPORT
EHS No. 35**

**ENVIRONMENTAL, HEALTH AND SAFETY MONITORING OF THE
HILE - BASANTAPUR ROAD REHABILITATION**

NOVEMBER 2007

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and

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1. BACKGROUND AND PROGRESS

The Hile-Basantapur road was opened to traffic some 15 years ago. It had a mixed gravel and earth surface. The 22+066 km length is being upgraded to a standard DBST feeder road. The following Contractors were mobilised to this road sector:

RNDP/LCB/HB-1	Lama Construction	km 0+000 to km 5+000;
RNDP/LCB/HB-2	Lama Construction	km 5+000 to km 10+000;
RNDP/LCB/HB-3	Prakash/Bokhim	km 10+000 to km16+000;
RNDP/LCB/HB-4	Hirachan/Bokhim	km 16+000 to km 22+066.

Contracts were awarded in early 2005, and were mobilised by June of that year.

The Project's environmental baseline study was conducted in September 2004, before the mobilisation of the Contractors. At that time, the overall environmental conditions were described as appearing to be fairly good, with no major environmental issues observed (please refer to EHS Report No. 4).

The road passes through three small bazaars (Jorpati, Sindhuwa and Chitre) and the rest through terraced crop fields, utis plantations and other forest land.

The first environmental monitoring visit was conducted on 29 July 2005, the second on 28 and 29 November 2005, the third on 26 and 29 June 2006, the fourth on 24 and 25 January 2007 and the fifth on 7 August 2007. This current visit, is therefore,, the sixth one for this road section and was undertaken on 28 November 2007.

By the time of this visit, Contracts HB-1 and HB-2 had been completed for nearly six months and the Contractor had demobilised. The Contractors for the other two Contracts, were still working and appeared to be struggling to keep to any kind of schedule. An extension of time for these latter two Contracts has been awarded and the Contracts' Completion Dates thereby both amended to 04 April 2008. There is still some doubt as to the Contractors' ability to finalise the Works by that date.

2. DETAIL OF ENVIRONMENTAL IMPROVEMENTS

2.1 *General Environmental Enhancements*

The upgrading and black-topping (DBST) of the first 10 km of the road has transformed this access facilities beyond recognition. In addition, the full width pavements being provided in Jorpati, Sindhuwa, Chitre and in Basantapur, along with covered drains, will greatly enhance the quality of the local environment. To date only the first of these bazaar areas has been black-topped.

2.2 *Jorpati Bazaar*

For this bazaar (located from km 7+600 to 7+900), covered drains and new drainage outfalls have been provided. The road has been widened and five tap stands have been moved back from the roadway. The villagers appear to be happy with these improvements, but unfortunately some are already spoiling the improvements by dumping stone in the bazaar. This appears to be partly for new house construction in the bazaar (so hopefully temporary), but in some cases appears to be stockpiled for transport elsewhere, and so perhaps the start of a longer term problem.

2.3 School Protection

A safety wall has been built on the mountain side of the road in front of a primary school at km 4+850 to prohibit children running out of the school entrance directly into the road. This is a good safety enhancement which should be implemented universally at school entrances on all road sections.

2.4 Recreational Facilities

At the request of the locals, a football ground has been constructed by the HB-4 Contractor at Basantapur by levelling the approved tipping site (at km 21). This is a very commendable enhancement for the local population. The Contractor has also been reported to have constructed earthen drains on this ground. This is a good example of a potential environmental hazard being turned to good use for the benefit of all concerned parties.

2.5 Tree Plantation

On the valley side slope at km 8+750, too much debris had previously been tipped during the road rehabilitation works. This has now been reduced. Meanwhile the local landowner had felled a large number of utis trees on the slope. The area has been replanted with utis, and appears to be managed as a sustainable private plantation. No further work appears necessary.

2.6 Water Supplies

A drinking water pipe at km 14+040 has now been relocated and no other problems have been reported so far in respect of water supply. There is no further disruption of kulo (irrigation leats) and drinking water pipes; those identified in earlier EHS Reports have all been relocated.

2.7 Drainage Systems

The following comments are noted in respect of the drainage provisions for this road section:

Location	Issue
0+000	The drainage of the first ascent of the road out of Hile has not been resolved. The proposed discharge point was opposed by the local inhabitants, so the old location is still being used. This is located in the middle of the bazaar, about 200 metres before the start point of this road section. The Dhankuta Division Road Office has taken over liaison with the Municipality on this issue.
1+300	A new, approximately 80 metre long, cascade takes water from the outfall of a causeway, across the slope below the road, to a large kholsi. This is an excellent piece of design, which properly discharges the flow and protects the adjacent farmland.
1+650	A new cascade has been built to take drainage water from a hairpin loop safely down to the next road level.
6+750	A 100 metre long lead-off drain has been constructed to take discharge from a causeway in a broad saddle in the ridge that was previously subject to bad ponding of water.

3. DETAIL OF ENVIRONMENTAL HAZARDS

3.1 Quarrying Activities

No uncontrolled quarrying from the roadside slopes was observed during the visit.

Sand for the remaining sections of this road is currently being brought from the Gachhiya khola, some 5 km beyond Itahari. This means haulage of approximately 100 km and 3 km of vertical ascent (including the climb over the Mahabharat lekh above Dharan). Obviously this

involves a range of environmental disadvantages, but there appears to be no other option. For economic reasons, it is certain that the Contractor would have found an alternative had such been available. The one redeeming factor is that the Project is planting a large number of trees and to some extent these will offset the carbon-liberating consequences of the long haulage of sand to the site.

The quarry at km 3+780 (Lama) is distinctly visible from the far distance, giving the impression of a large landslide. The Contractor has made a minor attempt to close it (by building a small gabion wall across the access road) but local people have cut around this to restart use of the quarry. In June 2006 the Contractor's site staff agreed on a rehabilitation plan (see EHS Report No. 21) but, as yet, no work has been done towards this. This plan was endorsed by the ADB Environmental Safeguard Review Mission in September 2006. Now, erosion of debris and the roads within the quarry area are causing high levels of sedimentation along the road which regularly blocks culverts at km 3+800 and km 4+000. Clearance of the culverts is not manageable by DoR's routine maintenance programme.

The Consultant has discussed this issue repeatedly with the Contractor and included it in the snag list, but the Contractor continues to ignore the problem, claiming that he will take appropriate action before the end of the Contract Defects Liability Period. This is not considered to be satisfactory and it is recommended, therefore, that consideration should be given to the following course of action if the Contractor does not take immediate action to remedy this default:

- (a) implement the full rehabilitation plan given in EHS Report No. 21, and deduct the cost from the Contractor's retention money (or bank guarantee provided in lieu thereof); and
- (b) disqualify the Contractor (Lama Construction) from any further contracts under ADB funded projects for a period of, say, three years.

This drastic action is considered to be justified because the rehabilitation of quarries and borrow pits is very clearly the responsibility of the Contractor under the Contract and there would appear to be no other method of enforcing a contractor to meet his obligations in this regard.

The quarry at km 17+500 (Contract HB-4) for capping material lies on a steep slope, on private land near the road at Chitre. The 4-metre high gabion wall provided on the lower side of the quarry seems to have been effective in stopping the debris slides on to the roadway. An agreement has been reached by which the Contractor will leave the slope terraced for the landowner to use for agricultural purposes. However as the slope is very steep, this will not be easy to implement. If it proves not to be possible, then the slope must be fully re-vegetated to prevent erosion of the weak debris materials.

Rehabilitation still has to be done of the quarry at km 19+200 (HB-4) which is sited on community-managed land. As this quarry is still in use, there are still negative environmental effects on the road and surrounding land. EHS Report No. 21 (June 2006) contains all the details agreed on site with the RE and the Contractor concerning the rehabilitation of the quarry site.

3.2 Crusher Plant

The aggregate for the Contracts is being extracted from the Leoti khola and crushed near the Tamur bridge at Mulghat. A visit was made to the crusher on 5 December 2007 and it was found that dust control has been improved by pouring water on the stones as they were being fed into the crusher. However, it was disappointing to find that no safety provisions at all were in place. There was only one helmet on the site, lying under the rock hopper.

This situation exists despite the agreement reported in EHS Report No. 21 (June 2006) and the specific mention in the ADB's Aide Memoire of the Environmental Safeguard Review Mission of September 2006, which stated "With regard to the crusher plant at Mulghat, the Mission requested the contractor to equip safety fence around a band pulley, to further improve dust control measure, and to improve sound alarm for safer start-stop operation."

Discussions were held with the plant manager regarding the need for the following basic measures, which were noted as being extremely easy to implement and costing a total of about Rs 50/-:

- the roping-off of the band pulleys;
- provision of cotton wool for the three men feeding rock from the hopper into the crusher jaws; and
- removal of discarded steel pieces littering the site.

In addition, it was noted boots should be provided for all workers entering the crusher site. In addition to these basic provisions, many other safety features could usefully be implemented but these are beyond the scope of the Contract and cannot, therefore, be enforced.

We were pleased to note in a follow-up visit on 13 December 2007 that the band pulleys had been well fenced off. Workers had mufflers over their ears because it was cold, but the manager informed us that he had so far failed to convince them to use ear protection.

3.3 Tipping Sites

The following issues were found in relation to tipping sites.

Location	Issue
2+100	A former tipping and stockpile area has been smoothed off and left as per the landowner's request. It is not vegetated but it is stable. No further action is required.
8+750	See comments in the section on Environmental Improvements, under the sub-head of "Tree planting".
13+500	The approved tipping site here is a good location.
19+300, 19+350 and 19+400	As earlier reported, these tipping sites are well located and are showing no major signs of environmental damage down the valley. However, the check dam that was requested (see EHS Report Nos 21, 28 and 33) has so far not been constructed
21+000	See comments herein in the section on Environmental Improvements under the sub-head of "Recreational Facility".

3.4 Worker Safety

There were not many workers active on the road at the time of the visit, as full re-mobilisation had not been achieved after Tihar. The biggest gang was involved in scarifying the sub-grade at km 15+500. About half of the workers had helmets. Most were using sledge hammers to break stones but without boots or goggles. It seems that the Contractor repeatedly fails to fulfil its (employer's) responsibility in the provision of basic safety equipment for workers. This is currently a common problem throughout most construction sites in Nepal which must be addressed as a matter of urgency.

3.5 Delineator Posts

Delineator posts have been erected and painted in distinct colours. However, some of them have been broken and many tilted or uprooted and pushed down the slope. The primary reason for this is vandalism but it was noted that the posts, which are 1.5 metres in length, have been inserted in the soil to a depth of only about 300mm. This makes the posts very easy to push over and minor subsidence in the road shoulders often means that they can tilt on their own, even if not disturbed by misbehaving locals. It is recommended that in future

posts be lengthened and set into the ground by approximately 700mm, retaining the above ground dimension at 800mm. Setting them in concrete would not help unless the depth of the hole is adequate to offset the leverage provided by the length of the post and this would render them potentially hazardous if struck by a vehicle..

3.6 Traffic Safety

Despite increased traffic speeds after the completion of the roadway, precautions for traffic safety are minimal, signage is sparse and drivers frequently exceed safe speeds. This is a common problem for new roads in developing countries where the limited funds availability means that the provision of safety features and driver behaviour improvement training understandably tends to take a distant second place to the provision of development projects. A nation wide approach is deemed necessary to implement safety campaigns to educate drivers and to implement at least rudimentary but consistent standards of safety provisions on the road system.

During the visit damage was observed to the side drain and slope in three locations (km 1+700, km 4+000 and near km 7+000) where vehicles had run off the road in the last few days. This demonstrates the frequency of minor incidents and suggests that a major accident is only a matter of time.

3.7 Contractors' Camps

Lama's abandoned camp site still requires some debris (plastic, rubber and metal) to be cleared up. Bitumen spilled over an area of about 50m² on the opposite side of the road from the camp has also still to be cleared.

4. BIO-ENGINEERING AND SLOPE STABILISATION

4.1 Cut Slope Angles

The design grade for cut slopes is 3:1 (v:h), or 71°, which is too steep for many of the weak residual soils found along this road section to remain stable. During the design slopes of 1.5:1 or 3:2 (v:h), or 56°, were advocated which would have resulted in much greater stability. Unfortunately for economic reasons this recommendation could not be adopted. Slopes of the recommended grade in the weak materials can be stabilised, but the steeper (design) angle will inevitably lead to a failure within a few years. It is accepted that it was necessary to keep Project costs within certain limits and, therefore, to minimise the extents of slope cuttings. As a consequence, however, there will almost certainly be a number of small failures in fresh cut slopes over the next few years.

4.2 Backfilling Behind Walls

In the last report (No. 33) it was noted that, in accordance with good practice, backfilling had been done behind breast walls at km 3+620 and km18+000. At km 3+550 there is a masonry breast wall that has not been backfilled. The people living in the houses immediately above requested that it be left unfilled with a flat ground surface so that they can use the space for penning animals and growing vegetables. If this is what the local inhabitants want, then this counts as an environmental enhancement; but there is a slight danger in that the houses above are not fully protected against subsidence. The Consultant's Engineers have explained this situation to the occupants, and they have accepted it.

4.3 Landslides

Minor slip failures in the cut slopes have occurred in a number of locations along the road length, with the debris damaging the road surface and blocking the drains. Seventeen (17) individual failures were identified (see table below):

Frequency of Mountain Side Slope Failures by Chainage

Km	No.	Km	No.
0-1		11-12	1
1-2	1	12-13	
2-3	2	13-14	1
3-4	1	14-15	
4-5		15-16	
5-6		16-17	
6-7	1	17-18	2
7-8		18-19	1
8-9		19-20	2
9-10		20-21	1
10-11		21-22	4

Obviously the existing failures need to be rectified before the road starts to suffer excessive damage (rectification by the Contractors under their maintenance obligations has been instructed). While it is clear that more failures will occur in the next few years, since the disturbance caused by road upgrading has destabilised the slopes in some stretches over most of the road length, this will probably not be excessive. The worst problems are in the last 500 metres of the road, where there is severe damage caused by the kulo on the slope above (for more details, see EHS Report No. 36, covering the Basantapur-Sabha khola road). The Division Road Office will need to be informed of this problem and the need for appropriate action to be taken.

4.4 Bio-engineering Works

The bio-engineering works, mainly grass planting and brush layering, were started on schedule in late June 2007, and all plantation work was finished before the end of July. The survival rate of the plants so far is good.

The following table identifies a number of sites where the bio-engineering works have been well implemented, as well as a few places where further works are needed.

Location	Issue	Action required
3+550, VS	Brush layers of dhusun and lines of setaria grass are growing well.	None.
3+630, MS	A well vegetated backfill slope above a masonry breast wall.	None.
13+400, MS	Grass planting with phurke and ningalo are growing well. Also a small fascine.	None.
13+400, VS	Mixed brush layers of dhusun, ghurbis and asare are growing well.	None.
13+450, MS	Ningalo was planted here, but there has been a small partial slope failure. Minor trimming is needed, then grass planting and seeding, brush layers and more ningalo.	Consultant's Bio-engineering Specialist (I. Kafle) to prepare a detailed design. Contractor to be instructed to execute.
14+500, MS	Above a small masonry breast wall, brush layers of dhusun and asare, lines of setaria and planted seedlings of utis are all growing well.	None.
14+500, VS	The utis seedlings planted here are not enough. Brush layers are also needed to protect this section of slope properly.	Consultant's Bio-engineering Specialist (I. Kafle) to prepare a detailed design. Contractor to be instructed to execute.

Location	Issue	Action required
15+000, MS	A cut slope on the higher side of a hairpin bend has been treated with jute netting. This work is very poor and needs to be re-done. Although this is a newly cut site, it was not properly cleaned of loose debris after trimming. Now the debris has washed out from under the netting so that much of the netting is hanging across the front of cavities in the slope. The netting is stretched too tight and there are not enough pegs.	RE to instruct the Contractor to remove and dispose of the jute netting, re-trim and properly clean the slope, and install new jute netting carefully, precisely following the Specifications. The netting must hug the surface closely and be pegged on by at least 4 pegs per square metre. It must then be replanted with grasses.
16+100, MS	Brush layers of asare and ghurbis on the backfill behind a masonry breast wall. This is a cold, north-facing site, but the plants are surviving well and growing slowly.	None.
21+700, MS	A failure in very weak, sandy and micaceous residual soil that was treated with brush layers. The layers are growing well, but the debris has eroded badly because these alone were not adequate. The slope really needs gabion bolsters, though there is no specific BoQ item for these.	RE to make provision for gabion bolsters, either as a modification of existing gabion quantities or as a VO. A gabion breast wall, 2 metres high by 25 metres long, should be installed. Slope to be re-trimmed and compacted. Dry stone packing to be placed in the main gully. Bolsters to be instructed at 1-metre intervals. Grass (phurke) to be seeded throughout.

5. TABLE OF ENVIRONMENTAL, HEALTH AND SAFETY ISSUES MONITORED

Identified benefit	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Enhancement measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of enhancement measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Hile-Basantapur road: Part 1: Benefits and their enhancement										
Production of vegetables for "export" from the areas served by the road.	At least six loading sites affecting 300 m of road length before project.	At around km 6+500 to km 7+500 the fallow land, which was initially thought to be of government, is being cultivated with vegetables.	Improve the paving in areas regularly used for vegetable collection. Road upgrading might have encouraged the locals to cultivate their fallow land.	Consultants/DoR to include in detailed design DoR to approve. Site engineering staff are to apply	By the end of implementation.	-	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Not applicable	No problems identified.
Upgrading of roadsides through bazaar areas, particularly Sindhuwa and Basantapur.	At least 900 m of six roadside bazaars lacking pavement and drainage before project.	Road widened and drains installed through three bazaars.	Provision of drainage and pavements, and paved widened street-selling areas.	RNDP Consultants to include in detailed design. Site engineering staff are to apply.	By the end of implementation.	-	Checked and reported by Consultant Environmental Specialist.	Satisfactory	Not applicable	No problems identified.
Existing roadside slopes to be strengthened and vegetation cover improved.	At least 3 MS sites affecting a total road length of 400 m requiring strengthening and vegetation improvement before project.	Bio-engineering works have been done satisfactorily. However some repairs are necessary.	Bio-engineering and other appropriate slope protection and stabilisation measures to be used wherever weaknesses occur. Grasses not grazed by cattle are to be selected.	RNDP Consultants have included in detailed design. Site engineering staff are to apply.	Works to be completed during DLP.	-	Checked and reported by Consultant Environmental Specialist.	Satisfactory	Strict environmental clauses for slope protection seem to be having the desired result.	No problems identified at this stage.
Existing off-road drains (not side drains) to be strengthened and discharge areas improved.	In three sites (km 9+725, km 13+445 and km 15+990) active gullies threaten the road and need strengthening.	Drains have been improved at km 1+300, km 1+650 and km 6+750. The discharge in Hile bazaar at km 0+000 remains unresolved.	The Project Engineers have identified problems and appropriate drainage systems have been used wherever weaknesses were found.	Site engineering staff are to apply.	By the end of implementation.	-	Checked and reported by Consultant Environmental Specialist.	Satisfactory so far.	Effective except for the problem at Hile.	Dhankuta DRO Division Chief to liaise with Hile Municipality to resolve discharge at the start point of the road section..

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Hile-Basantapur road: Part 2: Hazards and their mitigation										
Quarrying of stone from roadside slopes, by local people, DoR and contractors, gives rise to erosion, slope instability or other environmental damage, or risk of it happening.	Seven sites have been identified where informal quarrying is affecting the road before project, extending to a total of 1300 m ² .	Previous unauthorised quarrying has been stopped. No rehabilitation work of any kind for the project quarries at km 3+780, km 17+500 and km 19+200 has been done yet.	The general plan already given in the Monitoring reports (EHS Report Nos 21 and 28) to be followed.	The Contractors are to be responsible for compliance during DLP.	Immediate	-	Checked and reported by Consultant Environmental Specialist.	Not yet satisfactory as no rehabilitation has been done.	Not effective	DoR Project Manager to tender works for the rehabilitation of the quarry at 3+780 and deduct the cost from the retention money. The CRE should recommend that the Contractor is to be barred from further ADB-funded projects for three years.
Existing side-slope failures and active valley side gullies threaten the road and surrounding land.	No existing side slope failures were noticed during walkover survey on 24-25 September 2004.	One serious side slope failure is present at km 21+700. Three others require minor works. Other old ones have been treated with bio-engineering.	Bio-engineering and other appropriate slope protection and stabilisation measures have been used to rehabilitate problem sites.	The Contractors have complied responsibly.	-	-	Checked and reported by Consultant Environmental Specialist.	Mainly satisfactory.	Mainly effective so far.	RE to ensure that failures at km 13+450, km 14+500, km 15+000 and km 21+700 are stabilised (see text for details).
Tipping sites for excess spoil lead to instability of roadside land.	Not applicable.	Suitable sites for tipping have been identified and used.	Appropriate mitigation measures have been followed.	The Contractors have complied responsibly.	-	-	Checked and reported by Consultant Environmental Specialist.	Satisfactory	Effective so far.	No problem identified.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Hile-Basantapur road: Part 2: Hazards and their mitigation										
Increased danger to road users, especially bus passengers, from faster traffic speeds.	Data not available.	The traffic volume and speed have increased considerably at least up to Siduwa. There are inadequate warning signs, safety barriers and traffic calming measures (e.g. speed bumps in bazaars).	Adequate warning signs, safety barriers and traffic calming measures (e.g. speed bumps in bazaars) must be placed.	The contractors are to be responsible for compliance during DLP.	Immediate	-	Checked and reported by Consultant Environmental Specialist.	Not yet satisfactory as no caution signs have been placed.	Not yet effective.	CRE and RE to look into the matter and instruct provisions that comply with the DoR's Safety Code of Practice. Consultant's Traffic Safety Specialists' advice is to be followed. Damaged delineator posts are to be re-set as required.
Increased danger to road users, especially pedestrians, from greater volumes of traffic.	No deaths or injuries reported among pedestrians for the last several years.	Same as above.	Provision of bus stops and off-road parking sites in appropriate locations (mainly road head points).	The Contractors are to be responsible for compliance during DLP.	Immediate	-	Checked and reported by Consultant Environmental Specialist.	Same as above	Not yet effective.	Same as above
Dust nuisance during the construction period.	All households interviewed reported an uncomfortable level of dust coming into their shops and houses from moving traffic, and wind. They mostly sprinkle water in bazaar areas. Quantification of the dust problem was not possible.	Nearly half of the road is now black-topped, removing the problem. For the remainder, poor road conditions currently mean very slow traffic speeds.	Vehicles should be permitted to run for normal work only between 6 am and 8 pm or daylight hours if shorter, and speed is to be limited to 30 km/h in open areas and 15 km/h within 100 metres of dwellings.	Contractor.	Throughout implementation.	To be checked every four months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective so far.	No problem identified.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Hile-Basantapur road: Part 2: Hazards and their mitigation										
Noise pollution during the construction period.	No unacceptable traffic noise was reported by the local roadside residents during walkover survey.	No noise pollution at present. However once the contractors' vehicle numbers increase for the construction of packages beyond Basantapur, appropriate mitigation measures will be necessary.	Vehicles should be permitted to run for normal work only between 6 am and 8 pm or daylight hours if shorter, and speed is to be limited to 30 km/h in open areas and 15 km/h within 100 metres of dwellings.	Contractor.	Throughout construction period.	To be checked every four months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Satisfactory at present.	Effective so far.	No problem identified.
Annoyance (noise and dust) from crusher plants.	Not applicable.	The only crusher plant in operation is at Mulghat.	Crusher plants to be placed at least 100 metres from dwellings and operated only during the hours of daylight.	Not applicable	Throughout construction period.	To be checked every four months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Satisfactory at present	Effective.	No problem identified.
Labour and work camps are disturbing to the local community and provide health and social risks.	Not applicable.	Not applicable at present.	Not applicable at present.	Not applicable	Not applicable	-	-	Strict contract clauses seem to have had the desired result.	Effective so far.	No problem identified.
Construction activities are dangerous to the workers.	Not applicable.	Few workers were present, but they had not been given adequate basic safety equipment.	Appropriate safety gear must be provided to all staff and workers, as specified in contract documents.	Contractors	Throughout implementation.	-	Checked and reported by Consultant Environmental Specialist.	Strict contract clauses seem not to be having much effect.	No evidence of contractors fulfilling their obligations throughout the construction period. Fortunately no major accident happened.	Site staff should keep repeating orders to the contractors on future projects. Consideration to be given to enhancing compliance by financial penalties.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Hile-Basantapur road: Part 2: Hazards and their mitigation										
Construction activities give an increased risk of traffic accidents.	Not applicable.	Poor road conditions mean that traffic speeds are minimised at present.	Appropriate signs and lane marking.	Contractors	Throughout implementation.	-	Checked and reported by Consultant Environmental Specialist.	Slow traffic speeds mean that lack of action has had little effect.	Bad road conditions have played a bigger role than mitigation measures.	Site staff should keep repeating orders to the contractors on future projects. Consideration to be given to enhancing compliance by financial penalties.

6. PROPOSED NEXT MONITORING VISIT

Since most technical matters appeared to be either under control or well understood by site staff at the time of this monitoring visit in November 2007, it is proposed that a follow-up visit should be made by the local Specialist in January 2008, when the remaining contractor's road construction work should be in full swing. This would probably not be necessary in its own right, but is justifiable through the need to travel along this road en route to the longer Basantapur-Khandbari road.

Government of Nepal
Ministry of Physical Planning and Works
DEPARTMENT OF ROADS

ROAD NETWORK DEVELOPMENT PROJECT

Asian Development Bank Loan No. 1876 – NEP(SF)

**ENVIRONMENTAL, HEALTH AND SAFETY REPORT
EHS No. 36**

**ENVIRONMENTAL, HEALTH AND SAFETY MONITORING OF THE
BASANTAPUR - MUDHE SANISCHARE - SABHA KHOLA
ROAD CONSTRUCTION**

DECEMBER 2007

Roughton International

in association with

Montgomery Watson Harza

and

ITECO Nepal Full Bright Consultancy ICGS

1. THE BASANTAPUR - KHANDBARI ROAD

1.1 Background and Progress

a) *General*

Construction of the 88 km long earthen road from Basantapur to Khandbari was started some 17 years ago by the DoR. The Government's own funds were used for construction over a period of some years, but the road was not completed. It was initially intended to follow the alignment of the first part of the access road to the proposed Arun III Hydroelectric Power Project, but in a number of places, due to construction constraints, the route deviates from the Arun III alignment. The Arun Valley Hydropower Company used the Basantapur – Khandbari Road up to Piluwa Khola (km 37) for constructing and servicing a small hydropower station. From there onwards to Chainpur (km 50), public transportation by four wheel drive vehicles started in early 2007.

This road section commences at the interface with the RNDP Hile – Basantapur Road Contract HB-4 at Basantapur, about 2,200 metres above sea level, crosses a pass at Deurali (2,450 metres) and then follows the contours to Mude Sanishchare (km 13) at an altitude of about 2,300 metres. The road then descends to the Piluwa Khola (900 metres) at km 37 and ascends again to Baneshwor (km 53) at an altitude of about 1,900 metres, via Chainpur Dhoka (about 1,800 metres) at km 50. From Baneshwor the road descends all the way to Sabha Khola (km 75.5), at an altitude slightly lower than that at the Piluwa crossing. The alignment then climbs to the ancient erosion terrace of Tumlingtar above the Arun river and ascends to its end point at Khandbari (km 88), around 1,400 metres in altitude.

Attempts by RNDP to build this road using labour-based methods by community groups were finally abandoned in mid 2006. For the Basantapur-Mude section, an ICB contract was awarded in August 2006 to rehabilitate the road section to DBST surfaced standard and the expected date of completion of these works is 20 May 2008 (a 640-day contract). Mobilisation started with surveying work in September 2006. The international partner of the joint venture Contractor has contributed in any visible way to the construction of the Works and one of the two local partners has also been conspicuous by his absence. Accordingly, the works are being implemented solely by Bokhim, the second local partner.

For the 37 km between Mude Sanishchare and Chainpur (i.e. km 13 to km 50 of the Basantapur-Khandbari road), work was packaged out and tendered to nine different LCB contractors. This section is to be brought up to bitumen standard, using an Otta seal surfacing. Contracts were awarded in November 2006, and the expected date of completion of all the contract packages is May 2008.

A major bridge over the Piluwa khola has been designed and a separate contract let for its construction. This Contract, which commenced in June 2007, is scheduled to be completed in early January 2009.

A further seven contract packages have been awarded for the road length between Chainpur and the Sabha khola, where no work has previously been undertaken. This section is only being constructed to a full width earth road with structures and drainage, and the contract durations are the same as for the nine packages up to Chainpur. RNDP is not due to build a bridge over the Sabha khola or the roadway beyond to Khandbari due to financial constraints.

Between the Sabha khola and Khandbari, an earth track was opened some years ago by the Sankhuwasabha DDC with support from GTZ And this section is trafficable during the dry seasons.

b) Environmental Reviews to Date.

In the initial report on the first part of this road (EHS Report No. 4, September 2004), it was stated that there were no major environmental issues observable. This situation was still the case when a revised baseline was undertaken in June 2006 (EHS Report No. 22). The rest of the road was also subject to a full baseline survey at that time (EHS Report No. 23). A summary of environmental issues was given in the Corridor Specific Hazard Identification and Mitigation Plan (EHS Report No. 24, September 2006). A monitoring visit was conducted in August 2007 (EHS Report No. 33), which showed a number of matters requiring to be addressed but no major environmental problems.

c) Details of Contract Packages

Package	Contractors	Package chainage
Basantapur (km0) to Mude Sanishchare (km13)		
RNDP/ICB	Gorkha/CWE/Bokhim & Sons JV	00+000 to 13+000
Mude Sanishchare (km13) to Chainpur (km50)		
RNDP/LCB/MK 1	Lama Builders/Bajraguru/Kankai JV	13+000 to 17+000
RNDP/LCB/MK 2	MK Nirman Sewa	17+000 to 22+900
RNDP/LCB/MK 3	Tamang/Himdhung/Lohani/Gauri Parvati JV	22+900 to 27+300
RNDP/LCB/MK 4	Lama Construction/Nagarjun JV	27+300 to 31+700
RNDP/LCB/MK 5	Super Sherpa/Waiba/Pushpanjali JV	31+700 to 36+100
RNDP/LCB/MK 6	BT/Elite JV	36+100 to 40+500
RNDP/LCB/MK 7	Nepal Adarsha/Golden Good JV	40+500 to 44+400
RNDP/LCB/MK 8	Kalika Construction Co. Ltd.	44+400 to 47+900
RNDP/LCB/MK 9	Jayee Construction/Contech/PS JV	47+900 to 50+000
Chainpur (km50) to Sabha Khola (km75.508)		
RNDP/LCB/MK 10	Tamang/Koshi & Neupane/Gitanjali & Gajurmukhi/Lokbir and Betali JV	50+000 to 54+250
RNDP/LCB/MK 11	Lama Construction/Bhairab/Trishuli JV	54+250 to 58+750
RNDP/LCB/MK 12	Amar/Mahalaxmi/Shankar Mali JV	58+750 to 62+950
RNDP/LCB/MK 13	Sapana/Jagat/Thodung JV	62+950 to 66+950
RNDP/LCB/MK 14	Hirachan/Bokhim/Mahadev Khimti/Mainachuli JV	66+950 to 70+200
RNDP/LCB/MK 15	Gaura Construction/Atlas Engineering/Apex JV	70+200 to 73+200
RNDP/LCB/MK 16	Swachhanda/Pacific/Oasis/Shree Rautaha/Diwa JV	73+200 to 75+508

An additional separate contract for constructing the Piluwa khola Bridge has been awarded to the joint venture of CTCE (China) and Kalika Construction Co. Ltd.

d) General Progress

So far, all the Contractors for the roadway rehabilitation/construction have been involved only in structural works, with overall progress varying significantly from around 20% to approaching 50%. By the end of January 2008, all Contractors are expected to have completed the bulk of the structural works and will be commencing road pavement construction activities.

At the time of the site visit, none of the Contractors had really got back into full swing after the Dasain and Tihar festivals closedown period. With mounting pressure to complete the works to the specified Contract deadlines in May 2008, there may well be more pressure on the environment in the coming months, when the numbers of workers and machines increase, construction activities become more mechanised and, for the first nine Contracts, bitumen works (Otta seal) are to be undertaken.

1.2 General Environmental Advantages of the Project Approach

The particular circumstances of this road section have led to a number of advantages from the environmental viewpoint.

i) Alignment

The whole road from Basantapur onwards runs along a carefully identified alignment. In general it follows the route selected for the “high level” option of the first part of the access road to the proposed Arun III Hydroelectric Power Project, although it deviates slightly from this in a number of places. Careful consideration of the terrain in the selection of the alignment means that there are relatively few sections of slope instability compared with many other roads currently being built in similar terrain in Nepal.

ii) Earthworks Balancing

For some years it was intended to undertake the construction of this road using labour-based methods. This meant that localised balancing of cut/fill quantities had to be achieved as far as possible, to avoid the movement of large quantities of material (due to the large amounts of labour this would involve) and to avoid having to import and/or disposing of large quantities of earth and rock, all without the use of machines. Detailed designs devised early in the project were modified by the engineering site teams to achieve this balance to the maximum extent feasible.

Although the works are now being undertaken through contractors who make extensive use of machines, the previous design philosophy is paying dividends. Having been involved in other comparable roads in Nepal and other countries in recent years, it can be stated with confidence that the combination of a well designed alignment with good local earthworks balancing has led to the construction of a major road where the damage to the biophysical environment is about as limited as it is possible to achieve. The eventual use of machines has certainly given the Contractors an advantage over purely labour-based methods, but dedicated site supervision by the Resident Engineers and their staff must also be recognised as playing a vital role in minimising environmental degradation. There are a few exceptions to the general trend, caused by the need for rapid opening of the track on the steep lower valley side slopes on the approach to the Sabha khola, and in isolated other locations, but otherwise the road is generally excellent in respect of its compatibility with the local environment.

iii) Slope Protection

Although most of the earth works operations are still at an early stage, advanced planning for the required bio-engineering works (which provide for the required extensive slope protection) in association with the previously planned labour-based construction approach, has meant that the project had the capacity to implement slope protection works as soon as soil slopes has been completed. This has given rise to a situation that is very unusual on construction projects: excellent inter-linking of physical and bio-engineering works that have ensured the protection of slopes in the first rainy season after they were formed. The more usual practice is to leave all slope protection until after all the physical works are finished, which invariably leads to unnecessary damage to both the slopes and the road.

1.3 Environmental Hazards Identified as General to the Whole Road Section

a) *Cut Slope Angles*

For economic reasons, cut slopes of 3:1 (v:h), or 71°, have been adopted for the roadway. This is considered to be too steep for many of the weak residual soils found along the alignment. During the design a 1.5:1 or 3:2 (v:h), or 56°, slope was advocated which was considered to be more appropriate. Slopes of the latter grade in the weak materials can be stabilised, but a steeper angle will inevitably eventually lead to localised failures, possibly within a few years. In this regard it has had to be accepted that it has been necessary to keep construction costs within certain limits and, therefore, to minimise the extents of slope cuttings. Also, the use of steeper cut slopes means that there is less land take; and obviously the more land that remains in agriculture, the better it is for the socio-economic environment. RNDP's bio-engineering specialists have coordinated with a number of landowners to ensure that the top edges of cut slopes are as well protected with vegetation as possible. However, it is inevitable that there will be a number of small failures in fresh cut slopes over the next few years.

b) *Drainage Water*

The drainage systems along this road section are generally satisfactory, but in most cases they discharge into unprotected kholsis (gullies). It is very likely that some of these will erode badly in future because of the excessive amounts of water discharge from the road in periods of extreme rainfall. This situation needs careful monitoring through the Contracts' Defects Liabilities Periods and for a few years thereafter.

c) *Temporary Drainage*

A number of valley side bio-engineering works carried out in 2006 and 2007 have been damaged by excessive runoff from the temporary surface of the earth track. This problem should be eliminated from the 2008 monsoon onwards as, by then, the permanent drainage systems should be in operation.

d) *Weak Soils*

There are many places where the road alignment passes through areas of weak, highly micaceous residual soils. Once disturbed by road construction, these become very plastic and extremely difficult to compact. A particular area of such material is found between km 31 and km 38. Allowance has been made for better sub-base material on some of the bends in these areas, but it is more than likely that pavement failure will be a recurring problem in these areas for some years to come.

2. BASANTAPUR - MUDE SANISHCHARE SECTION

2.1 Background and Progress

a) *Background*

The Basantapur – Mude Road section needs special consideration owing to its environmental sensitivity. For most of its length, the road skirts along the edge of the Milke Danda – Tinjure Danda forest. This is of mixed oak and rhododendron, and remains as one of the best forests of its type in the Himalayas. It is, therefore, of high international importance and is recognised as such, having been proposed as a protected area on several

occasions. The forest is renowned for its varieties of rhododendrons, which attract visitors from afar when they bloom during March to May. Its declaration as a Rhododendron Conservation Area is under consideration by the Forest Ministry and this could happen at any time. The road is within the buffer zone of this area of outstanding environmental value and for this reason the biophysical environment must be treated with a great deal of sensitivity.

b) Progress

The Contractor has made reasonable progress in the building of structures, although there is increasing concern over the large amount of work remaining to be done in the last six months of the Contract. The total progress to date is only 20% after 13 months, although the rate of progress should increase once pavement works are started. Work has not yet begun on the road formation and considerable lengths of side drains are still needed. The bio-engineering works are only 25% complete, so that most of these items will need to be completed in the Defects Liabilities Period (because of seasonal constraints).

2.2 Details of Environmental Improvements

The slow progress of the Contractor means that there are relatively few environmental improvements yet apparent. The following paragraphs outline the achievements thus far.

a) Bio-engineering Works using Valuable Plants

Argeli (*Edgeworthia gardneri*) is being used extensively in the Contract’s bio-engineering works. Not only is this plant robust and resistant to grazing, but it is also favoured by forest user groups because it is useful for paper making. The project has liaised widely with the FUGs on either side of Deurali over the use and protection of this and other species used in the bio-engineering works. At km3+100, the project has managed to arrange protection for a small argeli plantation previously established by the FUG.

b) Drainage Systems

The table below provides details of the drainage improvements being instigated by the project.

Location	Issue
0+840 to 2+550	The original undrained earth track, combined with the Deurali-Basantapur kulo, gave rise to massive water management problems and high rates of uncontrolled erosion. The Contract’s extensive works to resolve these problems represent a significant environmental improvement.
2+550	Covered drains will improve conditions in the small Deurali bazaar.
8+000 to 200	A kulo supplying water to land below Mude crosses the road at km 8+160. Extensive structural works under the Contract will help to protect the channel and surrounding.

2.3 Details of Environmental Hazards

a) Quarrying Activities

No uncontrolled quarrying from the roadside slopes was seen during the visit.

b) Quarry at Km 8+500

The Contractor has caused considerable damage to slopes above the road at this point, in investigating a potential source for material for water-bound macadam. The material is not yet tested and approved for use. The damage must be repaired whether the material is accepted for use on the Contract or not. The same requirements apply to the access track at km 8+600.

c) Sand

Sand for this road section construction is currently being brought from the Gachhiya khola, some 5 km beyond Itahari. This means haulage of approximately 100 km and 3 km of vertical ascent (including the climb over the Mahabharat lekh above Dharan). Obviously this gives a range of environmental disadvantages, but there appears to be no other viable option. For economic reasons, it is certain that the Contractor would have found an alternative source if such was available closer to the Contract. The one redeeming factor is that the Project is planting a large number of trees and, to some extent, these will offset the carbon-liberating consequences of the long haulage.

d) Tipping Sites

There are very few tipping sites needed on this road section on account of the good earthworks balance achieved in the design.

e) Crusher Plant

The aggregate for this road section is being extracted from the Leoti khola and crushed near the Tamur bridge at Mulghat. The crusher was visited on 5 December 2007 and found that dust control has been improved by pouring water on the stones as they are fed into the crusher. However, it was disappointing to find that no safety provisions were in place at all. There was only one helmet on the site, lying under the rock hopper. This was despite the agreement reported in EHS Report No. 21 (June 2006) and the specific mention in the ADB's Aide Memoire of the Environmental Safeguard Review Mission of September 2006, which stated

"With regard to the crusher plant at Mulghat, the Mission requested the contractor to equip safety fence around a band pulley, to further improve dust control measure, and to improve sound alarm for safer start-stop operation."

This issue was discussed with the plant manager and the need for the following basic measures was emphasised:

- the roping-off of the band pulleys;
- provision of cotton wool for the three men feeding rock from the hopper into the crusher jaws; and
- removal of discarded steel pieces littering the site.

It was pointed out to the manager that the measures are extremely easy to implement and would be of minimal (say NRs 50) cost.

In addition, boots should be provided for all workers entering the crusher site, and many other safety features could usefully be added. On a further brief visit on 13 December 2007, it was found that the band pulleys had been well fenced off and the site tidied up. However, there were still no items of safety gear in use.

f) Kulo (irrigation leat) from Deurali to Basantapur.

There was severe damage caused during the 2007 monsoon to the mountain side slope at the starting point of the road, by a kulo running across the hillside above. The user group responsible for this kulo has promised in the past to put a labourer in charge of its maintenance, but has never actually done so. At km 0+840 some 50 metres of masonry channel for the kulo has been constructed under the Contract and the VDC has also added an additional length. Yet the kulo remains a constant threat to both the road and the surrounding environment, as it can cause a huge amount of erosion when it overflows. It runs along the side drain of the road for many hundreds of metres, so that even a small blockage will cause it to spill over and scour the valley side embankment slope below the road. DoR will not be able to maintain the road as long as this remains a threat. It is therefore strongly recommended that the Dhankuta DRO Division Chief writes formally to the VDC, the DDC District Technical Office and DoLIDAR, demanding that this item of small scale irrigation infrastructure should be managed properly. It is further recommended that the letter should be copied to the Ministry of Environment, Science and Technology because of the danger to the environment in such a sensitive area; and to the Ministry of Finance because of the danger to such a valuable section of road. Specific recommendations for physical works on the slopes around this kulo are given in other sections of this report.

g) Kulo (irrigation leat) at Km 8

Another kulo crosses the road at km 8 approximately, supplying water to land below Mude Sanishchare. Some gabion works already supported this, but a lot more have had to be built, along with masonry underpinning, slope retaining breast walls and concrete lining of sections of the kulo channel. A 2-metre high gabion wall has also been built under the Contract above the kulo at the exact point where it crosses the road (km 8+160), to retain a small slope failure. All of the above works appear to be well implemented.

2.4 Bio-engineering and Slope Stabilisation

a) Slope Mass Retaining Structures

The following table summarises the problems found in connection with the retention of slope mass failures. Some are linked to the need for bio-engineering works, as described in the next table.

Location	Issue	Action required
0+040, MS	There is a gabion breast wall that starts at this point and runs for a considerable distance. It has trapped a good deal of debris washed down by the kulo on the slope above. It does, however need to be extended by about 20 metres.	RE to instruct the extension of the wall from 0+040 to 0+020.
1+550, LHS	A hairpin bend at this point has a large gully on its outside edge, caused by the outwash of a huge amount of water running off both the road and the surrounding slopes. The gully is now filled with a gabion cascade, which is good, but some finishing touches are required.	RE to instruct the installation of a gabion mattress below the outfall of the cascade, and dry stone dentition, as required, between the cascade and the surrounding soil.
1+750, MS	The kulo passes the road beside a hairpin bend. Massive scour has occurred, which will require backfilling before the side drain-cum-kulo channel can be built. Also, a large, active gully comes in here, and this certainly requires the gabion check dam that is planned.	RE to instruct works as planned.

Location	Issue	Action required
3+300, MS	A substantial shear failure in a very wet portion of slope. This needs a heavy gabion retaining structure at least 4 metres high. Filter material behind the wall and french drains on the slope above are also essential.	RE to instruct works as described.

b) Bio-engineering Sites.

The following table lists some examples of successful works and also identifies places where substantial further works are required.

Location	Issue	Action required
0+000 to 0+400, MS	Palisades of argeli and asare and grass planting and seeding have been implemented here. These are mainly growing well but have been partly damaged by heavy water flows from the kulo above.	RE to instruct the repair of damaged bio-engineering works, with assistance from the Project's Bio-engineering Specialist.
0+000 to 0+400, VS	Brush layering and other bio-engineering works on this slope have been damaged by both debris thrown down the slope and by heavy water flows from the kulo above.	RE to instruct the repair of damaged bio-engineering works, with assistance from the Project's Bio-engineering Specialist.
0+840 to 2+550, MS	The Deurali-Basantapur kulo runs along the side of the road for much of this length. Even a small blockage will cause severe scour on the fill slope below the road. For this reason, intensive bio-engineering works are required on the cut slopes here to try to prevent this happening.	Bio-engineering Specialist to ensure intensive bio-engineering works are included in the 2008 programme as necessary.
Around km 1	Grass planting has been undertaken on some cut slopes. Argeli seedlings have been planted on gentler slopes. Both of these appear to be growing well. Argeli is resistant to grazing and is also favoured by forest user groups because it is useful for paper making.	Continue to use argeli wherever it is technically suitable.
1+550, LHS	The bio-engineering works below the structure look suitable, but may require enrichment in 2008.	Bio-engineering Specialist to include in the 2008 programme as necessary.
1+750, MS	Refer to the table on structural works for a description of the problem here. After trimming the cut slope and gully sides, and backfilling around the structures, intensive bio-engineering works will be necessary to protect against further erosion.	Bio-engineering Specialist to include in the 2008 programme as necessary.
3+300, MS	Refer to the table on structural works for a description of the structures works required at this site. In addition, bio-engineering works will be required on both the back scar and the backfill above the retaining wall and around the french drains.	Bio-engineering Specialist to include in the 2008 programme as appropriate.
5+150, VS; 5+450, VS	Two good examples of bio-engineering works implemented on backfill below road retaining structures. Tree planting, brush layers and grass planting. Close liaison with the FUGs.	None.
8+160, MS	A gabion retaining wall has been built above where the Mude kulo crosses the road. This requires partial backfilling using debris trimmed from the scar at the head of the small slide. An upstand of about 0.5 m should be retained to catch boulders. Appropriate bio-engineering works should then be implemented.	Bio-engineering Specialist to include in the 2008 programme as appropriate.
9+100, VS	Bio-engineering works that mainly consist of brush layers on the fill below the road retaining wall, on the very steep slope down to the Mude kulo. These appear to be growing well.	None.

3. MUDE SANISHCHARE - CHAINPUR SECTION

3.1 Progress

The Contractors for this section of the road have generally made slow progress in the building of structures and there is concern over the large amount of work remaining to be done in the last six months of the Contract periods. On most Contracts the total progress to date is only around 30% after 11 months. The rate of progress should increase significantly once pavement works are started but as yet work on the road formation has not commenced and considerable lengths of side drains still have to be constructed. The bio-engineering works are, on average, only about 40% complete, so that most of these items will need to be completed in the Defects Liability Periods (because of seasonal constraints).

3.2 Details of Environmental Improvements

The slow progress of the Contractors means that there are relatively few environmental improvements yet apparent. The following paragraphs outline the achievements thus far.

a) *Drainage Systems.*

The table below gives details of the drainage improvements being instigated by the Contractors.

Location	Issue
13+000	Drains from Mude bazaar clash with a kulo crossing the road. The project proposes to take discharge water from the bazaar by a special 350-metre drain, to a different discharge point. This seems to be appropriate.
24+800	The hairpin loop at Lower Mamling. Water from the higher road section side drain is taken under the road because there is no safe outfall on the outside of the bend, where the ground drops steeply and houses are present. This is a good example of the careful management of drainage water typical of the design of this road, and the same solution is used in many places. While this is almost always the best option, there are two possible problems: (1) that the culvert under the road gets blocked, leading to an uncontrolled flow of water down the unprotected outer slope; and (2) that water is concentrated into relatively few natural gullies, rather than being dispersed, and in times of heavy rain overloads the gullies, causing serious erosion.
38+500	Irrigation water is to be taken across the road through a special catch pit and pipe arrangement.

b) *Assistance to Development Activities*

At km 46+800, the Contractor is supporting the Singha Devi Community Forest User Group in levelling an area of ground and opening a track to their office building. At km 47+400, the Contractor is to construct a public access leading to the school. At km 49+380 there is a good example of land reclamation, where farmers are cultivating millet behind a mountain side retaining wall.

c) *Agricultural Exploitation*

It is clear that the road is already serving a significant role in the export of cardamom, rudrakshya and oranges from the locality.

3.3 Details of Environmental Hazards

a) *General Comments on Terrain Characteristics.*

The table below summarises the nature of the terrain found in different parts of the road section.

Contract	Location	Comments
MK-1	13+000 to 17+000	The initial descent from Mude, mainly on stable upper slopes in residual soils.
MK-2	17+000 to 22+900	Generally a north-facing, shady and damp major slope. In places there are significant wet areas from springs and seepage lines. At some locations, trees are being felled to reduce the shade and allow the road to dry out better; the number is not known, but this is entirely within the compensated road reserve and is well controlled. Construction work in hand is mainly on side drains, and so far very few structures have been built.
MK-3	22+900 to 27+300	Similar situation to the package above.
MK-4	27+300 to 31+700	The road passes over a break of slope at km 28, on to the steeper and less stable lower slope terrain (unit 2 in the Fookes terrain model). It crosses the active main central thrust fault in this section.
MK-5	31+700 to 36+100	The road continues to descend steep lower valley side slopes, and there are several difficult locations.
MK-6	36+100 to 40+500	The bottom of the valley, with steep slopes on either side. The road crosses the Piluwa khola at km 37+500. The khola is highly unstable, and on the Chainpur side a smaller tributary enters just upstream of the crossing point, which is clearly subject to occasional devastating debris flows.
MK-7	40+500 to 44+400	The ascent up the lower hairpin stack towards Chainpur. The alignment makes good use of the relatively gentle slope of an ancient hillside formed in residual soils. However, while the slope is less prone to mass failures, the material is highly erodible.
MK-8	44+400 to 47+900	A steep section of less stable terrain. The road climbs across a number of fragmented slopes that are subject to occasional mass movement. The section from km 44+400 to km 45+700 is particularly steep and problematic and involves difficult engineering. The road here has been realigned into a small 'S' loop to avoid the most unstable part of the slope.
MK-9	47+900 to 50+000	More stable terrain near the top of the Chainpur ridge.

b) *Drainage of the Hairpin Stack at Km 38+500 to Km 43+500*

This is the main section of the lower hairpin stack in the ascent from the Piluwa khola towards Chainpur. There are two main drainage lines crossing the road in numerous locations and at each point the cross drainage is provided by a 900 mm Hume pipe culvert. Almost all the drainage water from the hairpin stack is diverted into these because of the proximity of houses and cultivated land close to the outer edges of the hairpins. This design of culvert, although economic, is prone to blocking, partly because of the difficulty of keeping the catch pits clean under the standard DoR routine maintenance regime.

During the first environmental walk-over survey in September 2003, the very high discharge rates of these gullies were noted and recommendations were made as to the need for special care to be taken in designing the drainage system on this hillside which comprises highly erodible residual soils. For both of these reasons, the use of causeways, which are self-cleaning and can carry very large volumes of water and, if necessary, debris, were recommended but economic considerations have evidently had to take precedence.. It is of noted that causeways would also act as traffic calming measures on the long descents.

c) Quarrying Activities

No uncontrolled quarrying from the roadside slopes was seen during the visit. The table below summarises the situation with regard to the Contractors' quarries and crusher sites.

Contract	Location	Comments
MK-1	13+600, MS	A small quarry with a gentle slope above. Judged to be acceptable.
MK-1	13+850, RHS	Crusher site on a spur beside the road. This is a good location, with no houses nearby. It was not yet operating.
MK-1	14+500, RHS	Another crusher site on a spur beside the road. This is in a very similar location to that at 13+850, with no houses nearby. It was not yet operating.
MK-1	14+770, MS	A small stone quarry beside the road. Good rock, no excess spoil and good management.
MK-1	16+260, LHS	Sand quarry located on private land. Very limited in size and apparently well managed.
MK-2	17+900	Source of sand for package 2. Not examined.
MK-2	24+600	Another sand quarry, beside houses at Lower Mamling. The land is provided by the school. The result will be a lowered and levelled area where shops will be built. No problems are reported or envisaged.
MK-3	25+500, MS	Quarry in a steep forested slope. This is not very big, and work has apparently almost finished. It will need some slope trimming to tidy it up and protect the slope when it is abandoned.
MK-3	25+600, MS	A sand quarry, now abandoned. The slope between the quarry and the road now needs to be cleaned of debris and protected with bio-engineering works.
MK-4	29+460, MS	Combined slope cutting and quarrying of capping layer material. This is acceptable, but a valley side failure needs rehabilitation: see notes under slope stabilisation structures.
MK-4	29+860, MS	Combined slope cutting and quarrying of rock for wall construction. This is well managed and acceptable.
MK-4	30+250, MS	A crusher site below a small quarry. It appears to comply with contractual requirements.
MK-5	33+250, VS	A quarry that has had to be abandoned because the owner is absent. It needs the slopes all around it to be trimmed and appropriate bio-engineering works implemented.
MK-5	33+800	Access track to the quarry at km 33+250. Also a stockpile on a stable spur.
MKs 3, 4, 5, 6, 7, 8, 9	37+500, Piluwa	Sand is being extracted from the Piluwa khola for all of these Contract s. This river is highly dynamic, with bed levels that fluctuate by at least 5 metres vertically, determined by peak hydrological events and debris supply from landslides in the headwaters. Therefore the Project is unlikely to cause significant damage by extracting the amount of sand that is anticipated.
MKs 5, 6, 7, 8, 9	37+500, Piluwa	Boulders are being extracted from the Piluwa khola for all of these Contract s, both for structures and for crushing to form aggregates. Several crusher plants were either working or were being set up on the stony valley bottom land. There is no agriculture or habitation here (because of the geomorphological instability of the valley), so it is a suitable place for crusher operation. Stone extraction is judged to be acceptable for the reasons given above.
MK-7	42+100, VS; 42+150, VS	Two temporary boulder quarries accessed by a track from km 41+650. They are in a steep rocky slope and not much stone is being extracted, so is deemed to be acceptable. Appropriate slope rehabilitation will be required when they have been abandoned.
MK-8	44+740, MS	A good site for the quarry and crusher plant, but it will need careful rehabilitation later.

d) **Tipping Sites**

There are very few tipping sites on this road section, on account of the good earthworks balance achieved in the design. The table below gives details of a number of specific sites.

Contract	Location	Comments
MK-2	19+250, MS	A proposed tipping site in a depression, within the loop of a hairpin bend. A good location, though it needs to be monitored for signs of seepage.
MK-3	25+500, VS	A tightly controlled area of tipping on to khet land, apparently by arrangement with the landowner. Once tipping has finished, the debris slope must be trimmed to 35° and then stabilised using extensive bio-engineering works.
MK-5	32+250, VS	A good location on the top of a spur, just below a hairpin bend. A level platform has been requested by the local community. It is important that no debris falls down the steep side slopes of the spur.
MK-8	46+430	Debris fallen from the road on to the khet land must be removed as soon as possible. On the mountain side there is an abandoned DoR track where surplus spoil can be tipped.

e) **Contractors' Camps**

The table below summarises the situation with regard to the contractors' camps.

Contract	Camp location	Comments
MK-1	12+900, Mude bazaar	Camp and gabion store, just below Mude bazaar. The location appears acceptable. A fuel tank and pump is about to be installed: this needs to be checked once established.
MK-2	19+250, VS	A farm and an area of bari have been taken over. So far the site is clean and there are no hazardous materials.
MK-3	26+000	Site office and plant yard. Acceptably clean and tidy.
MK-4	30+200	A camp where about 16 drivers, gabion weavers etc live. So far it is acceptably clean and tidy.
MK-5	33+300	A camp where 6 to 8 people are living at present. So far it is well kept. The fuel store is too close to the house and should be moved further away.
MK-6	36+900	A large permanent camp rented from the Arun Valley Hydropower Company (which operated the Piluwa khola hydropower plant). This is a good location.
Bridge	36+900	A building has been rented by the Contractor for the Piluwa khola bridge in the same camp as the Contract MK-6 Contractor.
MK-7	41+100	Temporary buildings on rented bari land. About 8 staff were living there at the time of the visit. The cement and fuel stores were tidy and seemed to be safe.
MK-8	47+600, VS	Access track to the camp, which is in rented houses. The workshop area is allowing oil and fuel to leak into the soil: this should be stopped by using polythene sheeting that drains into a proper sump. Cement stored at another rented house is acceptable.
MK-9	48+860, MS	The camp is in temporary buildings on rented farm land. The 40 drums of diesel should be kept at a greater distance from the residential buildings.

f) **Worker Safety**

This was seriously inadequate at all Contract sites except for Contract MK-8. On that Contractor's site, all labourers were seen with helmets. The Contractor's site engineer, Mr Ujjwal Prasai, also distinguished himself by being the first RNDP contractor to fulfil his obligations of providing safety gear to the Consultants in four years of Project activities.

g) **Traffic Management**

The first warning sign seen to be in an appropriate location was at km 47+600. Almost all the traffic warning signs seen were in Contract MK-8; those elsewhere were mostly in the wrong places. Fortunately bad road conditions mean that traffic volumes are low and speeds are slow and so there have been very few accidents.

3.4 Bio-engineering and Slope Stabilisation

a) *Cut Slope Angles*

For economic reasons, cut slopes of 3:1 (v:h), or 71°, have been adopted for the roadway. This is considered to be too steep for many of the weak residual soils found along the alignment. During the design a 1.5:1 or 3:2 (v:h), or 56°, slope was advocated which was considered to be more appropriate. Slopes of the latter grade in the weak materials can be stabilised, but a steeper angle will inevitably eventually lead to localised failures, possibly within a few years. In this regard it has had to be accepted that it has been necessary to keep construction costs within certain limits and, therefore, to minimise the extents of slope cuttings. However, it is inevitable that there will be a number of small failures in fresh cut slopes over the next few years.

There is still a large amount of slope cutting to be done.

b) *Slope Mass Retaining and Other Structures.*

The following table summarises the problems found in connection with the retention of slope mass failures. Some are linked to the need for bio-engineering works, as described in the next table.

Location	Issue	Action required
29+320	The road passes just above a big spring (kuwa) which provides an important local water source. To protect this, the road has rightly been moved back into the slope. Unfortunately the slope above is part of the debris zone of a large old landslide, and even without this shift of alignment a retaining breast wall is advisable.	RE to design and instruct a suitable gabion breast wall. Quantities may need to be adjusted from elsewhere, or added through a Variation Order.
29+460	A large section of slope cutting on the steep, rocky mountain side slope. A small failure on the valley side has resulted from poor management of water from a spring found in the slope being cut. This has led to the formation of a long gully of loose debris down the steep slope below the road. This is the only instance of really bad mass management south of the Piluwa khola.	Contractor to lead spring water to a safe discharge point until the roadside drainage is in place. RE to design and instruct suitable gabion check dams. Bio-engineering staff to design and instruct appropriate vegetation works, particularly brush layers.
31+200, MS	There is an active landslide pushing debris on to the road. The failure plane appears to be above road level.	RE to ensure that the proposed breast wall is constructed.
31+325 to 800	A kulo crosses the road and runs along the side drain. The cross-flow structure and other measures (i.e. cascades, a check dam, retaining walls and breast walls) proposed at the start of this section are appropriate, but additional measures are required between km 31+400 and 800.	RE to implement works as proposed. Additional details of bio-engineering works are given in the bio-engineering table below. One pine tree on the crest of the cut slope needs to be cut down.
37+300	The kulo to a private micro-hydropower plant crosses the road.	RE to extend the existing culvert as planned.
37+300 to 380	A very narrow section of road without adequate space for a side drain, where it is squeezed between the micro-hydro kulo and the final steep drop to the valley bottom. The proposed solution had an outward slope, but this is not good on account of (a) the steep lower slope being partly formed in soil and therefore prone to serious erosion, and (b) the possibility of runoff water concentrating in one place, especially if the kulo overflows, and scouring out the valley side slope with a big gully.	RE to revise the design, giving the road an inward slope, towards the hillside. The inner 1 metre of road surface should be formed of masonry 450 mm thick, to form a drainage channel-cum-road pavement that allows water flow along the masonry wall of the kulo and discharges into the side drain where it starts again at km 37+380. Similar designs were used by TRIP on the Ilam-Pauwa Bhanjyang road.

Location	Issue	Action required
37+500	The Piluwa khola crossing. A 96-metre single span bridge is planned. Only two houses need to be removed, one on each side, and these have been fully compensated.	RE to ensure good, robust river protection for the bridge abutments.
37+750	The first hairpin loop on the Chainpur side butts into the old debris flows along the sides of the Ghatte khola. It is protected by a masonry retaining wall, but still at some risk of damage when another debris flow occurs, as it narrows the valley floor. However, the Piluwa khola hydropower plant and the houses below the road are in much greater danger.	Maintain a watching brief.
38+250, MS	An 80-metre gabion breast wall is proposed where the road crosses a large area of khet.	RE to implement as proposed.
42+100, VS	An old gabion retaining wall is being dismantled due to its partial failure and will be rebuilt. This is highly appropriate. However, the workers are allowing debris to fall too far down the slope.	RE and site staff to be strict with the Contractor about debris disposal. Bio-engineering staff to help plan careful rehabilitation of the slope. Contractor to place warnings of the excavation in the road.
44+100, MS	A masonry breast wall 60 or 70 metres long is being constructed to help retain a wet slumping mass above the road. This seems to be appropriate.	RE to ensure that the large amount of backfill required is placed and compacted properly.
44+250, MS	Just beyond a big kholsi, a lot of slope cutting is required to bench the road into the slope properly. There are signs that this is the bowl of an old landslide, and also of significant surface water flows. It may therefore be quite unstable.	RE to check the site carefully once the slope cutting is finished. A substantial breast wall may be required to retain the slope mass.
44+400 to 46+500	There are too few breast walls in this section of steep terrain, to retain the unstable slope masses found in several areas. Unless more are built than is currently planned, there will almost certainly be a lot of mountain side slope failures in the next few years.	CRE and RE to re-examine their budget allocations and see if greater quantities of breast walls can be constructed in key locations.
44+560	There are many water-worn boulders in the kholsi which are bigger than 120 cm, and can block the pipe culvert proposed here.	If financial considerations permit, change the design to a causeway, which would be a preferable option here.
44+765 to 810	The road runs across the base of an unstable slope that will not support itself.	RE to design and instruct an appropriate retaining breast wall.
44+420 to 460	A toe wall is being constructed below to support the gabion retaining wall.	None.
44+770 to 865	The irrigation channel which runs above the road in this unstable site should be relocated.	The use of a pipe rather than a masonry channel is recommended. This is because there is a greater chance of debris from above blocking the open channel anywhere across about 100 metres of unstable slope, which would lead to a lot of water washing down to the road. A pipe can only overflow in one place, and care taken to protect the slope at that point.
46+480 to 880	About 400 m of the MS is composed of loose material which is prone to sporadic failure. Following construction, frequent repairs will be needed.	CRE and Project Manager should make specific mention of this location at the time of the handover to the Division Road Office.
47+015	A 900 mm pipe culvert is being constructed here. A house is situated just below the outfall, at one side of the kholsi.	RE to ensure that the discharge is channelised through a cascade so as to protect the house.
47+300	A kuwa is to be protected at this location.	RE to ensure that this is done.
48+140	Seepage site. A masonry breast wall is proposed, but the mass is extremely wet.	RE to consider providing a gabion wall instead, plus a sub-surface slope drain.
48+175	A drinking water kuwa is to be protected by covering it and diverting the drain away.	RE to ensure that this is done.
49+140 to 170, and 48+520	At these locations there are large masses of tipped debris below gabion road retaining structures that are overloading the valley side slopes.	Remove surplus loose debris and fill it at the base of the gabion retaining walls. Trim the slope and implement bio-engineering works.

c) Debris Slopes below Road Retaining Structures

In many places there is a bulge of debris on the slopes below retaining structures, caused by the material from foundation excavations not being completely removed from the slope or backfilled against the structure. In most cases this causes unnecessary instability in the valley side slopes. Excessive debris must always be removed before bio-engineering works are implemented, as it will otherwise lead to eventual mass failure and undermining of wall foundations.

d) Bio-engineering Sites

The following table lists some examples of successful works and also identifies places where substantial further works are required.

Location	Issue	Action required
Km 13 to 15	Various bio-engineering sites, mainly on the valley side. These generally appear well executed.	None.
24+550	A valley side retaining wall has been raised in height. On the earth slope below there is an example of good brush layers using dhokre (a plant found in the Mude-Mamling area), growing well under large utis.	None.
29+460	See details in the table above on slope mass retaining structures.	Bio-engineering staff to design and instruct appropriate vegetation works, particularly brush layers.
Around km 30	There is a lot of slope cutting in this area, on high, steep slopes. Some debris has been allowed to fall down the valley side slope, though not enough to be a danger.	Bio-engineering staff to ensure adequate slope protection of damaged areas.
31+325 to 800	See details in the table above on slope mass retaining structures.	Bio-engineering staff to ensure that all soil cut slopes are very carefully trimmed and planted with grass, so that small failures do not block the kulo.
34+200, VS	A good example of brush layering work on the fill slope below a gabion road retaining wall. Mainly simali.	None.
42+800, VS	A good example of brush layering work on the fill slope below a gabion road retaining wall on the lower side of a hairpin bend. Mainly simali, with some jatropa.	None.
43+800, VS	A new gabion road retaining wall. Below it is a steep slope down to khet land. Some stones have fallen down on to the khet and the steep area between the road and the khet has been damaged.	Contractor is to remove stones from the khet terraces. Bio-engineering staff to ensure that the slope is fully rehabilitated.
44+100, VS	A gabion road retaining wall with a kulo below it and bio-engineering works below the kulo.	Bio-engineering staff to ensure that the further work required is implemented.
49+140 to 170, and 48+520, VS	See details in the table above on slope mass retaining structures.	Implement bio-engineering works on the regraded fill slopes below gabion road retaining walls.
49+180, VS	There has been excessive erosion of the bio-engineering site due to runoff from the track.	Dry stone packing is required in the gullies.

At the time of the visit, the onset of the colder winter weather meant that the grass planting at higher altitudes was starting to look dead, while lower down in the valley, it remained greener and more healthy. However, at high altitudes it will re-sprout when spring comes.

e) Bio-engineering Nurseries

The Project has the following nurseries.

Nursery	Location	Ownership	Packages supplied	Comments
Okhre		Community FUG	BM road	8,000 seedlings currently in stock.
Dobate		Community FUG	BM road, MK 1	27,000 seedlings currently in stock.
Magar Tole	18+500	Leased private land	MK 1, 2	747 m ² of grass beds. 2,000 seedlings sent to site in 2007; 15,000 remaining.
Mamling Health Post	26+000	Government, lease agreement	MK 3, 4	
Tirtire	34+000	Leased private land	MK 4, 5, 6, 7, 8, 9	Well located on a terraced spur, in a warm location in khayer forest. 715 m ² grass beds. 34,000 seedling capacity.
Phalate	46+200	Leased private land	MK 9, 10, 11, 12, 13, 14, 15, 16	900 m ² of grass beds. 45,000 seedlings capacity (8,000 distributed in 2007, 37,000 planned for 2008).

Funding restrictions led to the cancellation of three further nurseries for the road sections beyond Chainpur. This has led to serious supply difficulties.

In addition, the agreement between RNDP and RAP for the funding, by the latter, of the staff and resources for these nurseries expired in July 2007 and despite repeated requests by the RNDP Consultants it has not been possible for an extension to be agreed. The funds originally available for this purpose (UK Pds 67,000) were not fully utilised as of the end of the original agreement, which was timed to expire at the same time as the RAP loan facility expired. With the extension of RAP it appears that the surplus funds were reallocated by the RAP Consultants, without reference or advice to RNDP. The balance of the original funds will be adequate to continue the RNDP nurseries until the completion of RAP in June 2008.

Currently the nurseries are being supported by the RNDP Consultants to ensure plant materials are available for the MK Contracts.

If it proves impossible for an extension to be agreed between RAP and RNDP then it will be essential that RNDP assumes responsibility for the funding of the nurseries to meet its commitments to the Contractors under the MK Contracts.

4. CHAINPUR - SABHA KHOLA SECTION

4.1 Progress

At the time of this monitoring visit, Contracts MK-10 to MK-16 were still involved mostly in structural works. A track had been opened for the transportation of construction materials. However, local business people have started to use it to transport goods by tractor to Khandbari, and a few public four wheel drive vehicles were seen plying the track even though it is in no sense suitable for that purpose. It is still hoped that the seven Contractors can finish their work before the due date of the end of May 2008.

4.2 Details of Environmental Improvements

a) *General Environmental Enhancements*

The main enhancements identified at present are as follows:

- A proposed minor realignment at km 55+980 to avoid an unnecessary loop, shortening the road by about 140 metres.
- The construction of sub-surface drains in seepage areas.
- The relocation of drinking water pipes and irrigation channels at various places.
- Further planned bio-engineering works for slope protection.

Apart from the issues, discussed elsewhere in this report, the overall environmental conditions of this road section look satisfactory. Mitigating the issues outlined in the next section will greatly help to enhance the environment of this road section.

4.3 Details of Environmental Hazards

a) Side Tipping

A large quantity of debris (stones and soil mass) have been thrown down the hills in many locations, damaging, and in places destroying, areas of both community forest and khet lands. Excavation of the bulging debris on the valley side slopes, followed by their re-grading and brush-layering, must be done by the Contractors as suggested in the table below.

Location	Issue
53+400	Stones and soil are being thrown down the valley side slope. All loose debris needs to be cleared from the slope and rehabilitation undertaken using bio-engineering works.
53+830	Stones and soil are being thrown down from the excavations for a retaining wall. This should be collected and backfilled at the base of the wall, and then treated with bio-engineering works.
54+400	As per the suggestion made in August 2007, a toe wall has been constructed at this location to arrest debris falling down the hill. This provides a good example of debris management.
56+160 and 56+170	Toe walls are required to arrest side tipping and then suitable bio-engineering works implemented
60+100 and 60+ 580	Tipped soil needs to be removed from the forest land, the slope corrected and bio-engineering works implemented.
61+950	Stones and soil are being thrown down the valley side slope. All loose debris needs to be cleared from the slope and rehabilitation undertaken using bio-engineering works.
63+020	Stones and soil are being thrown down the valley side slope. All loose debris needs to be cleared from the slope and rehabilitation undertaken using bio-engineering works.
63+380 and 63+780	Stones and soil are being thrown down the valley side slope. All loose debris needs to be cleared from the slope and rehabilitation undertaken using bio-engineering works.
67+060	Back excavation is required of the tipped materials in a gulley, along with the construction of dry stone check dams and live check dams.
69+600	Along the access track to a quarry of Contract MK-14, stones and soil are being thrown down the valley side slope. All loose debris needs to be cleared from the slope and rehabilitation undertaken using bio-engineering works.
71+900, 72+100 and 72+320	Back excavation is required of the tipped materials, especially the bulging higher portion. It must be backfilled at the bottom of the gabion walls and bio-engineered.
71+920 and 72+500	Appropriate tipping sites which could be used for surplus material according to the Contract Specifications.
73+170	Trim the tipped soil to a depth of about 50 cm and install brush layers.
73+200 to 260 and 73+395 to 435	These two sites need special mention in terms of side tipping. A huge quantity of spoil has slid down, leaving the top half of the slope at an angle of 42 degrees. To stop further mass movements, two long check walls should be constructed, the top half of the slopes trimmed carefully, and brush layering be done in the 2008 monsoon.

b) Quarrying

In general, almost all of the quarrying activities of Contracts MK-11 to MK-16 are contributing to the environmental hazard. While a substantial amount of debris has rolled down side slopes, there is also a major concern for personal safety. The labourers have been working

in extremely dangerous conditions without having any basic safety gear. The worst examples are where people work from the foot of the quarry with a mass of hanging stones, rocks, top soil and trees above them. It is recommended that working down from the top in benches is implemented, first removing whatever loose material is hanging on the cliff, and then extracting stones from the top downwards. On completion of the quarrying activities, Contractors should clear all the debris lying on the land below, which is especially important on the bari land such as that of Contract MK-14 at Gahate. For rehabilitating this particular quarry, the contractor is suggested to take help from the consultant's bio-engineering personnel.

Location	Issue
56+150 (some 30 m from the MK-11 camp at Kharang)	Quarry on leased bari land. There are hanging masses of hard rock and trees at the top and loose rocks in the middle, while labourers are digging at the bottom without any protective gear. The Contractor must make benches from the top while extracting stones. He must also construct a toe wall, spread the soil and implement bio-engineering works.
64+730 (some 250 m east of the road)	Quarry on leased private forest land. The description above also applies here. No rehabilitation is probably required if stones are extracted from the top and benches are made.
69+600 (some 150 m from the road at Gahate)	Quarry on leased bari land of Bhakta Bahadur Dahal. Rehabilitation is required; it is suggested that the Contractor takes the help of the RNDP bio-engineering personnel for making a rehabilitation plan for when the quarry is stopped after three months.
72+000 (some 50 m from the road)	A small quarry of Contract MK-15 taken on lease from Kalika Community Forest; no cutting down of trees is permitted. Minor rehabilitation will be needed later.
73+440 (some 60 m from the road)	Quarries of Contracts MK-15 and 16 taken on lease from Kalika Community Forest. There are hanging masses of hard rock and trees at the top and loose rocks in the middle, while labourers are digging at the bottom without any protective gear. The Contractor must make benches from the top while extracting stones. A rehabilitation plan is also required.

The sand quarrying from the Sabha khola is acceptable and did not show any signs of environmental hazards.

c) **Worker Safety**

Almost all of the Contractors have repeatedly failed to provide the basic safety equipment to their labourers. In some cases, even if they have done so, they have failed to convince their labourers to use the helmets provided. A typical example of what not to do was observed at km 52+510 (MK-10), where eight labourers without helmets were preparing the foundation of a retaining wall 5 metres below the road, with three trips of stones tipped just above their heads. The Contractor and the supervisor (Mr Tul Bahadur Lama of Kakani, Kathmandu) were strongly reminded about their responsibility towards their workers. This is not the only case and in almost all other Contracts similar situations were observed.

d) **Contractors' Camps**

In general, the Contractors' camps and stores have been properly maintained, but with a few exceptions where drums of diesel are stored very close to kitchens. The concerned Contractors have undertaken to remove the fuel supplies sufficiently far from such places.

e) **Labourers' Camps**

Almost all the labourers' camps were found to be below standard, with the exception of the one at km 53+800. The camps of Contract MK-14 at km 69+400 at Gahate, MK-15 at km 72+060 and MK-16 at km 73+450 and km 75+100 were especially bad and need immediate improvement.

f) Traffic Safety

As previously pointed out, the track opened from km 50 to km 75.5 is not intended for public transport but only for road construction purposes. Therefore, allowing public transport, especially passenger vehicles, to ply on this track whilst the construction works are in progress is considered to be extremely dangerous. It is recommended that the track be closed to the public by co-ordination with the district authorities, initiated by the Project Manager. There is one particularly deadly blind curve at km 54+000 which needs immediate improvement in warning signs even if only for the safety of Consultants' and Contractors' staff.

g) Electricity Wires

In at least two Contracts, live electricity wires were found hanging too low. This is especially dangerous at km 62+220, where gabion wire is being stored: it would be easy for children playing here to hook a spare length of wire over the 33,000 volt cable. NEA has been requested to raise the wires and the money for this work has been deposited by the Contractor, but so far nothing has been done.

It is strongly recommended that the DoR Project Manager raise this matter as soon as possible with the regional manager of the NEA, to ensure the promptest possible action before an accident occurs. Meanwhile, the Resident Engineer should instruct Contractors not to store gabion wire close to low electrical cables.

4.4 Bio-engineering and Slope Stabilisation

a) Bio-engineering Works Implemented to Date.

In general, an impressive growth of bio-engineered plants such as brush-layering, grass planting, etc. were observed throughout most of the road length. However, the progress of MK-14 in this regard was relatively slow, which was reported to be due to necessary changes in design.

b) Drainage of the Road

It is currently planned to install masonry side drains along the whole of this road section. These will stand some 300 mm above the earth road surface, since they will allow for the road formation to be laid on top of the earth at some date in the future. This is an extremely unusual and risky approach as although provisions will be for drainage to be allowed to gain entry to the drains, vehicles are certain to cause rutting of the earth road and this will lead to water flow along the road rather than into the drains. It is to be hoped that wet season maintenance can keep the drains functioning adequately. Uncontrolled water discharge can be the biggest cause of physical environmental damage.

c) Cut Slope Angles

As is the case for other sectors of the road, the design grade for cut slopes is 3:1 (v:h) which is too steep for many of the weak residual soils found along this road section. Slope correction using 3:2 (v:h) is therefore recommended to minimise slip failures in such fresh cut slopes, wherever this can be achieved.

d) Backfilling behind the Walls

Behind all the breast walls mentioned above (see table on landslides), backfilling to the proper angle (35°) is essential, followed by bio-engineering works during the 2008 monsoon.

e) Slope Mass Retaining Structures and Bio-engineering Works

The table below summarises the physical works required. This is based on an assessment of terrain conditions and slope stability along the road section length. The steep lower valley side slopes on the approach to the Sabha khola are particularly problematic, as is the usual nature of this type of landform. It is recognised that the project probably does not have adequate funding to install all of the structures that are essential if the roadside slopes are to be properly stabilised. If this is not done, however, there is a very high chance of road closure due to landsliding and damage to the physical environment as a result. If structures are not built at the locations listed below, then the CRE and Project Manager should pass the list of locations to the Division Road Office when the site is handed over.

Location	Issue	Action required
51+000	The proposed design of the cross drain will affect the existing irrigation system of khet land.	RE to make the necessary provisions to resolve this issue.
51+070, MS	A classic small shear failure in a relatively gentle but very wet slope in khet land. The slope mass is pushing into the road.	A gabion breast wall (20m) and sub-surface drain are required.
51+200, MS	An unusually active mass movement is threatening the road in gentle terrain with bari terraces. This is larger and more serious than it first appears.	Instead of the proposed masonry breast wall, a gabion wall of about 25 m in length is recommended, plus three sub-soil drains running along the three slip planes.
51+400	A kulo crossing the road needs to be properly relocated through a pipe.	RE to design and instruct as appropriate.
59+055 to 090, MS	An unstable colluvial slope. If the quantity allows, a slope mass retaining structure should be installed.	A gabion breast wall is advisable, plus a sub-soil drain. The drain outlet will serve to provide irrigation water.
59+110 to 140, MS	A gabion breast wall is required to support the unstable colluvial slope.	RE to design and instruct if at all possible.
59+140 and 59+234	Considering the large amount of debris transported from the gullies above, causeways would be better options than the proposed 900 mm pipe culverts at these two locations.	RE to re-design and instruct if at all possible.
59+260 to 330, MS	A gabion breast wall is required to support the unstable colluvial slope.	RE to design and instruct if at all possible.
59+380 to 420, MS	A gabion breast wall is required to support the unstable colluvial slope.	RE to design and instruct if at all possible.
60+180	An unstable slope with a considerable amount of seepage.	Sub-surface drain is required below the side drain.
60+340 to 380	Very unstable land with an ancient debris flow. A gabion breast wall is required to support the slope.	RE to design and instruct if at all possible.
61+410 to 430	A gabion breast wall is required to protect the wet khet land above.	RE to design and instruct if at all possible.
61+680	Sub-surface drains are required (20 metres).	RE to design and instruct if at all possible.
62+360; 62+450 and 62+959	Further back-cutting at these sites will certainly threaten the houses above the road. Breast walls with adequate weep holes are therefore required to protect them.	RE to design and instruct if at all possible.
62+530	Sub-surface drains are required (40 metres).	RE to design and instruct if at all possible.
62+420; 63+560; 63+870; 63+967; 64+470 and 64+510	Considering the unstable MS and khet land, the variation order proposed by the RE for breast walls at these sites is appropriate.	RE to implement as planned.

Location	Issue	Action required
65+270; 67+060; 68+050; 72+150; 72+550; 73+440; and 73+630	Gabion breast walls are essential at these chainages in order to protect the critically weak and unstable MS.	RE to design and instruct if at all possible.
72+150	Sub-surface drains are required (60 metres).	RE to design and instruct if at all possible.

5. TABLES OF ENVIRONMENTAL, HEALTH AND SAFETY ISSUES MONITORED

5.1 Basantapur - Mude Sanishchare Section

Identified benefit	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Enhancement measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of enhancement measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Basantapur - Mude Sanishchare Section: Part 1: Benefits and their enhancement										
Upgrading of roadsides through bazaar areas, specifically Deurali and Mude.	At least 200 m of two roadside bazaars lacking pavement and drainage before project.	No change from the baseline.	Provision of drainage and pavements, and paved widened street-selling areas.	Consultants/DoR have included in detailed design. Site engineering staff are to apply.	By the end of implementation. Works to be completed as per schedule.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Satisfactory so far.	Effective so far.	No problem identified.
Existing roadside slopes to be strengthened and vegetation cover improved.	Numerous slope issues require strengthening and vegetation improvement: see bio-engineering schedules.	About 25% of bio-engineering works, and 50% of gabion walls completed. Generally, the plants have established well.	Bio-engineering and other appropriate slope protection and stabilisation measures to be used wherever weaknesses occur.	Consultants/DoR have included in detailed design. Site engineering staff are to apply.	By the end of implementation. Works to be completed as per schedule.	To be checked annually following monsoon rains, throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Satisfactory	Effective so far.	Project Bio-engineering Specialists to ensure remaining sites are included in the 2008 programme (see text for details).
Existing off-road drains (not side drains) to be strengthened and discharge areas improved.	One kulo is a problem between 0+000 and 2+550, and another at 8+000 to 8+200. An active gully at 0+800 threatens the road and needs particular strengthening.	Situation unchanged from the baseline.	Appropriate slope drainage systems to be used wherever weaknesses occur.	Consultants/DoR have included in detailed design. Site engineering staff are to apply.	By the end of implementation. Works to be completed as per schedule.	To be checked annually following monsoon rains, throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Satisfactory so far.	Effective so far.	CRE and RE to complete works as planned (see text for details).
Productive quality of roadside vegetation cover improved.	Forest user groups are using the forested slopes close to the road for a range of valuable timber and non-timber species.	Widespread use of argeli (<i>Edgeworthia gardneri</i>), lokta (<i>Daphne bholua</i>), utis (<i>Alnus nepalensis</i>) and other useful species is supporting FUG aims.	Inclusion of useful, productive species favoured by local people wherever it is technically feasible in the bio-engineering programme.	Bio-engineering staff have included valuable plants in the programme and are producing them in the nurseries.	By the end of implementation. Works to be completed as per schedule.	To be checked annually following monsoon rains, throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective so far.	No problem identified.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Basantapur - Mudhe Sanishchare Section: Part 2: Hazards and their mitigation										
Quarrying of stone from roadside slopes, by both local people and DoR staff.	Three sites have been identified where informal quarrying is affecting the road before the project, extending to a total of 1000 m ² .	No active informal quarrying sites identified.	Undertake consultation with the VDC and DDC authorities, as well as local stakeholders, to establish demarcated sites where future quarrying is to be permitted, and where there should be no danger of damage to the road as a result.	VDC and DDC authorities, supported by the DoR Project Manager and Division Chief.	Agreement to be reached between stakeholders before start of construction. All quarrying to cease by the end of FY 2060/61.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Satisfactory so far.	Effective so far.	No action required at present.
Quarrying of materials for project works gives rise to erosion, slope instability or other environmental damage, or risk of it happening.	No pre-project contractor's quarrying sites and no induced erosion or instability were seen during the baseline survey.	Several contractor's quarrying sites are active. Erosion and instability features are expanding as works continue.	Material sources to be sited only in stable areas. Contractors are limited by strict contractual clauses regarding Engineer's approval for material sources.	Locations of material sources are to be approved by the RNDP Consultants. The Contractor is to be responsible for compliance during implementation.	By the end of detailed design.	Not applicable.	Checked and approved by Consultant Environmental Specialist.	Partly satisfactory so far.	Effective so far.	Contractor to manage quarries properly.
Existing side-slope failures and active valley side gullies threaten the road and surrounding land.	Many small but active side slope failures: for details, see bio-engineering schedules.	Numerous side-slope failures and active gullies: see text for details.	Bio-engineering and other appropriate slope protection and stabilisation measures to be used to rehabilitate problem sites.	Consultants/DoR have included in detailed design. Site engineering staff are to apply.	By the end of implementation. Works to be completed as per schedule.	To be checked annually following every monsoon rains throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Satisfactory so far.	Effective so far.	No action required at present.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Basantapur - Mudhe Sanishchare Section: Part 2: Hazards and their mitigation										
Proximity of existing kulo causes damage to both the road and the surrounding slopes.	Two existing kulo at 0+000 to 2+550 and 8+000 to 200 show signs of significant leakage.	The kulo at 0+000 to 2+550 remains badly managed and caused major damage to roadside slopes in the 2007 monsoon; the kulo at 8+000 to 200 has been stabilised by the project.	Bio-engineering and other appropriate slope protection and stabilisation measures to be used to rehabilitate problem sites.	Consultants/DoR have included in detailed design. Site engineering staff are to apply.	By the end of implementation. Works to be completed as per schedule.	To be checked annually following every monsoon rains throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Not yet satisfactory.	Not yet effective.	Strong action is required by the Dhankuta DRO Division Chief to insist on better management of the kulo at 0+000 to 2+550 (see text for details).
Increased danger to road users, especially traffic passengers, from faster traffic speeds.	Data not available.	No injuries or deaths reported among vehicle passengers.	Provision of adequate warning signs, safety barriers and traffic calming measures (e.g. speed bumps in bazaars).	Consultants/DoR have included in detailed design. Site engineering staff are to apply.	By the end of implementation. Works to be completed as per schedule.	To be checked annually throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Not yet applicable. Poor road conditions are reducing traffic speeds.	Not yet applicable.	No action required at present.
Increased danger to road users, especially pedestrians, from greater volumes of traffic.	No deaths or injuries reported among pedestrians for the last several years.	No injuries or deaths reported among pedestrians.	Provision of bus stops and off-road parking sites in appropriate locations (mainly roadhead points).	Consultants/DoR have included in detailed design. Site engineering staff are to apply.	By the end of implementation. Works to be completed as per schedule.	To be checked annually throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Not yet applicable. Poor road conditions are reducing traffic speeds.	Not yet applicable.	No action required at present.
Dust nuisance during the construction period.	All households interviewed reported an uncomfortable level of dust coming into their shops and houses from moving traffic, and wind. They mostly sprinkle water in bazaar areas.	No roadside households interviewed report a worse dust nuisance resulting from construction traffic.	Provision of speed control measures (typically speed bumps) in all areas of working to limit traffic speed to 30 km/h in open areas and 15 km/h within 100 metres of dwellings.	Contractor.	During all dry weather until a sealed surface is in place.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Not yet applicable. Poor road conditions are reducing traffic speeds.	Not yet applicable.	No action required at present.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Basantapur - Mudhe Sanishchare Section: Part 2: Hazards and their mitigation										
Noise pollution during the construction period.	No unacceptable traffic noise was reported by the local roadside resident during walkover survey.	No roadside households report an unacceptable traffic noise problem.	Contractor's vehicles permitted to run for normal work only between 5 am and 8 pm or daylight hours if shorter, and speed to be limited to 30 km/h in open areas and 15 km/h within 100 metres of dwellings.	Contractor.	Throughout construction period.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Not yet applicable. Poor road conditions are reducing traffic speeds.	Not yet applicable.	No action required at present.
Labour and work camps disturb the local community and provide health and social risks.	Not applicable.	One camp visited at 5+600 and found to be satisfactory. No complaints received by local residents relating to disruption by construction workers.	Camps are to be sensitively located in relation to the local community, and external labour forces minimised through use of local labourers. All camps are to take adequate precautions for sanitation and prevention of pollution.	Contractors.	Throughout project.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Satisfactory so far.	Effective so far.	No action required at present.
Construction activities are dangerous to the workers.	Not applicable.	Numerous instances of workers active in hazardous conditions without appropriate safety gear.	Contractors are to provide standard and special safety gear as described in the contract clauses. Environmental Specialist is to run EHS seminar for all site staff.	Contractors. Engineer is to insist on compliance.	Throughout project.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Not satisfactory.	Not effective. Contractor resists all urging to comply.	Resident Engineer to continue to insist that contractors fulfil their obligations, under threat of with-held payments if they do not comply.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Basantapur - Mudhe Sanishchare Section: Part 2: Hazards and their mitigation										
Construction activities give an increased risk of traffic accidents.	Slow traffic speeds mean that construction labourers are at limited risk until the road surface has been improved.	No instances of excessive traffic speed or accidents.	Contractors should follow DoR's "Code of Practice for Signing at Roadworks" plus additional contract clauses on measures to keep the road open and safe for traffic. As a basic minimum, white-painted stones should be used to mark road works.	Contractors. Engineer is to insist on compliance. Environmental Specialist has already run a seminar on EHS issues for all site staff.	Throughout project.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Not yet applicable. Poor road conditions are reducing traffic speeds.	Not yet applicable.	No action required at present.
Project duration does not give adequate time for environmental mitigation measures to be completed.	Initial timeframe gave a very tight schedule for contractor to complete works, particularly those requiring fair weather (on account of local climatic conditions).	Advanced planning for bio-engineering works means that slope protection is unusually well advanced. Too early to judge for other measures, but many will be carried over to the defects liability period.	ADB and DoR must agree on flexibility in the project completion date, to allow adequate time for works to be completed, or make special budgetary provision for follow-up works.	Project Director and Project Manager, as advised by the consultant and contractor.	Final year of the project.	To be checked every six months during the last year of the project.	Checked and reported by Consultant Environmental Specialist.	Satisfactory so far.	Effective so far.	No action required at present.

5.2 Mude Sanishchare - Chainpur - Sabha Khola Sections

Identified benefit	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Enhancement measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of enhancement measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Mude Sanishchare - Chainpur - Sabha Khola Sections: Part 1: Benefits and their enhancement										
Production of horticultural crops, rudrakshya and cardamom for "export" from the areas served by the road.	None before project.	Not applicable.	Construct paved surfaces at three bazaar areas such as Chainpur Dhoka, Kharang and Gahate.	Consultants/DoR to include in detailed design DoR to approve. Site engineering staff are to apply	By the end of implementation.	-	Checked and reported by Consultant Environmental Specialist.	Not applicable at present	Not applicable	Additional quantity be approved.
Upgrading of bazaar areas close to the road, specifically at Mamling, Chainpur Dhoka, Khatrigaon, Baneshwor, Kharang bazaar, Luwakot and Gahate.	All bazaars have earthen surfaces, which can be alternately dusty and muddy.	Situation unchanged from the baseline.	Provision of drainage and pavements, and paved widened street-selling areas.	Consultants/DoR have included in detailed design. Site engineering staff are to apply.	By the end of implementation. Works to be completed as per schedule.	To be checked every four months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Not yet applicable	Not yet applicable	CRE to investigate with a view to resolving the matter or finding a suitable compromise.
Existing roadside slopes to be strengthened and vegetation cover improved.	Not reported before.	Bio-engineering works have been done satisfactorily. However some repairs are necessary.	Bio-engineering and other appropriate slope protection and stabilisation measures to be used wherever weaknesses occur. Grasses not grazed by cattle are to be selected.	RNDP Consultants have included in detailed design. Site engineering staff are to apply.	Works to be completed as per schedule	To be checked every four months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Satisfactory so far.	Strict environmental clauses for slope protection seem to be having the desired result.	No problems identified at this stage.
Existing drains to be strengthened and discharge areas improved.	Not reported before.	No disturbance to the existing irrigation channels is expected especially a round the paddy fields	The Project Engineers have identified problems and appropriate drainage systems have been used wherever weaknesses were found.	Site engineering staff are to apply.	By the end of implementation.	To be checked every four months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Satisfactory so far.	Effective so far.	No problems identified at this stage.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Mudhe Sanishchare - Chainpur - Sabha Khola Section: Part 2: Hazards and their mitigation										
Quarrying of stone from roadside slopes by the contractors gives rise to erosion, slope instability or other environmental damage, or risk of it happening.	Not reported before.	A number of stone quarrying activities observed (see details in the text)	The general plan of mitigating the damage is given in the text.	The contractors are to be responsible for compliance.	Immediate.	Every two months from now onwards.	Checked and reported by Consultant Environmental Specialist.	Not satisfactory as any basic principle of stone quarrying has been adopted.	Not effective.	RE to remind Contractors and to share the suggestions made in this and the earlier reports.
Existing side-slope failures and active valley side gullies threaten the road and surrounding land.	No existing side slope failures were noticed during walkover survey on 24-25 September 2004.	Numerous side slope failures have been observed: see text for details.	Bio-engineering and other appropriate slope protection and stabilisation measures will be used to rehabilitate problem sites.	The Contractors will comply responsibly.	Before next monsoon.	Every two months from now onwards.	Checked and reported by Consultant Environmental Specialist.	Not yet fully satisfactory.	Likely to become effective.	RE to ensure that all unstable areas are included in the work schedules as far as quantities allow.
Tipping sites for excess spoil lead to instability of roadside land.	Not applicable.	Suitable sites for tipping have been identified, however bad spoil disposal at various locations were observed (see details in the text).	Very little spoil is generated through careful balance of cut and fill. Appropriate mitigation measures as suggested in the text should be followed.	The Contractors will comply responsibly.	Immediate.	Every two months from now onwards.	Checked and reported by Consultant Environmental Specialist.	Not satisfactory as any basic principle of side tipping has been followed.	Not effective	RE to remind Contractors and to share the suggestions made in this and the earlier reports.
Danger to road users, especially public transport on the newly opened track.	Not applicable before.	A number of tractors carrying the goods of the local business people and passenger vehicles were seen plying in the track.	So far, the track from Chainpur to Sabha khola is not suitable for the plying of public transport, and it hence must be stopped.	The contractors should stop other unauthorised vehicles.	Immediate.	Every two months from now onwards.	Checked and reported by Consultant Environmental Specialist.	Not yet satisfactory as no caution signs have been placed.	Not yet effective.	CRE, RE and ARE to report this to the PM and the latter to negotiate it with the local district authorities concerned.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Mude Sanishchare - Chainpur - Sabha Khola Section: Part 2: Hazards and their mitigation										
Dust nuisance during the construction period.	Quantification of the dust problem was not possible before the start of road construction.	Dust nuisance was observed at few settlements however no complain was reported by the locals.	In case of complains, vehicles should be permitted to run slowly.	Contractor.	During all dry weather.	Every two months from now onwards.	Checked and reported by Consultant Environmental Specialist.	Satisfactory so far.	Effective so far.	No problem identified.
Noise pollution during the construction period.	No unacceptable traffic noise was reported by the local roadside residents during walkover survey.	No noise pollution at present. However once the contractors' vehicle numbers increase, appropriate mitigation measures may be necessary.	Vehicles should be permitted to run for normal work only between 6 am and 8 pm.	Contractor.	Throughout construction period.	Every two months from now onwards.	Checked and reported by Consultant Environmental Specialist.	Satisfactory so far.	Effective so far.	No problem identified.
Annoyance (noise and dust) from crusher plants.	Not applicable.	Several crusher plants have been established (see text for details).	Crushers must be located at least 100 metres from houses and operated only in daylight hours.	Contractor.	Throughout construction period.	Every two months from now onwards.	Checked and reported by Consultant Environmental Specialist.	Satisfactory so far.	Effective so far.	No problem identified.
Labour and work camps are disturbing to the local community and provide health and social risks.	Not applicable.	Numerous camps inspected (see details in text). No reports of labourers disturbing the locals have been recorded so far.	Not applicable at present.	Contractor.	Throughout construction period.	Every two months from now onwards.	Checked and reported by Consultant Environmental Specialist.	Satisfactory so far.	Effective so far.	No problem identified.
Construction activities are dangerous to the workers.	Not applicable.	Contractors have repeatedly failed to fulfil their responsibility in providing basic safety equipment, nor have they convinced the labourers about the precautionary measures.	Appropriate safety gear must be provided to all staff and workers, and keep on briefing about the precautionary measures.	Contractors	Throughout implementation.	Every two months from now onwards.	Checked and reported by Consultant Environmental Specialist.	Strict contract clauses seem not to be having much effect.	Accidents seem to have been avoided only by the grace of God.	The CRE and RE need to insist on the Contractors following their agreed provisions.

6. PROPOSED NEXT MONITORING VISIT

Even though most technical matters appeared to be either under control or well understood by site staff at the time of this monitoring visit (November 2007), it is proposed that a follow-up visit should be made in January 2008, when the Contractors' construction work should be in full swing.

This will involve a repeat of the EHS monitoring reported here. However, a half-day Seminar on Environmental, Health and Safety will be conducted at the end of January or the first half of February 2008 for site staff of Contracts MK-7 through MK-16. The participants for the Seminar should include one technical and one managerial staff from each Contract and the Consultants' RE, ARE and IOW. This means that there will be a maximum of 20 people from the Contractors and three each from the respective REs' offices, thus totalling 26. However, those who have already participated in this Seminar while they were deputed elsewhere in RNDP need not attend.

**Government of Nepal
Ministry of Physical Planning and Works
DEPARTMENT OF ROADS**

ROAD NETWORK DEVELOPMENT PROJECT

Asian Development Bank Loan No. 1876 – NEP(SF)

**ENVIRONMENTAL, HEALTH AND SAFETY REPORT
EHS No. 37**

**FINAL REVIEW OF
ENVIRONMENTAL, HEALTH AND SAFETY ISSUES IN THE
BIRATNAGAR – RANGELI - BARDANGA; URLABARI - BARDANGA
ROADS UPGRADING**

DECEMBER 2007

Roughton International

in association with

Montgomery Watson Harza

and

ITECO Nepal Full Bright Consultancy ICGS

1. BACKGROUND AND PROGRESS

This Contract involves the upgrading of approximately 66 km of national feeder road south of the East-West Highway at Urlabari, which is about 6 km west of Damak. From Urlabari the road heads 26 km southwards to the small bazaar of Bardanga, adjacent to the border with India and then about 40 km west via Rangeli to Devkota Chowk at Biratnagar, the largest industrial town of Nepal adjoining the Indian border in the eastern Terai.

Apart from a few small bazaars, the road runs through agricultural land, mostly used for paddy cultivation. Settlements have been long-established with little recent in-migration. There were few if any squatters. Bazaar areas tended to be dusty or muddy, but much of the private property was clean and well-kept. There was every reason to suppose that, as has already happened along other Terai feeder roads, upgrading and full black-topping of the road would lead to a much improved appearance of built-up areas.

The Contract's environmental baseline study was conducted in October 2004, before the mobilisation of the Contractors. At that time, the overall environmental conditions were described as appearing sound, with no major issues observed. The first monitoring visit was conducted in December 2005; the second in June 2006; the third on 21 and 23 January 2007; the fourth on 18 August 2007. The fifth visit on 7 December 2007, reported herein, represents the final review of EHS monitoring for these road sections.

The Contract was awarded in early 2005 and mobilisation had occurred by June of that year. At the time of this final review, DBST had been completed over the entire road length except for a few short stretches in the settlements of Diania, Rangeli, Karsia, Katahari and Naya Bazaar. This work was well in hand and expected to be completed within a month or so.

At the time of our visit we found the security situation fine, and we had no problem whatsoever stopping the vehicle at various locations to examine the road works and associated bio-engineering, or to discuss the road improvements with the locals; a situation, which was out of the question in some previous monitoring visits.

2. DETAILS OF ENVIRONMENTAL IMPROVEMENTS

2.1 *Bazaar Areas*

The full-width pavement and covered side drains now constructed in all the 17 bazaars have greatly enhanced the local environment. Foot paths have also been constructed in the majority of these bazaars. The locals have become, however, vociferous in demanding additional works and facilities, but it will be difficult for these to be fulfilled given the status of the overall Project finances and the near completion of the Contract Works.

2.2 *Property Access*

Concrete slabs joining the road and personal property have been provided above the side drains between Urlabari and Ambari. This is a significant enhancement and, hopefully, the same facilities will be provided for the rest of the section.

2.3 *Drainage*

Drainage from the bazaars has been taken away, as far as possible, to natural outfalls, but owing to the lack of good discharge points, a build up of water at peak times was reported by the local people at Itahara. They wished to see box culverts instead of the existing piped

ones (the existing 800 mm pipe is being replaced with by two 900 mm pipes at 23+300). This provision is considered to be adequate as this is a balancing culvert which does not handle a regular through flow. All the same, the site should be monitored by DoR in the future to check that the culvert provisions are functioning adequately. It is to be noted in this regard that changes in cross road channels and irrigation flows in the Terai lead to numerous problems regarding the cross drainage of roads and hence solutions adopted to meet current conditions can require amendment in the future as flow patterns are changed.

2.4 Dust Nuisance

It is obvious that, after black-topping, the dust nuisance has almost completely disappeared from these road sections. This has resulted in a clean appearance to the surroundings, which previously looked dirty. How long the cleanliness at these sites will remain is doubtful and it is considered that the Municipality and all other local authorities must take initiatives to try to maintain the present standards of cleanliness. It is recommended that the PM (DoR) should organise a meeting with the relevant authorities to appraise them of the opportunity for implementing initiatives with the aim of maintaining the cleanliness of the road and its surroundings.

2.5 Embankment Slopes

The embankment slopes of the road and bridge approaches between Urlabari and Ambari have been well constructed and the planted grasses and brush layers have become established. The local people have even been growing pigeon pea, black gram and greens on the embankment slopes. At a few locations, banana and bitter gourd were also seen being cultivated in these locations.

3. DETAILS OF ENVIRONMENTAL HAZARDS

3.1 Safety at Crusher Plant

Safety at the crusher plant at Chisang khola was almost nil. Despite repeated earlier requests from the Consultants, workers were still seen without basic protective gear of any kind. There was a first aid box but instead of medicine, it contained jars of oil and grease. Scrap metal with sharp edges was scattered everywhere around the crusher site. The electrical controls for the plant had a network of live wires dangerously close to the operator and the metal shelter in which it stood. All these things make the site extremely dangerous for both workers and visiting officials.

3.2 Equipment Camp and Labourers' Camp

As the road construction work has almost been completed, the Contractor's labour camps had been removed. Whatever labourers were at site were reported as locals. An equipment camp near Rangeli was in generally acceptable condition; except that patches of grease and spilled fuel needed to be cleaned. There was bitumen spillage in a paddy field on the north side of the road between Ambari and Rangeli: this should be cleaned immediately.

3.3 Traffic Levels

The following traffic levels were observed during the final review visit.

Category	Biratnagar-Bardanga Eastbound traffic (1.66 hour)	Urlabari-Bardanga Northbound traffic (1.25 hour)
Heavy (lorry, bus etc)	20	13
Light (car, jeep, tractor etc)	19	16
Motorbike	58	29

3.4 Traffic Safety

As was anticipated, the traffic volumes and speeds have both increased on these road sections after black-topping. Road signs have been erected at appropriate locations, but at none of these places were the drivers seen to be slowing their vehicles. In order to reduce the cost of land compensation, these road sections were restrained to follow the alignments of the original roads, hence incorporating many curves and bends which could otherwise have been avoided. In addition, there are bridges and culverts off-alignment involving low standard curves on the approaches. It is recommended that consideration be given to limited additional quantities for crash barriers (probably 2m x 1m x 1m gabions), delineator posts and white paint for parapets. In particular, crash barriers should be constructed on both sides of the bridge approach at Bakra khola and be painted white, to stop vehicles hitting the end of the iron railings.

In addition to these measures the Consultant is arranging for the provision of chevron signs at sharp bends and other hazardous locations.

Considering the combination of careless road use by the road neighbours and reckless driving, the probability of road accidents happening on these road sections has increased greatly. As was suggested in the earlier EHS reports, rumble strips are to be constructed as a trial in several locations along the road sections. These low cost installations will be monitored to ascertain whether or not they are an effective solution to the issue of excessive speeds. Such measures are required especially on the approaches to built-up areas such as Diania and Rangeli, where the road section narrows considerably and relatively large numbers of pedestrians are present.

3.5 Construction Materials

In about 25 km of road length between Urlabari and Ambari, construction materials (for local development projects) were piled at about 50 locations, destroying the bio-engineering on the embankment slopes. At one location, workers were bending iron rods in the roadway. In other places, agricultural residues, hay, leftovers of retted jute, dung cakes, etc. were piled up. Stopping this is beyond the Consultants and Contractor's capacity, but the Project Manager (DoR) needs to inform the local authorities about these issues and the requirement for the local people to be made aware that this behaviour is detrimental to the longevity of the road and associated bio-engineering works, and that such activities should be ceased immediately.

4. BIO-ENGINEERING AND SLOPE STABILISATION

In general, impressive growth of the bio-engineering works of brush layering, grass planting, etc. were observed along most of the road lengths. However, further work is needed in the Biratnagar-Bardanga section, km 0 to km 12, in terms of re-grading of the embankment slopes. These slopes have not all been properly finished, so that, in places, there is a sudden vertical drop that leaves the immediate shoulder of the road exposed. Grass turf laid along these lengths has been covered by aggregates in many places. These should be removed to allow the grass to grow properly. Also, since turfing has been done recently (in the dry season), watering is required for it to survive until the next monsoon. At these sites,

brush layering and grass planting must also be done at the onset of the next monsoon, which will still be in the DLP.

The guidelines for bio-engineering works are that:

- turfing must be done along the immediate edge of the road shoulder;
- grass planting using kans (*Saccharum spontaneum*) must be done on all embankment slopes longer than 1.5 metres in length;
- brush layers using simali (*Vitex negundo*) must be done on all embankment slopes greater than 4 metres in length;
- combined grass planting and brush layering must also be done on the approaches to the three bridges between Biratnagar and Rangeli.

5. TABLE OF ENVIRONMENTAL, HEALTH AND SAFETY ISSUES MONITORED

Identified benefit	Baseline extent and severity (quantified indicators)	Checked extent and severity (FINAL REVIEW)	Enhancement measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of enhancement measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Terai feeder roads (Biratnagar-Bardanga; Urlabari-Bardanga roads): Part 1: Benefits and their enhancement										
Increased areas for the grazing of cattle tethered on embankment slopes.	Embankments regularly used by 200 tethered cattle grazing along approximately 15 km of road before project.	The embankment slopes from Urlabari to Bardanga have well established plants and the rest are being planted with prescribed species.	All embankment slopes will be grassed with robust but palatable species to prevent erosion and permit controlled grazing, once they have been raised.	Contractor to implement works as instructed by the Bio-engineering Specialist.	By the end of implementation. Works to be completed as per schedule.	Regular.	Checked and reported by Consultant Environmental Specialist.	Performance in the first 26 km section is very good, and some improvement is needed for the rest.	So far effective	No problem identified.
Provision of shade trees to improve the environment for road users.	Approximately 80 religious trees (Bar and Pipal) with more or less equal numbers of other trees such as Mango, Guava and Jackfruit were present before the project. 15 km of the RoW has potential for tree plantation.	No tree felling reported as required during widening. At least 80 religious trees were counted during the final review.	Since road neighbours graze cattle, and also do minor cultivation on embankment slopes, the dense planting of trees is not really appropriate. However, all other existing trees will be preserved.	Contractor to implement works as instructed while abiding by Contract clauses that forbid damaging trees.	Throughout implementation.	Regular.	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective.	No problem identified.
Upgrading of road helps increase traffic volumes.	Vehicles plying on road counted during pre-project survey. (See Baseline Survey Report).	Traffic levels have increased; local three-wheelers, jeeps and buses are more common.	Black-topping has almost been completed, providing a much better ride quality.	Contractor to implement works as instructed by Resident Engineer.	By the end of implementation.	Regular.	Checked and reported by Traffic and Road Safety Engineer of RNDP.	Satisfactory	Effective.	No problem identified.

Identified benefit	Baseline extent and severity (quantified indicators)	Checked extent and severity (FINAL REVIEW)	Enhancement measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of enhancement measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Terai feeder roads (Biratnagar-Bardanga; Urlabari-Bardanga roads): Part 1: Benefits and their enhancement										
Reduction of stagnant water in old roadside borrow pits, giving rise to an increased risk of mosquito-borne diseases.	Approximately 50% of the road length has depressions that become waterlogged during rain. About 2.5 km of road is affected by dry season stagnant water in borrow pits.	Road surface has been raised to avoid water logging. Borrow pits are mostly surrounded by farmed land and fresh drainage systems are unpopular.	Where possible, simple sluices should be cut in the walls of borrow pits to permit drainage outside the monsoon and jute retting seasons.	Resident Engineer to identify problem areas during the dry season and instruct the Contractor; Contractor to implement works as instructed.	By the end of implementation. Works to be completed as per schedule.	Regular.	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Not effective: too difficult a problem to solve in the current political environment.	Abandon the idea.
Upgrading of roadsides through bazaars and bus stations.	Seventeen bazaar areas with about 15,180 m ² of bazaar roadsides (which also includes paved area for a 6 m width bus station) lack paving.	Full-width pavement, covered side drains, and foot paths have imparted a better look to all the 17 bazaars. The standard raised roadways in bazaars give rise to serious safety implications in the middle of busy bazaars. Vehicles could swerve off the road into houses.	Speed control measures are essential.	Resident Engineer to review site requirements and propose more drainage, paving and speed restrictions as far as quantities allow. DoR to approve. Contractors to implement works as instructed by RE.	By the end of implementation. Works to be completed as per schedule.	Regular.	Checked and reported by Consultant Environmental Specialist.	Partially satisfactory.	Not effective. RE and site staff have recognised the problem but could not resolve it as this was not incorporated in design.	RE to consider possible options for improved traffic calming measures and design whatever arrangements are possible.
Road signs, humps at schools and bazaars.	Two schools and the 17 bazaar sites lack warning signs and speed control measures.	Traffic signs have been placed but the construction vehicles as well as others were seen moving fast on the new DBST surface.	Provision of traffic calming measures.	RE to review the site requirements and propose the traffic calming measures.	Immediately required.	Regular.	Checked and reported by Consultant Environmental Specialist.	Not satisfactory unless enhancement measures are scheduled for implementation.	Not effective.	RE to instruct the Contractor to post warning signs and traffic calming measures wherever required.
Improvement of environment where road passes close to religious trees and shrines.	No specific sites identified before project.	No change from the baseline.	Not applicable	Not applicable	Not applicable	Regular.	Checked and reported by Consultant Environmental Specialist.	Not applicable	Not applicable	No problems identified.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (FINAL REVIEW)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Terai feeder roads (Biratnagar-Bardanga; Urlabari-Bardanga roads): Part 2: Hazards and their mitigation										
Confrontation with local residents following road widening, in all settlements where roads are too narrow to carry a full width feeder road.	Seventeen narrow settlements and bazaars before project.	No confrontation is found.	Negotiation with affected stakeholders.	Project Manager to ensure confrontations if any, are settled satisfactorily.	Immediately when problems occur.	Regular.	Checked and reported by RNDP Environmental Specialist.	Satisfactory.	Effective.	No problems identified.
Erosion of high embankment slopes on approaches to bridges.	Only minor erosion features were visible on high embankment slopes on approaches to bridges.	Road widening works have altered the previous embankment slopes. A high quality of bio-engineering work has eliminated all such erosion.	Bio-engineering measures (mainly grass planting, brush layering or turfing) used to protect all high embankment slopes near bridges where erosion may occur.	Contractor to implement bio-engineering works as required.	Works to be completed as per schedule.	Regular.	Checked and reported by consultant Environmental Specialist.	Good progress in this regard has been achieved, and its standard is satisfactory.	Effective.	No problems identified.
Increased danger to road users, especially vehicle passengers, from faster traffic speeds.	Data not available	The traffic volume has considerably increased, with faster speeds.	Provision of adequate warning signs, safety barriers and traffic calming measures (e.g. speed bumps in bazaars). Particularly necessary on sharp curves between Urlabari and Bardanga.	Contractor to implement works as instructed by RE.	By the end of implementation.	Regular.	Checked and reported by consultant Environmental Specialist with collaboration by TRSE.	Not yet satisfactorily implemented.	Not fully effective.	RE to instruct Contractor to post adequate warning signs.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (FINAL REVIEW)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Terai feeder roads (Biratnagar-Bardanga; Urlabari-Bardanga roads): Part 2: Hazards and their mitigation										
Increased danger to road users, especially pedestrians, from greater volumes of traffic.	Data not available	Vehicles were found to be moving fast. During the project, a Contractor's vehicle crushed a pedestrian to death, and a passenger fell from the roof of a public bus.	Provision of adequate warning signs, bus stops and off-road parking sites in appropriate locations (mainly road junctions). Speed limit to be strictly enforced.	Contractor to implement works as instructed by RE.	By the end of implementation. Works to be completed as per schedule.	Regular.	Checked and reported by Consultant Environmental Specialist with collaboration by TRSE.	Needs improvement	Unsatisfactory.	RE to instruct Contractor to post adequate warning signs on road, and follow precautionary measures in working sites.
Following upgrading, a substantial increase of motorised traffic using the Urlabari-Rangeli-Biratnagar route to avoid Itahari endangers non-motorised traffic.	The current data are not available; however vehicular count done on the day of drive over survey, the following numbers were noticed: Truck 2; Bus 3; Tractor 2; Mo'bike 2.	The number of motorised traffic has considerably increased. However, there is no evidence that the route is yet being used as an alternative to the main highways.	If the indicators show a dramatic increase in accidents, then the project authorities must design an appropriate solution.	Depends on measures adopted if this situation arises.	Depends on strategy adopted.	Regular.	Checked and reported by Consultant Environmental Specialist.	Not applicable	Not applicable	No problem identified.
Grazing of cattle on embankment slopes interferes with traffic flows, and gives rise to dangerous traffic situations.	200 cattle grazing on embankment slopes during the pre-project survey represent the possibility of cow-related accidents that might happen at any time.	Similar to pre-project situation. As yet, no such accidents have been reported.	If this situation arises, the RNDP Consultants' Social Development team will make an investigation of the issue.	Consultant Environmental Specialist to raise the issue if a problem is observed.	Depends on strategy adopted.	Regular.	Checked and reported by Consultant Environmental Specialist.	Not applicable	Not applicable	No problem identified.
Dust nuisance during the construction period.	All people interviewed reported a regular dust nuisance from moving vehicles and wind. But due to low traffic volumes, this is only occasional.	No dust observed after black-topping the road.	Provision of speed control measures, and sprinkling of water.	Contractor.	Throughout implementation.	Regular.	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective.	No problem identified.

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Terai feeder roads (Biratnagar-Bardanga; Urlabari-Bardanga roads): Part 2: Hazards and their mitigation										
Noise pollution during the construction period.	None of the people interviewed reported an unacceptable traffic noise before project.	No unacceptable noise pollution reported.	Contractor's vehicles permitted to run for normal work only between 6 am and 6 pm or daylight hours if shorter, and speed to be limited to 30 km/h in open areas and 15 km/h within 100 metres of dwellings. Machinery working areas to be located at least 100 metres from the nearest habitation.	Contractor.	Throughout construction period, and during running of the machines.	Regular.	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective.	No problems identified.
Noise pollution at the crusher plant.	Not applicable.	Loud noise during the operation of the crusher plant and especially the rattling sound of the rotating aggregate grader was observed. No ear protection was provided to labourers.	Contractor to provide ear plugs to the workers at crusher site.	Contractor	Throughout the running period of the crusher plant.	Regular.	Checked and reported by Consultant Environmental Specialist.	Not satisfactory.	Not fully complied.	RE to take action if appropriate ear protection devices are not given to the labourers at the crusher site.
Unacceptable levels of noise pollution following upgrading.	None of the people interviewed reported an unacceptable traffic noise before project.	Similar to pre-project situation.	Speed controls are the only viable option.	Not applicable at present	Not applicable at present	Regular.	Checked and reported by Consultant Environmental Specialist.	Not applicable.	Not applicable.	No problems identified.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (FINAL REVIEW)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Terai feeder roads (Biratnagar-Bardanga; Urlabari-Bardanga roads): Part 2: Hazards and their mitigation										
Disturbance to nearby settlements by workers living in large labour camps.	Not applicable.	No disturbance to the nearby settlements by workers was observed.	Contractors are encouraged to employ local people as far as possible. Contractual clauses include strict provision for contractors to maintain small labour camps as close to large bazaars as possible, to minimise social disruption.	Contractor. CRE to approve the sites of all labour camps.	Throughout construction period.	Regular.	Checked and reported by Consultant Environmental Specialist.	Contract provisions appear to be having the desired effect.	More or less effectively complied.	No problem identified.
Labour camps, and plant and equipment camps give rise to pollution of the soil or water courses through the leakage of sewage, oils, bitumen, etc.	Not applicable.	One equipment camp, and one bitumen yard are not tidy (see text above).	Contractual clauses include strict provision for contractors to maintain high environmental standards in all camps, to avoid pollution and contamination.	Contractor. CRE to approve the sites of all camps.	Throughout construction period.	Regular.	Checked and reported by Consultant Environmental Specialist.	Not fully satisfactory as yet.	Not fully effective so far. The stated sites must be made tidy before leaving them.	RE to instruct the Contractor to comply with his responsibility.

Government of Nepal
Ministry of Physical Planning and Works
DEPARTMENT OF ROADS

ROAD NETWORK DEVELOPMENT PROJECT

Asian Development Bank Loan No. 1876 – NEP(SF)

ENVIRONMENTAL, HEALTH AND SAFETY REPORT
EHS No. 38

FINAL REVIEW OF
ENVIRONMENTAL, HEALTH AND SAFETY ISSUES IN THE
DAMAK - GAURIGANJ ROAD UPGRADING

DECEMBER 2007

Roughton International

in association with

Montgomery Watson Harza

and

ITECO Nepal Full Bright Consultancy ICGS

1. ENVIRONMENTAL SITUATION

1.1 Background

This Contract involved the upgrading of approximately 22 km of national feeder road F2, from the East-West Highway some two kilometres east of Damak at Padajung, southwards to the small bazaar of Gauriganj. Apart from a few small bazaars, the road runs through agricultural land, mostly used for paddy cultivation. Before RNDP, only the first 6 km of this road section were black-topped; the rest was gravelled. Settlements have been long-established with little recent in-migration. There were few if any squatters.

Some twenty-five years or so after initial construction, the road section blended in well with the landscape. Before the start of RNDP, the bazaar areas tended to be dusty or muddy, but the private properties were maintained in a clean and well-kept condition, and there was every reason to suppose that, as has already happened along other Terai feeder roads, upgrading and full black-topping of the road would lead to a far better appearance within the built-up areas. This is exactly what has happened on this road section after the completion of the Contract Works.

The Contract's environmental baseline study was conducted in October 2004 (EHS Report No. 6), before the mobilisation of the Contractors. At that time, the overall environmental conditions were described as appearing sound, with no major environmental issues observed.

The four (4) Contracts (DG-1 to DG-4) comprising the road construction works were awarded in early 2005, and all Contractors were mobilised by June of that year. The first environmental monitoring study was conducted on 4 July 2005; the second on 19 February 2006; the third on 19 June 2006, the fourth on 7 and 9 January 2007 and the fifth on 16 August 2007. The Contracts DG-1 and DG-2 Works were completed on 30 June 2007 whilst those for Contracts DG-3 and DG-4 were finalised on 30 August 2007.

This final review was conducted on 9 December 2007, in which the Consultants Environmental and Bio-engineering expatriate Expert and local Specialist were accompanied by the Resident Engineer.

1.2 Environmental Enhancements

a) General Enhancements

The most obvious improvement is the black-topping of the whole road section. This gives comfortable year-round access with minimum dust and mud. The next most significant enhancements are the covered drains and full-width (14 m) pavements in all the bazaar sites. The main provisions are as follows:

Bazaar	Chainage	Provisions
Padajung	0+000 to 1+000	Full width pavement and extensive lengths of covered drains.
Mangalbare	1+900 to 2+200	Covered drains.
Small bazaar	Km 4	Covered drains.
Sitapuri	Km 7	A widened paved road and covered drains. Bus stops also constructed.
Gauradaha	10+400 to 10+590	Full width pavement, covered drains and raised foot paths.
Gwaldubba	16+380 to 16+630	The road has been widened and is now higher than the houses on either side. The drain covers have been lowered, making a distinct zone between the raised road and the foot paths.
Jurepani	18+700 to 18+900	Covered drains.
Gauriganj	21+500 to 21+806	Full width pavement and covered drains. The drains separate the high road level from the low houses.

b) Embankment Stabilisation and Protection

Embankment stabilisation and protection works have been installed throughout all four sites using simple but robust bio-engineering works, consisting of brush layering and grass planting. The work was done by the Contractors to minimum acceptable standards, but as most of the plants have taken and as the embankments are low, this will probably be adequate. The brush layers were done using only saruwa (*Ipomoea fistulosa*) but it is considered that a much better result would have been achieved if simali (*Vitex negundo*) had been employed, as was done on the Urlabari-Bardanga Road section (refer to EHS No. 37). Road neighbours are growing black gram on the embankment slopes in some places, but this does not seem to be causing any damage.

c) Side Access

Property access has been provided in numerous locations by placing reinforced concrete slabs across the side drains and some narrow borrow pits. For side roads, a standard 15 m length of (DBST) paving has been provided. Both provisions are considered to have significantly enhanced the environmental as well as access conditions for road users.

d) New House Construction

At the time of the final assessment visit, it was observed that there was a significant level of new house construction in the small bazaars along the road section. Whether this is a response to the better road conditions or results from other factors was not established during the review visits as it was not pertinent to the study. Nevertheless, the scale and extent of this activity is indicative of the importance of the road and the perception of its proximity being environmentally acceptable. House building materials were stacked on the road itself in 17 separate locations and there were many other sites where houses were being constructed nearby.

e) Drainage

The timing of the monitoring visit in August 2007 was deliberately selected to try to ascertain if at the mid-monsoon time there were any significant drainage problems. It was pleasing to note that no serious cross-road or side-drainage issues were apparent. The concern of inadequate drainage provision, especially at km 10+500 and km 21+800, that were raised in the previous EHS reports, has been addressed by suitable mitigation measures and there were no problems evident at that time in either location. The box culvert at km 4+450 and the pipe culvert at the southern end of Gwaldubba bazaar (km 16+700) have coped with the storm water discharge even in times of torrential rainfall.

1.3 Environmental Hazards

a) Delineator Posts

Some 200 posts have been erected to mark the edges of the road. A few are unstable and need to be re-set in deeper holes. Improvements are recommended in the following locations:

Location	Issue
11+830, slight bend	Three more delineators on each side would improve the safety at this bend. The lower part of the electricity pole on the left hand side (heading south) should be painted white.
16+200, approach to Gwaldubba	Three more delineators would be a benefit on the bend as the road approaches this bazaar from the north.

b) Traffic Calming Measures

The need to place traffic calming measures in bazaar areas and at schools has been constantly highlighted (see, for instance, EHS Report 18), but apart from a few road signs, no such measures have yet been implemented. The Resident Engineer has been requested to consider the placement of rumble strips or road humps at key locations on the approaches to bazaars; these have been observed to be effective on the Jogbani-Dharan road, the East-West Highway and other roads.

c) Overloaded Buses

The few buses observed during the review visit were seriously overloaded. As elsewhere in Nepal, the decline in government authority following the recent widespread political disturbances means that the police are no longer able to control vehicle loading effectively. The local authorities appear not to have licensed enough operators of public vehicles on many routes, with the result that the operators tend to overload their vehicles and pay little heed to adequate vehicle maintenance. The Project Director is urged to request the Director General to raise this issue with the Department of Transport Management. The Department of Roads' efforts to improve traffic safety will be seriously prejudiced, if not negated, if vehicles are dangerously overloaded.

d) Traffic Levels

The following traffic levels were observed during the final review visit.

Category	Northbound traffic (1 hour)	Southbound traffic (½ hour)
Heavy (lorry, bus etc)	2	2
Light (car, jeep, tractor etc)	12	7
Motorbike	36	21

e) Tractor Access to Fields

A new problem has been identified on this road section following the completion of the construction works. In this area, tractors are increasingly being used to cultivate paddy land. The standard design of Terai roads does not provide proper access between the road and the adjoining fields, and so there is a tendency for tractors to be driven over the embankment slopes wherever convenient for the ploughing. The slopes are too steep for this to be done without damage and evidence was found of such damage in a number of locations. Future designs will need to take this type of activity into account.

2. ENVIRONMENTAL, HEALTH AND SAFETY ISSUES MONITORED

Identified benefit	Baseline extent and severity (quantified indicators)	Checked extent and severity (FINAL REVIEW)	Enhancement measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of enhancement measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Damak-Gauriganj road (a Terai feeder road): Part 1: Benefits and their enhancement										
Upgrading of roadsides through bazaars.	There is no drainage or paving of bazaars: at least 360 m of bazaar roadsides lack drainage and 1920 m ² lack paving (this also includes area for bus station).	In eight bazaar areas, paving has been done as wide as 14 m and drains have been covered. Raised foot paths have been built in a few locations.	Have been applied effectively and satisfactorily.	The Contractors have complied as instructed by RE.	Complied in time.	Not applicable at present.	Checked and reported by Consultant Environmental Specialist.	Satisfactory	Fully effective.	No problem identified.
Improvement of environment where road passes close to religious trees and shrines.	No specific sites identified before project, but local people may raise objections during construction work.	The small temple at km 18+830 was moved a little from its original position by the locals themselves giving way to road construction.	Not applicable at present.	Not applicable at present.	Not applicable at present.	Not applicable at present.	Checked and reported by Consultant Environmental Specialist.	Satisfactory in so far as the negotiations with the locals ended up with a good result.	Not applicable at present.	No problem identified.
Upgrading of road helps increase traffic volumes.	Vehicles plying on the road counted during pre-project survey.	The local traffic level is still low, but is reported as higher than the pre-project situation.	Not applicable at present.	Not applicable at present.	-	Not applicable at present.	Traffic and Road Safety Engineer of RNDP.	Not applicable.	Not applicable.	No problem identified.
Traffic calming measures at schools and bazaars.	Low speed gravel surface means that no warning signs or humps have been deemed necessary at the two schools and the 12 settlement areas.	Except for a few warning signs, no traffic calming devices were seen at schools and bazaars.	Construction must incorporate a number of traffic and engineering safety measures.	Traffic and Road Safety Engineer of RNDP to support RE in this respect.	Throughout implementation.	-	Checked and reported by Consultant Environmental Specialist.	Not yet satisfactory	Not yet effective.	RE to instruct the Contractors to place rumble strips or speed bumps as necessary.

Identified benefit	Baseline extent and severity (quantified indicators)	Checked extent and severity (FINAL REVIEW)	Enhancement measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of enhancement measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Damak-Gauriganj road (a Terai feeder road): Part 1: Benefits and their enhancement										
Areas for the grazing of cattle tethered on embankment slopes maintained or increased.	Embankments used for over 200 tethered cattle grazing along about 13.5 km of road during the rice growing season.	The embankment slopes have now been renovated and planted with grasses palatable to cattle. Cattle were not grazing during the visit as it was not the rice growing season.	The enhancement measures are in place as the embankment slopes have been grassed with robust but palatable species to prevent erosion and permit controlled grazing.	Contractors have complied with their responsibility.	Timing is good, though with a little delay.	-	Checked and reported by Consultant Environmental Specialist.	Satisfactory, as the Contractors have now caught up with time.	Effective.	No problem identified.
Provision of shade trees to improve the environment for road users.	At least 60 religious trees (Bar and Pipal), with a more or less equal number of other trees (Mango, Guava and Jackfruit) are present.	The existing roadside trees have not been disturbed by road construction and remain mostly in healthy condition.	The planting of shade trees is not really appropriate. However, all other existing trees have been preserved.	Contractors have complied with their responsibility, by not damaging the existing trees.	-	-	Checked and reported by Consultant Environmental Specialist.	Satisfactory	Effective	No problem identified.
Reduction of stagnant water in old roadside borrow pits, giving rise to an increased risk of mosquito-borne diseases.	Waterlogging occurs in about 10% of the roadsides during dry season, but these areas are used by local people for paddy cultivation during the monsoon.	No major changes from the pre-project situation are seen. Appropriate side and cross drains have been constructed to match with the discharge	Drainage measures placed where appropriate. Rice cultivation is done right up to the embankment toes.	Contractors have complied with their responsibility.	The timing of compliance schedule is appropriate.	-	Checked and reported by Consultant Environmental Specialist.	Satisfactory	Effective	No problem identified.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (FINAL REVIEW)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Damak-Gauriganj road (a Terai feeder road): Part 2: Hazards and their mitigation										
Confrontation with local residents following road widening, in all settlements where roads are too narrow to carry a full width feeder road.	Nine settlements and three bazaars with no evidence of latent confrontations.	No problems in this respect were reported.	The project's social development specialists undertook detailed liaison.	Not applicable at present.	Not applicable at present.	-	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective.	No problem identified.
Material extraction sources give rise to erosion, loss of land or downstream problems in water courses.	Three rivers (Chisang, Mauwa and Ratuwa), were judged to be environmentally acceptable for material extraction.	Not applicable.	Site-specific mitigation measures were proposed.	Contractors appear to have extracted materials following the provisions of the contract, and fulfilled their responsibility.	Not applicable at present.	-	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective.	No problem identified.
Haulage of materials through Damak and other bazaars causes a temporary increase in traffic levels and associated disruption.	Not applicable.	Not applicable.	Traffic control measures (timing and speed) were imposed on the contractors.	Not applicable at present.	Not applicable at present.	-	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective.	No problem identified.
Crushing of materials causes noise and dust pollution.	Not applicable.	Not applicable.	Site-specific mitigation measures were proposed.	Not applicable at present.	Not applicable at present.	-	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective.	No problem identified.
Discharge from drains may flood roadside agricultural land.	Virtually no drainage, so no impacts from outfalls.	No visible problem related to drain discharge, particularly in habitation areas.	Appropriate designs were proposed.	The Consultant Engineers and the Contractors have fulfilled their responsibility.	Not applicable at present.	-	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective.	No problem identified.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (FINAL REVIEW)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Damak-Gauriganj road (a Terai feeder road): Part 2: Hazards and their mitigation										
Inadequate cross-drainage will lead to extensive upslope flooding once the embankment is raised during project construction.	Low existing road is frequently over-topped after heavy rain.	No problems related to drain discharge were seen during the last monsoon.	Appropriate designs were proposed.	The Consultant Engineers and the Contractors have fulfilled their responsibility.	Not applicable at present.	-	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective.	No problem identified.
Raised embankment will lead to difficulties and dangers in wide bazaar areas at km 10+500 and 21+800.	Not applicable.	Although the locals are not complaining of raised road surfaces in the bazaars, both they and we think that this might cause accidents.	The limited engineering design does not permit a level surface in these bazaars; however appropriate traffic calming measures must be in place after black topping of the road.	RE to review site requirements and place traffic calming measures. Contractor to implement works as instructed by RE.	By the end of DLP.	-	Checked and reported by Consultant Environmental Specialist.	Not sufficiently incorporated in detailed design, but shortcoming is identified.	Ineffective.	RE to propose traffic calming measures in main bazaar areas. Project Manager to give positive support to RE's proposals.
Raised embankment will lead to problems of access at intersections with small tracks and paths.	Not applicable.	No problems in the intersections have been observed.	Access points are properly designed.	The Consultant Engineers and the Contractors have fulfilled their responsibility.	Not applicable at present.	-	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective.	No problem identified.
Erosion of raised embankment slopes, especially when newly formed.	No significant erosion features were visible during pre-project survey.	All embankment slopes appear to be stable and well protected.	Bio-engineering measures (mainly grass planting, turfing or brush layering) will be used to repair them.	Contractors to repair bio-engineering works.	Works to be completed during DLP.	-	Checked and reported by Consultant Environmental Specialist with collaboration by GEU.	Satisfactory	Effective.	No problem identified.
Construction activities are dangerous to the workers.	Not applicable.	Not applicable.	Detailed safety requirements were included in contract provisions.	Contractors to follow contract provisions.	Not applicable at present.	-	Checked and reported by Consultant Environmental Specialist.	Measures were not properly applied.	Very poor.	No longer applicable.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (FINAL REVIEW)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Damak-Gauriganj road (a Terai feeder road): Part 2: Hazards and their mitigation										
Construction activities give an increased risk of traffic accidents.	Not applicable.	Not applicable.	Detailed safety requirements were included in contract provisions.	Contractors to follow contract provisions.	Not applicable at present.	-	Checked and reported by Consultant Environmental Specialist.	Measures were not properly applied.	Very poor.	No longer applicable.
Increased danger to road users, especially vehicle passengers, from faster traffic speeds.	No records available on accident data, as far as could be ascertained.	The volume and speed of vehicular traffic have considerably increased.	Provision of adequate warning signs and traffic calming measures.	Contractor to implement works as instructed by RE.	By the end of DLP.	To be checked annually following project.	Checked and reported by Consultant Environmental Specialist with collaboration by TRSE.	Measures have not yet been properly applied.	Poor.	RE to propose traffic calming measures in main bazaar areas. Project Manager to give positive support to RE's proposals.
Increased danger to road users, especially pedestrians, from greater volumes of traffic.	No records available on accident data, as far as could be ascertained.	The volume and speed of vehicular traffic have considerably increased.	Provision of bus stops and off-road parking sites in appropriate locations (mainly near road junctions and in bazaars).	Contractor to implement works as instructed by RE.	By the end of implementation. Works to be completed as per schedule.	To be checked annually following project.	Checked and reported by Consultant Environmental Specialist with collaboration by TRSE.	Some measures have been applied.	Limited	No particular problem identified, but action above is also relevant here.
Grazing of cattle on embankment slopes interferes with traffic flows, and gives rise to dangerous traffic situations.	The 200+cattle grazing on embankment slopes during the pre-project survey represent the possibility of cow-related accidents that might happen at any time.	Cattle have been stalled on embankments and there is a risk of accident happening.	No one has been able to identify a suitable solution to the problem, as there are no alternative grazing sites during the rice growing season.	Consultant Environmental Specialist to raise this issue before the consultant's Sociologist.	Depends on strategy adopted.	-	Checked and reported by Consultant Environmental Specialist.	No suitable measures could be identified.	Not applicable.	No solution identified.
Dust nuisance during the construction period.	All local people and teashop keepers interviewed report a regular dust nuisance due to moving vehicles and wind.	No dust problem observed after black-topping.	Traffic control measures (timing and speed) were imposed on the contractors.	Not applicable at present.	Not applicable at present.	-	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective.	No problems identified.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (FINAL REVIEW)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Damak-Gauriganj road (a Terai feeder road): Part 2: Hazards and their mitigation										
Noise pollution during the construction period.	None of the people interviewed reported an unacceptable level of noise due to moving vehicles before project.	No problems observed and reported by the locals at present.	Traffic control measures (timing and speed) were imposed on the contractors.	Contractors.	Not applicable at present.	-	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective.	No problems identified.
Unacceptable levels of noise pollution following upgrading.	None of the people interviewed reported an unacceptable level of noise before project.	No problems observed and reported by the locals at present.	None.	Transport operators.	Not applicable at present.	-	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective.	No problems identified.
Disturbance to nearby settlements by workers living in large labour camps.	Not applicable.	Not applicable.	Contractors were required to employ only local labourers.	Contractors.	Not applicable at present.	-	Checked and reported by consultant Environmental Specialist.	Satisfactory.	Effective.	No problems identified.
Disturbance to nearby settlements by activities in slab-casting yards; and permanent damage to land from slab casting.	Not applicable.	Yards have been returned to the landowners, apparently in satisfactory condition.	Detailed environmental requirements were included in contract provisions.	Contractors.	Not applicable at present.	-	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective.	No problems identified.
Labour camps, and plant and equipment camps, give rise to pollution of the soil or water courses through the leakage of sewage, oils, bitumen, etc.	Not applicable.	Camps have been returned to the landowners, apparently in satisfactory condition.	Detailed environmental requirements were included in contract provisions.	Contractors.	Not applicable at present.	-	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective.	No problems identified.

Government of Nepal
Ministry of Physical Planning and Works
DEPARTMENT OF ROADS

ROAD NETWORK DEVELOPMENT PROJECT
Asian Development Bank Loan No. 1876 – NEP(SF)

ENVIRONMENTAL, HEALTH AND SAFETY REPORT
EHS No. 39

ENVIRONMENTAL, HEALTH AND SAFETY MONITORING OF THE
PAUWA BHANJYANG - PHIDIM ROAD REHABILITATION

DECEMBER 2007

Roughton International

in association with

Montgomery Watson Harza

and

ITECO Nepal Full Bright Consultancy ICGS

1. BACKGROUND AND PROGRESS

This road section starts from Pauwa Bhanjyang on the Mechi Highway, at km 42 from Ilam. It is an old road opened to traffic some 30 years ago, and had a mixed surface of earth, gravel and *in situ* rock. The project upgraded this 24+359 km road to a standard DBST feeder road through the following contractors:

PP 1	Kalika-Sapana Nirman Sewa	km 0+000 to km 5+000
PP 2	Kalika-Sapana Nirman Sewa	km 5+000 to km 13+000
PP 3	Kanchanjunga-Kailash J/V	km 13+000 to km 18+000
PP 4	Santoshi-Bhairab-Nagarjun J/V	km 18+000 to km 24+359

The Project's environmental baseline study was conducted in October 2004, before the mobilisation of the Contractors. At that time, the overall environmental conditions were described as fairly good, with no major environmental issues observed (please refer to the Environmental Baseline, RNDP-EHS Report No. 3).

Contracts were awarded in early 2005 and the Contractors mobilised by June of that year.

Environmental, health and safety monitoring visits were conducted as follows:

- the first on 2-3 July 2005,
- the second on 20-21 February 2006;
- the third on 22-24 June 2006;
- the fourth on 5-6 January 2007;
- the fifth on 17-18 August 2007.

This current visit is the sixth review and was undertaken on 10 December 2007. All of the Contracts had been completed by that time and the Contractors were fully demobilised. The Resident Engineer had left the site in September 2007 and had been assigned to other duties. There were no personnel from either the Contractor or the supervision team available to accompany the Environmental Consultants to the site. For this reason, the chainage references given herein should be regarded as approximate only.

2. DETAIL OF ENVIRONMENTAL IMPROVEMENTS

The general environmental enhancements reported in earlier EHS Reports continue to improve conditions for the local people. They are as follows.

a) Covered drainage systems

The installation of covered drainage in the bazaar areas has certainly improved the local environment. These sites now look far better than before. The outfalls of drainage from Phidim bazaar at km 22+650, km 22+740 and km 24+ ??? are working well.

b) Kulo provision

The kulo (irrigation leat) that crosses the road in a gully at km 16+840, and re-crosses it at 17+540, is also functioning very well.

c) Sub-surface drains

Newly installed sub-surface drains at km 3+250, km 6+400, km 18+250 and km 21+031 are functioning well, and as usual, the local people are happy to have access to clear water. The sub-surface drain at km 6+720 is now boosting a lokta paper industry beside the road.

d) Full-width pavements

The full-width pavement has certainly made the four bazaar areas (Pauwa Bhanjyang, Kanchhi Dokan, Lali Kharka and Phidim) significantly better than before. At these sites, the vehicles parked along the road sides are now not carrying mud on to the black-top road.

e) Bio-engineering

The bio-engineering works undertaken in June 2006 have now established well. At undisturbed sites the growth of grass and brush layering is very impressive.

3. DETAIL OF ENVIRONMENTAL HAZARDS

The details of environmental hazards are described here as side tipping, quarrying, hanging rocks and traffic safety.

3.1 Side Tipping

The majority of tipping of debris/surplus materials has been carried out at approved sites. However, some tipping has been undertaken at other locations and, environmentally, this is undesirable. It has been recorded in earlier EHS Reports that debris generated from back cutting had been thrown down the hill sides with little concern for the environment. This debris can still be distinctly seen at many locations. The table below lists the main side tipped areas that require removal of surplus material, followed by correction of slope angles and brush layering.

Location	Issue
km 2+750	Surplus material has been tipped on the road edge near a kholsi crossing. The material should be removed and disposed of at the approved tipping site at Pauwa Bhanjyang. The debris slope should be trimmed and bio-engineering applied.
km 5+050	At this location the surplus material from the valley side road slope should be removed, the slope regraded and brush layering implemented.
km 6+350	The weight of the debris, the road edge appears to have caused subsidence at this location. This could initiate a slip failure in the next monsoon. The surplus debris must, therefore, be removed and brush layering provided on the valley side slope.
km 12+200 approx.	Debris collected from a rotational mountain side failure has been badly side tipped, ruining a good bio-engineered site. The solution requires excavating the surplus material and disposing of it at a designated disposal site, followed by the installation of brush layering.
km 12+700	The requirements at this location are as described above (km 12+200), but the quantity of material is much larger and hence the situation is more serious.
km 12+904 to km 13+????	A serious cut slope failure has occurred at this location which requires trimming and grass planting. On the lower side of the roadway, the debris tipped down the slope has damaged both the slope and the next road section below.
km 14+????	The debris tipped on the road edge near the access road to a stone quarry is surcharging the valley side slope. It should, therefore, be removed as soon as possible.
km 14+150 approx.	Debris thrown down the masonry retaining wall needs trimming, and then heavy bio-engineering is required. The mountain side cut slope just above the wall also needs trimming and grass planting.

Since the beginning of earthworks, the fact that side tipping was being done indiscriminately along the entire road length has been highlighted. Most serious instances have occurred in Package 4, but this phenomenon was also significant in Packages 1 and 2; by comparison,

the Contractor for Package 3 had managed the spoil disposal in a more satisfactory manner. The most objectionable locations for side tipping are at km 14+810, where debris has encroached onto terraced crop fields, and at km 16+740, where forest land has been damaged.

At the time of this monitoring visit, the consequences of side tipping are apparent, particularly at km 2+300 and km 13+890 to km 14+100 (over a hairpin bend). In the latter case, the debris has covered a considerable area of natural vegetation between the two loops and down the hill, and has blocked the side drain. In addition, it is to be noted that the debris thrown down the slope just below a newly constructed retaining wall will erode easily. Ideally, debris at both these sites should be removed (at the Contractors' expense) or alternatively it should be compacted properly and bio-engineering implemented.

3.2 Quarrying

Almost all of the quarry sites and their access roads require some sort of rehabilitation works. The details are highlighted in the table below. As works are now substantially finished, most quarrying has stopped, but none of the quarries have been adequately reinstated. It was previously noted that these sites must be treated with bio-engineering or other measures as site conditions require: these would mainly consist of brush layering and the planting of trees, of species chosen by the landowner, to the satisfaction of the Engineer and the Environmental Specialists.

Location	Issue
100 m east of Pauwa Bhanjyang bazaar	The sand quarry of the Contractor's first package has been left without any rehabilitation. Simple soil trimming and brush layering is required on the soil slopes above.
250 m east of Pauwa Bhanjyang bazaar	The sand quarry itself needs no special rehabilitating. However, a few dry stone check-dams are needed to control gully erosion due to water flowing down the valley side debris slope.
5+050 approx.	This is a quarry site. A mass of soil has been taken down by water flowing from the bari land above the quarry bench. A gabion check dam of about 18 m long above the catch pit should be constructed to trap debris. The existing large catch pit requires a head wall for obvious traffic safety reasons. Trimming all the soil slopes above the quarry, and planting grasses and utis trees on the flat ground, are also required.
13+890	A cut slope failure near the access road to a quarry has blocked the side drain, and must be cleared. No rehabilitation work of any kind has been done at the quarry, despite previous suggestions and recommendations. Even the access bench of this quarry has now cracked and will fail in the next monsoon if no action is taken. Boulders lying on the hill slope should be removed as soon as possible.
14+?????	The gully on the valley side slope of the access road to an abandoned stone quarry requires brush layering and additional grass planting as per specification. The amliso planted on this slope is too far apart. On the actual quarry site, which is about 150 m from the road, bio-engineering should be done as per specification. In addition, at least four dry stone check dams are required in the valley side gully where water from the quarry bench drains.

3.3 Hanging Rocks

The removal of hanging rocks, in at least two locations, has previously been requested. The locations were near Samding (km 8) and at km 12+500. These must be removed as soon as possible. In this visit, these rocks were observed to be hanging more dangerously than before. At the second site, one rock had recently fallen and punched out the side drain. Other rocks are ready to fall and are likely to damage the new road below. If this work cannot be instructed under the Contract, then the need for remedial works to remove these rocks must be highlighted when the site is handed back to the Division Road Office.

3.4 Traffic Safety

The delineating posts have been well placed. However, considering the high gradients on various lengths of this roadway, gabion crash barriers may have been a preferable option in certain locations. Also, near the bazaar areas, some method of reducing traffic speeds would be helpful in minimising the risk of accidents. Despite earlier requests, no speed reduction measures have been installed. The large catch pits at km 6+250 and km 6+300 urgently need head walls to prevent both pedestrians and vehicles from falling into them.

3.5 Contractor's Camp

Some soil trimming is needed at the Contractor's camp at Kanchhi Dokan (km 6), where there was previously a crusher plant.

3.6 Drainage at Phidim bazaar.

Although the side drains at Phidim bazaar look impressive, there needs to be better provision for the rain water collected on the road to get inside the drains. At present water ponds along the sides of the road because there are very few apertures into the drains. There are two low cost methods of resolving this. One is to space the cover slabs out more, with a gap of 30 to 35 mm between each one (a narrower gap blocks too easily and a wider gap is dangerous to pedestrians). Another is to cut off the corners of every fourth or fifth slab with an angle grinder, leaving a gap of at least 50 cm² for water to enter the drain. If action is not taken in this regard, the ponding water will cause serious deterioration of the road surface.

The open drains in the bazaar are full of debris from the nearby households. Whilst this is not related to RNDP activities, the Contractors should be required to clear the drains under their maintenance obligations. In the future (after the Defects Liability Periods are over) this obligation will pass to the Municipality and it is recommended that the Project Manager (DoR) writes to the Municipality to inform them of their pending responsibility in this regard.

3.7 Other Hazards

Monitoring of environmental hazards related to crusher plants, worker safety and Contractors' camps are now no longer required.

4. BIO-ENGINEERING AND SLOPE STABILISATION

4.1 Landslides

Minor slip failures in the cut slopes were seen throughout the road length, with their debris damaging the road surface and blocking the drains. Seventy-eight (78) individual failures (see table on next page) were identified.

Obviously the existing failures need to be rectified before the road starts to suffer excessive damage, and it is understood that instructions have been issued to all Contractors for this road section to remove the debris and undertake any necessary repairs to the road surfacing and side drains. However, it is clear that many more failures will occur in the next few years, since the widening of the road to meet the national standards for feeder roads has unavoidably destabilised the slopes along most of the road. Because of the steepness of the natural hill sides, and to reduce project costs, the cut slopes have been left at angles that are considered to be unsustainable under severe monsoonal conditions. The consequences will certainly be:

- (a) further slope failures, though mainly minor;
- (b) loss of further land and vegetation, mostly of forests, above the road;
- (c) physical damage to the road surface by rocks falling on to it and then being ground in by vehicle tyres;
- (d) scour below the road by runoff from blocked side drains; and
- (e) damage to valley side slopes from debris disposed by maintenance gangs in places other than official tipping sites.

The Division Road Office will need to be informed of these problems and the need for appropriate action to be taken over the coming years.

Frequency of mountain side slope failures by chainage

Contract Chainage	Frequency of Failures	Contract Chainage	Frequency of Failures
0-1		13-14	2
1-2	1	14-15	6
2-3	3	15-16	5
3-4	3	16-17	7
4-5	1	17-18	4
5-6	3	18-19	7
6-7	3	19-20	4
7-8	5	20-21	6
8-9	2	21-22	1
9-10		22-23	3
10-11	3	23-24	2
11-12	1		
12-13	6	Total	78

Long term resolution of most of the sites requires mainly trimming and bio-engineering works. This should be done by the Division Road Office in 2008 and 2009 if it is not possible to cover everything during the Defects Liability Periods of the Contracts. While the incidence of landslides is not necessarily serious, the construction works have undoubtedly made the situation worse and in this respect the existing slopes represent an unmitigated environmental hazard.

The serious landslide at km 17+950, which was causing trouble to the road stability before project implementation, has now been stabilised. This represents a good achievement by the project.

4.2 Further Structures Required

The table below gives details of required additional structures not listed under other headings in this report.

Location	Issue
14+550	Movement of a big wet slump on the mountain side requires about 20 metres of gabion breast wall.
17+950	At the valley side of the existing causeway, a gabion mattress and three gabion check dams are required; and at the mountain side, there is an active gully that requires three to four dry stone check dams. Back filling of the revetment and grass planting is also required here.
Km 24+????	The drain outfall from Phidim bazaar (near the DoR Camp) requires a gabion mattress and at least three dry stone check dams downstream of it.

These works should be implemented either under the project or, if this is not possible due to timing or budgetary constraints, by the Division Road Office following handover.

4.3 Bio-engineering Works

In general, an impressive growth of bio-engineered plants such as brush-layering, grass planting, etc. was observed throughout much of the road length. At some locations, vigorous growth of native plants has helped to cover the side tipped areas. However, additional works are still required at places where fresh side tipping has been done over the bio-engineering sites. In some locations where bio-engineering is required, it has not been implemented. These areas are as described in the table below.

Location	Issue
Pauwa Bhanjyang Quarry (about 100 away)	This sand quarry has been left unattended by the Contractor. A mass of bulging debris, fallen trees, etc. was observed. These require trimming and brush layering at the mountain side.
Pauwa Bhanjyang Quarry (about 250 away)	This sand quarry needs no rehabilitation on the mountain side. It does, however, require dry stone check dams at four locations and brush layering at the valley side, as the present small gully will certainly widen during the coming monsoon seasons and cause the failure of the existing road.
2+750	On the mountain side slope above a masonry breast wall, the landslide is still active. It is therefore recommended to trim the top and use the material to back fill the wall and plant grasses.
12+904 to 13+?????..	A serious cut slope failure requires trimming and grass planting. On the lower side of the road, the debris tipped down the slope has damaged both the slope and the next road section below.
13+890 to 14+100	Side tipping has been undertaken behind a newly constructed masonry wall, and this has a very untidy appearance and is highly erodible. Brush layering and some trees should be planted here.

In the text above, wherever there is mention of additional structures, there is also a need for backfilling such walls and creating a satisfactory slope angle (a maximum of 35 degrees is recommended).

5. TABLES OF ENVIRONMENTAL, HEALTH AND SAFETY ISSUES MONITORED

Identified benefit	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Enhancement measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of enhancement or mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Pauwa Bhanjyang-Phidim road: Part 1: Benefits and their enhancement										
Upgrading of roadsides through bazaars, and bus stops.	An estimated 2010 m in 10 bazaars and their roadsides lack drainage and paving, and 8,040 m ² of bazaars, including bus stopping areas, are unpaved before project. Approximately half of the requirement is in Phidim bazaar.	Black top to full width (6 m) along with drainage and foot paths at both sides at bazaar areas have been constructed. The requirements identified during the baseline study have generally now been met.	Measures for enhancing the environment were designed and have been placed in appropriate ways.	Consultants and the contractors have complied with their responsibilities.	The timing of compliance is well schedule	Regular.	Checked and reported by Consultant Environmental Specialist.	Satisfactory	Effective	No problem identified.
Sub-surface drainage systems used to provide water to local people.	None.	Sub-surface drainage systems are working well.	The local people will take care of these structures.	Consultants and the contractors have complied with their responsibilities.	As scheduled during implementation.	Regular.	Checked and reported by Consultant Environmental Specialist.	An excellent enhancement measure.	Effective.	No problem identified.
Condition of forests neighbouring the road continues to improve during project implementation.	About 2.8 km of road runs through good quality forest. The rest of the road runs either through poor quality forest or scrubland, or settlement, or terraced cultivation.	Some impacts on adjacent forest land especially around km 14 were observed due to tipping.	Strict contract prohibits side tipping in forests.	Contractors to abide by contract clauses. Site engineering staff are to apply contract provisions.	Throughout Defect Liability Period of the project.	Regular.	Checked and reported by Consultant Environmental Specialist.	There is limited damage to the forests resulting from the project, apart from the damage through bad debris disposal.	Poor.	RE to instruct appropriate bio-engineering works, which are essential to rehabilitate these tipped sites.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of enhancement or mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Pauwa Bhanjyang-Phidim road: Part 2: Hazards and their mitigation										
Quarrying of stone from roadside slopes, by DoR maintenance gangs, local people and contractors not involved in road works.	Five sites identified where informal quarrying is destabilising 180 m of roadside slopes, extending to a total of approx. 150 m ² .	Contractors are no longer involved in quarrying activities.	All damaging quarrying activities to be stopped.	RE to liaise with PM as necessary.	Throughout implementation and DLP.	Regular.	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective.	No problem identified.
Quarrying of materials for project works gives rise to erosion, slope instability or other environmental damage, or a risk of it happening.	No pre-project contractor's quarrying sites and no induced erosion or instability.	Quarrying activities have already ceased, but no rehabilitation work was observed.	Quarries need to be rehabilitated with appropriate bio-engineering measures.	The Contractors are to be responsible for compliance during DLP	By the end of DLP.	To be checked at the end of DLP.	Checked and reported by Consultant Environmental Specialist.	Mitigation measures have not been followed well.	Not effective so far.	RE to ensure that Contractors rehabilitate all quarries in collaboration with the owners of the land where quarries are located.
Existing side-slope failures in both cut and fill slopes threaten the road and surrounding land.	Three small slips threaten road at 2+200, 3+325-4+600, and 4+600-5+000 respectively; also one large failure at 17+950.	78 small slips are now found at various locations.	Bio-engineering and other appropriate slope protection and stabilisation measures are to be used to rehabilitate problem sites.	The Contractors are to be responsible for compliance during DLP.	By the end of DLP.	To be checked at the end of DLP.	Checked and reported by Consultant Environmental Specialist.	The project's standard slope stabilisation measures had performed well before and need to be repeated now.	Effective so far.	RE to ensure that Contractors comply with needs during the DLP.
Bare fill slopes threaten erosion of the road edge and damage to surrounding land.	Identified only on the valley side at 6+105-135 (original site chainages).	Both planted bio-engineering species and natural grasses are growing well on most fill slopes.	Bio-engineering protection measures are gradually rehabilitating all bare surfaces and areas of roadside erosion.	Consultants and the contractors have complied with their responsibilities.	Throughout implementation and DLP.	Regular.	Checked and reported by Consultant Environmental Specialist.	Performing well at present.	Effective so far.	No problem identified.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of enhancement or mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Pauwa Bhanjyang-Phidim road: Part 2: Hazards and their mitigation										
Improved road drainage leads to increased discharge at culvert and drain outfalls.	The existing drainage was found to be more or less acceptable. Outfalls affect neither the road nor cropped fields, except in a gully below the road at km16+840 that crosses the road again at km17+540 (original site chainages).	The culvert and drain outfalls have been rightly taken away from settlements, and no complaints have been reported. Drainage problems therefore seem to have been mitigated at present	Standard engineering designs for the drainage of hill roads on steep terrain.	The Consultant engineers and contractors have complied with this issue responsibly.	Works completed as per schedule.	Regular.	Checked and reported by Consultant Environmental Specialist.	Mitigation measures look effective, but require monitoring.	Effective	No problem identified.
Tipping sites for excess spoil lead to instability of roadside land.	Not applicable.	Unauthorised tipping still continues (please see text).	Follow DoR guidelines and contract clauses strictly, and avoid water courses and all property of value. Identify and enforce extension limits.	Contractors to comply with this during the DLP.	Mitigation measures to be completed during DLP.	To be checked at the end of DLP.	Checked and reported by Consultant Environmental Specialist.	There is damage to forests adjoining the road, resulting from bad debris disposal in unauthorised areas.	Poor.	RE to require Contractors to rehabilitate damaged slopes through proper bio-engineering measures.
Increased danger to road users, pedestrians, vehicle passengers etc, from faster traffic speeds and greater traffic volumes.	6 deaths and 35 injuries reported among vehicle passengers in the 7 years before project.	Traffic speed has certainly increased after grading at various sites. One contractor's driver was killed recently, although this was reported not to be due to high speed.	Provision of adequate warning signs, safety barriers and traffic calming measures (e.g. speed bumps in bazaars).	Contractors to comply with this during the DLP.	Mitigation measures to be completed during DLP.	To be checked at the end of DLP.	Checked and reported by Consultant Environmental Specialist.	Mitigation measures have not yet been fully applied, and there is no sign of traffic calming measures.	Not yet effective.	Speed restrictions should be placed after the running surface has improved. DoR to ensure this occurs, and continue enhancements after handover.
Dust nuisance during the construction period.	All roadside households interviewed report a regular dust nuisance before project.	No dust nuisance observed.	Strict traffic control measures were placed on the contractors.	Contractors.	Throughout implementation.	Regular.	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective this time.	No problem identified.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of enhancement or mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
Pauwa Bhanjyang-Phidim road: Part 2: Hazards and their mitigation										
Noise pollution during the construction period.	No roadside households interviewed report an unacceptable traffic noise problem before project.	Not applicable at present. Local public transport uses horns unnecessarily at all times, but, no one complains.	Strict control measures were placed on the contractors.	Contractors.	Throughout implementation.	Regular.	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective.	No problem identified.
Annoyance (noise and dust) from crusher plants.	Not applicable.	All three crusher plants have now been removed.	Strict control measures were placed on the contractors.	Contractors.	Throughout implementation.	Regular.	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective this time.	No problem identified.
Labour and work camps are disturbing to the local community and provide health and social risks.	Not applicable.	No labour camps now exist, except for a few labourers working as maintenance gangs.	Strict control measures were placed on the contractors.	Contractors.	Throughout implementation.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective.	No problem identified.
Construction activities are dangerous to the workers.	Not applicable.	Not applicable at present. However those few labourers clearing the drains are still vulnerable to head injuries through not having helmets.	Contractors are to provide standard safety gear as described in the contract clauses.	Contractors. Engineer is to insist on compliance.	Throughout the DLP.	Regular.	Checked and reported by Consultant Environmental Specialist.	Not yet fully satisfactory, however plenty of arguments are put forward as to why the workers do not use the protective gear provided.	No evidence of Contractors trying properly to fulfil their obligations.	Resident Engineer to insist that Contractors fulfil their obligations, under threat of with-held payments if they do not comply.
Construction activities give an increased risk of traffic accidents.	Not applicable.	No construction activities are going on, but speeding traffic puts maintenance gangs at risk.	Contractors should follow DoR's "Code of Practice for Signing at Roadworks".	Contractors are responsible to safeguard their labourers from any risk.	Throughout the DLP.	Regular.	Checked and reported by Consultant Environmental Specialist.	Not yet fully applied.	No evidence of Contractors fulfilling their obligations.	Resident Engineer to remind contractors of their obligations.

6. PROPOSED NEXT MONITORING VISIT

A final review is considered to be advisable to ascertain how far it has been possible for the project to resolve the issues raised in this monitoring report during the DLP. This should be done just after the next monsoon and will involve the wrapping up of the EHS monitoring reported here.

Government of Nepal
Ministry of Physical Planning and Works
DEPARTMENT OF ROADS

ROAD NETWORK DEVELOPMENT PROJECT
Asian Development Bank Loan No. 1876 – NEP(SF)

ENVIRONMENTAL, HEALTH AND SAFETY REPORT

EHS No. 40

ENVIRONMENTAL, HEALTH AND SAFETY MONITORING OF THE
BELBARI - CHAUHARWA (EAST - WEST HIGHWAY) UPGRADING

DECEMBER 2007

Roughton International

in association with

Montgomery Watson Harza

and

ITECO Nepal Full Bright Consultancy ICGS

1. BACKGROUND

This road section (total length of 140 km) begins at Belbari (km 78 from Karkabhitta) and ends at Chauharwa (km 218) on the East-West Highway. It was improved in 1995 by the Road Improvement Project. Resurfacing with a carrying depth asphalt concrete overlay was proposed over most of the length to strengthen the pavement structure and prolong the life of the pavement. Over three lengths (total 10.65km) the rehabilitation proposals were for complete reconstruction as the pavement was determined to be at or near the end of its useful life.

The Contract's environmental baseline study (EHS Report No. 5) was conducted in September 2004, before the mobilisation of the Contractor. At that time, the overall environmental conditions looked fairly good, with no major environmental issues observed. However, some social issues were described, that related to the use of the road by the road neighbours.

This Contract was opened to international competitive bidding, and was awarded to the Indian para-statal company IRCON, with a start date of 16 April 2005. Delays in mobilisation, procurement and the importation of equipment, compounded by the disturbed political situation in Nepal, led to long delays in the commencement of works. By June 2006 the works were only about 6% complete, although they should have been around 50% according to the planned schedule.

A considerable period elapsed, therefore, before enough progress had been made to justify environmental, health and safety (EHS) monitoring visits. However, an introductory seminar on Environmental, Health and Safety Issues was conducted at the DoR Project Manager's/CRE's office at Dharan on 28 November 2005. This was attended by representatives from the Department of Roads and the Consultant's and Contractor's staff.

The first monitoring visit was made on 18/19 June 2006 by the expatriate Environmental/Bio-engineering Expert (Mr. John Howell) and the local Environmental Specialist (Mr. Sushim Baral). Three months after this visit, on 6 September 2006, an Environmental Compliance Mission of the Asian Development Bank visited the Contract Site. The Mission also did not notice any significant environmental issues on this road, except for the negative impact of high load weights of the material hauling trucks from the Kamala extraction site which were using a 10 km section of the Otta-sealed road to Sindhuli. The Mission had recommended following the Consultant's suggested regulatory mechanisms to check the permissible loads on the Contractor's trucks. However, that system appears not to have been implemented and it is reported that the 10 km section of the road is now in a greatly deteriorated condition. It was not possible to verify this during the current monitoring visit.

The progress of this Contract has been seriously hindered by the political unrest in the Terai, over the last year in particular. There are frequent stoppages of the Contractor's work, especially west of the Koshi barrage and most seriously around the Lahan area. Due to its location, this Contract suffers each time a bandh is called on the East-West Highway, either directly by interference with the construction activities or indirectly by disruption to the delivery of materials and supplies for the Works. It also appears that the Contract is being used as a political tool by various local groups, who are trying to extort money from the Contractor. If the demands are not met, the Contractor's staff are threatened and at times physical violence has been used by the gangs of vandals who come to the Site and stop the work activities.

Although the initial completion date was 16 April 2007, this has been extended to 12 December 2007 and a further extension, until 25 April 2008, is in process. Both the physical and financial progress were around 45% at the time of the EHS monitoring visit on 12 December.

Progress on the eastern side of Koshi (where about 75% of the specified work had been completed) was much better than that on the western side, where only about 25% of the work had been accomplished.

On the day of the EHS visit, ongoing works were limited but no major environmental, health and safety problems were observed. However, the few matters related to upgrading of the road are highlighted in the next sections.

2. ENVIRONMENTAL ENHANCEMENTS

The most obvious environmental enhancement of this road is the black-topping of at least 40 km. The next is related to the full width pavement at the bazaar areas such as at Belbari, Itahari, Lahan, etc.

DBST has also been installed on the shoulders at certain sections, whilst preparations are being made for similar works at the other locations, particularly between Itahari and the Koshi. At a few places, base course material was being tipped on the shoulders. Once the road embankment is protected through turfing and brush layering at other sites, this will also enhance the road environment.

The absence of damage to the existing roadside trees by the construction work is also a significant contribution to the environment.

3. ENVIRONMENTAL HAZARDS

3.1 Health and Safety of Labourers

In the earlier EHS monitoring report (see EHS Report No. 17; June 2006) it was noted that the provision of safety equipment needed to be increased and made more appropriate to the actual hazards faced. For example, although fluorescent jackets were seen used by some of the work supervisors on the road, caution signs were inadequate at all working sites.

3.2 Safety at Asphalt Plants

For this road sector, there are two high standard modern hot mix plants established in suitable locations. However, a number of safety issues must be followed to minimise the risk of accidents. Some details of these are as follows:

Site at Inaruwa (Sunsari)

- Mr S.K. Singh, the manager for this plant, told us that for many days, the plant had remained closed due to the local political problems. It had restarted just 3 to 4 days before. The yard is adequately fenced, and watchmen posted at appropriate locations. Whilst no children were seen playing in the vicinity of the plant (highly desirable), several apparently unauthorised people were observed wandering aimlessly around the general area of the plant (undesirable). Also, no basic safety gear or ear protection had been supplied for the workers. Live wires of a welding machine and sharp fragments of scrap metal were found scattered on the ground.
- There is no prompt mechanism for stopping the machines if some accident happens. Although Mr Singh told us that there is a whistle which can be blown for this purpose, it was apparent that when there is a loud noise from the running crusher and hot mix

plants, no one will be able to hear it. The manager was requested to give thought to the provision of additional safety procedures in this regard.

- There was a first aid box but without any medicine in it. However, upon request, Mr Singh immediately sent a staff member to buy appropriate medicine. Two trained people for first aid are available at the plant.
- Eleven brand new fluorescent jackets were shown to us at this plant site. On being requested, Mr Singh distributed these to the workers on the ground and on the ramp of the crusher plant.
- No major dust pollution was seen; the ground was also watered to prevent generation of dust. A few patches of spilled bitumen and oil were observed and these should be cleared as soon as possible.

Site at Balan (Siraha)

- This plant was not in operation at the time of the EHS monitoring visit (12.30pm on 12 December 2007) but had been running during the morning. The reason for the stoppage was given, as a local political group had asked the manager, Mr Sanjaya Sawant, to stop the plant.
- Since this plant was not running at the time of the visit, it was not possible to see whether or not safety equipment had been provided to, and was being used by, the workers. However, Mr Sawant informed the monitoring team that all such requirements had been fulfilled. The fluorescent jackets looked unused, however, and there was no first aid kit at the plant.
- There are fuel spillages at several locations in this plant site. Also, piles of waste asphalt were observed, which should be buried at least one metre below ground, at the far side of the site from the nearby Gagan khola.

The actions required to improve the situation are given in the table below.

Environmental Issue	Mitigation Measures Taken	Mitigation Measures Required	Action Required
General suitability.	Plants are modern and as safe and non-polluting as could be hoped for.	See below: some operating methods leave room for improvement.	As described below.
Noise injury to workers.	None.	Ear protection (such as foam ear plugs or cotton wool) to be provided to all staff and workers within 50m of crushers, grading machines, un-silenced generators etc.	RE and Contractor's site-in-charge to ensure ear protection is provided and used whenever machinery is in operation.
Dust inhalation by workers.	Some masks supplied to workers.	Masks to be supplied to all workers in dusty environments.	RE and Contractor's site-in-charge to ensure masks are provided and used in all dusty conditions.
Risk of external injuries to staff and workers, particularly to head and limbs.	Some safety gear issued; most moving parts protected.	Helmets, boots and gloves to be provided as appropriate to the possibility of injury. Guards or barriers to be maintained to protect personnel from moving parts (particularly flywheels and drive belts).	RE and Contractor's site-in-charge to ensure equipment is provided and used whenever there is a risk of injury.
Risk of injury to mechanics working on complex machinery if they are started remotely.	Operator makes a visual check before starting plant.	Operator to be given a whistle and instructed to issue a loud blast, then wait at least 5 seconds before starting plant.	RE and Contractor's site-in-charge to ensure procedure is understood and followed.

Environmental Issue	Mitigation Measures Taken	Mitigation Measures Required	Action Required
Machinery can be stopped quickly in the event of an accident (especially if someone is caught in moving parts).	No emergency procedures are in place.	A machine-specific emergency procedure should be devised for every part of the plant, and all staff trained in its implementation.	Contractor's site-in-charge to devise and implement suitable plans. RE to approve if appropriate.
First aid provision is inadequate.	A small first aid kit is available and one person knows how to use it.	Keep the kits fully stocked and ensure that at least three people know how to use it.	Contractor's site-in-charge to ensure that the kit and staff are in place at all times.
Noise pollution to local residents.	Well located, close to the road but at least 200 m from houses.	No operation outside the hours of 5 am to 8 pm.	Contractor to schedule works to avoid operation outside these times.
Dust nuisance, which was identified as a hazard in May 2006 (Inaruwa site only).	Dust collector installed on the hot mix plant and a watering system on the crusher.	Measures taken appear to be adequate; ensure they are always used.	RE's staff to monitor during operation and ensure measures are adequate. The same precautions are to be taken at Balan if required.
Risk of injury to members of the public.	Sites fenced and chowkidars posted to exclude the public.	Nothing further.	Nothing further.

3.3 Construction Material Extraction Sites.

The stone and aggregate extraction sites at Kamala were not visited during this EHS monitoring visit. The Consultant's Materials Engineer stated that the Kamala site has not been in use for the last six months or so, because of the political unrest. Hence, materials have been collected only from the Gachhiya and Letang upstream sites, which are already approved as appropriate. Some extraction is also occurring from the Seoti khola and this will be checked during the next EHS monitoring visit.

3.4 Traffic Safety.

Of the entire RNDP sites, this road has the fastest traffic speeds. Hence demarking the locations of construction activities is essential so that speeding drivers can react appropriately as they approach road works. Nowhere have construction locations been appropriately signed. There are many places where level differences occur in the road surface where asphalt layers start and finish, and also where shoulder construction works have not yet been implemented. In cases the difference between the roadway and the shoulder is as much as 100 mm. Such locations are all potentially very dangerous. The Contractor must improve the sequencing of works so that sections of newly raised asphalt are not left standing high above the shoulders for long periods, and warning signs must be placed ahead of changes in asphalt surface levels. These matters have been raised repeatedly by the CRE and RE at meetings, but the Contractor continues to ignore them and to operate a dangerous site.

Bridge railings and parapets which have become so dirty that they almost look black, must be painted white for drivers to see them distinctly.

The culvert at km 145 is potentially dangerous to traffic due to the subsidence of the foundations. The Contractor is to be instructed to reconstruct this culvert and plans are already in hand for the construction of a detour to the left hand side (see also next section).

3.5 Damaged Culvert

The existing slab culvert at km 145+000 (Barmajhia, Saptari) is on the verge of collapse due to undermining of the foundations, resulting from excessive flow of water from the adjacent rice fields and consequent to exceptional discharge due to the overflow of two small rivers, namely the Mehuli and Saraswati, during the recent monsoon season. Mr Mehdi Husain, the immediate past Chairperson of Ward 6 of Badgama VDC, informed the EHS monitoring mission of local concerns over the way in which the project intends to deal with this issue (although plans are not yet finalised). It is considered that to understand this problem properly a detailed hydrological study would be needed to investigate the whole culvert catchment area, extending several kilometres upstream and downstream along the rivers. The urgency of the situation together with the costs for such a study effectively precludes this approach and it is understood that the intent is to replace the existing slab culvert with a new twin cell box culvert.

Brief observations of the rivers show that there is an unusually large amount of sediment currently in their beds. This has raised the bed levels and caused them to move sideways. The reason for the additional sediment is most likely to be the triggering of a number of large landslides in the Churia hills by unusually heavy monsoonal rain several years ago. This will have generated a large volume of material that takes some years to pass through the river system. This is a recurring natural event. The problem is that the downstream river banks are now covered in agricultural fields, and fixed road infrastructure does not have adequate provision for the cross-drainage of large volumes of water in unexpected locations.

It is possible that the increased sedimentation in the rivers is the result of changed land use in the Churia, and is the beginning of a long period of degradation, resulting in a substantial change to the downstream hydrology. This seems unlikely, especially as the forest conditions in the nearby hills have improved visibly.

It is confirmed, therefore, that the best option is considered to be the replacement of the slab culvert with one of about the same size, but with deeper foundations and better flow protection on both sides. This should be designed to survive full capacity flow for short periods. The expectation is that the sediment flux in the river will pass through this area within the next two monsoons and the situation return to normal. Should the case prove otherwise, and flooding be repeated for at least three years, then a study must be undertaken to try to understand the matter properly. The provision of a substantially larger culvert at this time without the appropriate hydrological study being undertaken might well prove to be a wasted investment.

3.6 Bio-engineering Works

As with the other construction activities, progress on bio-engineering is far behind schedule. As the quantities are small, the Contractor expects to derive planting materials from local sources. Embankment slopes should be made ready for works to be undertaken during the next monsoon (2008).

4. ENVIRONMENTAL, HEALTH AND SAFETY ISSUES MONITORED

Identified benefit	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Enhancement measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of enhancement measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
East-West Highway: Part 1: Benefits and their enhancement										
Upgrading of roadside bazaar areas and bus stands.	At least 5350 m ² of 16 bazaar roadsides need to be improved (this also serves for bus stands).	Some progress has been seen in this regard.	Provision of pavements in the Bazaars and Bus stands.	Consultants/DoR have included in detailed design. Site engineering staff are to apply.	By the end of implementation.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	More or less satisfactory.	Effective so far.	No problem identified.
New three-wheeler stand at Itahari Chowk.	A 1000 m ² paved Tempo stand should separately be made some 250 m west of Itahari Chowk.	The full-width pavement at Itahari might serve as a Tempo Stand.	Provision of pavements in the Bazaars and Bus stands.	Site engineering staff to apply if quantities permit.	By the end of implementation.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective so far.	No problem identified.
Bituminised approaches to the existing fuel pumps along the highway.	Sixteen existing fuelling stations with no bituminous approach before project.	Although this project has not supported this, but the owners are gradually improving their forecourts, but political turmoil is discouraging investment in the Terai.	Fuelling stations should pave their approach as per the DoR Guideline.	Project Manager to issue a letter to each fuelling station instructing them to pay the Contractor for paving their sites during upgrading of EWH.	At an appropriate time during implementation.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist with collaboration by the respective DoR Divisional Engineers.	Too early to determine.	Too early to determine.	No problem identified.
Existing areas for the grazing of cattle tethered on embankment slopes should not be damaged during construction.	Approximately 56 km (+ the length of Itahari to Pakali) road embankments being grazed regularly by tethered cattle.	No change in grazing practices from baseline. However, at many sites the embankment slopes have been disturbed for road construction.	All embankment slopes will be left grassed with robust but palatable species to prevent erosion and permit controlled grazing.	Consultants/DoR have included in detailed design. Site engineering staff are to apply.	By the end of implementation. Works to be completed as per schedule.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist with collaboration by GEU.	Too early to determine.	Too early to determine.	No problem identified.

Identified benefit	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Enhancement measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of enhancement measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
East-West Highway: Part 1: Benefits and their enhancement										
Improved and increased number of road signs, traffic calming devices on link roads, and crash barriers on bridges.	A minimum requirement of DoR standards for signs and speed restrictions in bazaar and school areas, and 27 crash barriers at bridges, were identified as most essential.	Some sections of the road have been improved with the new asphalt running surface, but no traffic safety measures have been put in place.	Warnings and restrictions to be placed. General awareness raised amongst the road neighbouring communities and school children.	Consultants/DoR have included in detailed design. Site engineering staff are to apply	By the end of implementation. Works to be completed as per schedule.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist with collaboration by Traffic and Road Safety Specialist (TRSE).	Not so satisfactory.	Not fully effective.	The RE to keep on reminding Contractor about this issue.
Provision of shade trees to improve the environment for road users.	Approx. 700+ shade trees (Mango, Simal, Gulmohar, Jalabi, Eucalyptus, etc.) already exist on the road.	No change from baseline. The contractor has not yet decided how to undertake plantation and bio-engineering works.	Where road neighbours do not graze tethered cattle and undertake to protect shade trees, appropriate trees should be provided by the project, along with robust bamboo tree guards.	Consultants/DoR have included in detailed design. Site engineering staff are to apply.	By the end of implementation. Works to be completed as per schedule.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Too early to determine.	Too early to determine.	Consultant's Bio-engineering Consultant to review work before the 2008 monsoon to ensure that the contractor is starting preparations in a timely way.
Reduction of stagnant water in roadside borrow pits currently giving rise to an increased risk of mosquito-borne diseases.	More than 1 km of waterlogged roadside 13 km east of Koshi barrage to be removed if possible. Substantial area of wetland due to the high embankment on Koshi river from 5 to 10 km east of the barrage to be kept for ecological reasons.	No change from baseline.	Where possible, simple sluices will be cut in the walls of borrow pits to permit drainage outside the monsoon and jute retting seasons.	Site engineering staff are to apply using discretionary quantities.	By the end of implementation.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist with collaboration by Design Engineers.	Too early to determine.	Too early to determine.	No problem identified.

Identified benefit	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Enhancement measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of enhancement measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
East-West Highway: Part 1: Benefits and their enhancement										
Improvement of environment where road passes close to religious trees and shrines.	No specific sites identified before project.	Although no need for improvements as such for the religious shrines were observed, neither have they been disturbed.	If sites are identified, traffic speed control measures will be placed on either side of these sites.	Consultants/DoR have included in detailed design. Site engineering staff are to apply	By the end of implementation.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Not applicable.	Not applicable.	No problem identified.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
East-West Highway: Part 2: Hazards and their mitigation										
Risk of accidents and injuries at road works during construction.	Not applicable.	Warning signs at road works do not meet specifications. Some workers (mainly maintenance lengthmen) have been given high visibility jackets.	Follow DoR's "Code of Practice for Signing at Roadworks". As a minimum, white-painted stones must be used to mark work sites. Provide high visibility jackets to staff and workers.	Contractor.	Throughout implementation.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Unsatisfactory. Contractor is not applying properly.	Ineffective.	RE to insist on compliance by contractor and to demand that it be complied with before inspecting each site location.
Risk of accidents during construction as a result of the raised asphalt pavement and low shoulders. This situation remains until the shoulders are filled and surfaced, which is sequenced to happen much later.	Not applicable.	There is a steep kerb of 100 to 150 mm along the edge of the asphalt overlay for most of the sections so far in place, giving a raised accident risk and making it hard for cyclists and bullock carts to get out of the way of bigger vehicles.	1. White-painted stones should immediately be placed at 10 m intervals along the edge of the overlay. 2. Within one week of placing the overlay, the shoulders should be filled and surfaced to the same level.	RE to ensure that the contractor schedules works carefully.	Throughout implementation.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Unsatisfactory. Contractor is not sequencing works carefully.	Ineffective. A significant hazard to traffic has been created.	RE to insist on compliance by contractor and to demand that it be complied with.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
East-West Highway: Part 2: Hazards and their mitigation										
Risks of environmental damage from the extraction and haulage of construction materials.	Not applicable.	Three major stone extraction sites could give rise to a number of environmental hazards. Heavily loaded tippers are reported to have damaged about 10 km of OTTA seal on the Mirchiya-Katari road.	Loads must be limited to a maximum of 10 tonnes.	Contractor.	Throughout implementation.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Generally good.	Appears to be effective at present except for the Kamala site.	RE must instruct the contractor to restrict the loads. He must also undertake spot checks of compliance, using the weighbridge at the Balan crusher site.
Risks of pollution from, and accidents at, crushers and asphalt plants.	Not applicable.	Crusher and asphalt plants give rise to a number of possible pollution and accident risks.	See detailed table in section 3 of text.	Contractor.	Throughout implementation.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Not entirely bad, but considerable scope for improvement.	Limited effectiveness.	See detailed table in section 3 of text.
Noise pollution during the construction period.	The roadside shopkeepers and pedestrians said that pressure horns blown by the buses in stands irritate customers rather than shopkeepers.	No change from baseline. Contractor's vehicles (mainly tippers) appear not to have made a significant change to the existing traffic levels.	Contractor's vehicles permitted to run for normal work only between 5 am and 8 pm or daylight hours if shorter, and speed to be limited to 30 km/h in open areas and 15 km/h within 100 metres of dwellings. Machinery working areas to be located at least 100 metres from the nearest habitation.	Contractor.	Throughout construction period.	To be checked every six months throughout project implementation.	Checked and reported by consultant Environmental Specialist.	Satisfactory.	Effective.	No problem identified.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
East-West Highway: Part 2: Hazards and their mitigation										
Disturbance to nearby settlements by workers living in large labour camps.	Not applicable.	Heavy reliance on machinery has led to a relatively small requirement for labourers. Also, as work was still minimal, the full number had not been deployed. Machine operators and other staff are housed in large bazaars such as Inaruwa and Lahan.	Contractors are encouraged to employ local people as far as possible. Contractual clauses include strict provision for contractors to maintain small labour camps as close to large bazaars as possible, to minimise social disruption.	Contractor. CRE to approve the sites of all labour camps.	Throughout construction period.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective.	No problem identified.
Labour camps, and plant and equipment camps, give rise to pollution of the soil or water courses through the leakage of sewage, oils, bitumen, etc.	Not applicable.	All plant and equipment camps were inspected and no leakages were found. Stores and tanks are of good quality. Bitumen and fuel are delivered in bulk tankers, reducing contamination from drums. Some waste asphalt at Balan needs to be buried properly.	Contractual clauses include strict provision for contractors to maintain high environmental standards in all camps, to avoid pollution and contamination.	Contractor. CRE to approve the sites of all camps.	Throughout construction period.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective.	No problem identified. Contractor should dispose of the waste asphalt at Balan as described in the text.
Dust nuisance during the construction period.	The owners of roadside tea and paan shops reported no significant dust nuisance before project.	No change from baseline.	Limited measures required, since there are few construction operations that produce a dust hazard.	Contractor.	During all dry weather until a new sealed surface is in place.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist.	Satisfactory.	Effective.	No problem identified.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
East-West Highway: Part 2: Hazards and their mitigation										
A culvert on the irrigation channel (lying 3.5 km east of Inaruwa) is narrower than the highway standard.	Neither warning signs nor any crash barriers were seen.	No change from baseline. Also, a culvert at Barmajhia (km 145+000) is nearly collapsed.	Culvert widened or adequate warning signs and safety barriers provided. The traffic should be immediately diverted from this culvert at 145+000)	Consultants/DoR have included in detailed design. Site engineering staff are to apply.	By the end of implementation. Works to be completed as per schedule.	To be checked annually throughout project implementation.	Checked and reported by Consultant Environmental Specialist with collaboration by TRSE.	Too early to determine.	Too early to determine.	RE to take immediate action to divert the traffic at the Barmajhia site.
Erosion of shoulders along the roadsides.	The shoulders were seen damaged almost throughout the length of the road.	No change from baseline.	Shoulders will be given DBST treatment once asphaltting has been completed, and slopes improved using bio-engineering.	Consultants/DoR have included in detailed design. Site engineering staff are to apply.	By the end of implementation. Works to be completed as per schedule.	To be checked annually following the monsoon rains, throughout project implementation.	Checked and reported by Consultant Environmental Specialist with collaboration by GEU.	Too early to determine.	Too early to determine.	No problem identified.
Erosion of high embankment slopes on approaches to bridges.	At least three sites with 1440 m ² of embankment slopes have erosion features before project.	No change from baseline.	Bio-engineering measures (mainly grass planting or turfing) will be used to protect all high embankment slopes near bridges where erosion may occur.	Consultants/DoR have included in detailed design. Site engineering staff are to apply	By the end of implementation. Works to be completed as per schedule.	To be checked annually following the monsoon rains, throughout project implementation.	Checked and reported by Consultant Environmental Specialist with collaboration by GEU.	Too early to determine.	Too early to determine.	No problem identified.
Erosion of river banks near bridges threatens to damage bridge abutments or embankments.	On the south-western end of Gagan II Bridge approximately 300 m ² , and on Mahuli 120 m ² area, have active erosion prior to the project.	No change from baseline.	Appropriate river training works, generally gabions topped or backed by bio-engineering measures, will be used to protect all river banks where cutting is a problem.	Consultants/DoR have included in detailed design. Site engineering staff are to apply	By the end of implementation. Works to be completed as per schedule.	To be checked annually following the monsoon rains, throughout project implementation.	Checked and reported by Consultant Environmental Specialist with collaboration by GEU.	Too early to determine.	Too early to determine.	No problem identified.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
East-West Highway: Part 2: Hazards and their mitigation										
Material (gravel, sand, boulders) source locations in rivers/khola (for non-project purposes) gives rise to increased danger of river shifting.	Eight khola viz. Gachhiya, Gangajali, Sishwari, Khutti, Musaharnia, Gagan, Choharwa and Ghurmi are serving as unmanaged material sources.	No change from baseline. Strict material quality control ensures that materials for the project are derived from sources well away from the road.	Appropriate river training and bio-engineering works, will be done to protect against possible shifting of rivers in future.	Consultants/DoR have included in detailed design. Site engineering staff are to apply	By the end of implementation. Works to be completed as per schedule.	To be checked annually following the monsoon rains, throughout project implementation.	Checked and reported by Consultant Environmental Specialist with collaboration by GEU.	Satisfactory so far.	Effective so far.	No problem identified.
Increased danger to road users, especially vehicle passengers, from faster traffic speeds.	Data not available	No change from baseline.	Provision of adequate warning signs, safety barriers and traffic safety measures (e.g. crash barriers in at least 24 bridges).	Consultants/DoR have included in detailed design. Site engineering staff are to apply	By the end of implementation. Works to be completed as per schedule.	To be checked annually throughout project implementation.	Checked and reported by Consultant Environmental Specialist with collaboration by TRSE.	Not yet satisfactory.	Not yet effective.	Contractor to comply with project provisions.
Increased danger to road users, especially pedestrians, from greater volumes of traffic.	No data on injuries and death were available. No appropriate road signs at road junctions, or near bazaars and schools were seen before the project.	No change from baseline.	Provision of bus stops and off-road parking sites in appropriate locations. Appropriate warning signs installed.	Consultants/DoR have included in detailed design. Site engineering staff are to apply	By the end of implementation. Works to be completed as per schedule.	To be checked annually throughout project implementation.	Checked and reported by Consultant Environmental Specialist with collaboration by TRSE.	Too early to determine.	Too early to determine.	No problem identified.
Following upgrading, a substantial increase of motorised traffic endangers non-motorised traffic.	Data not available.	No change from baseline.	If the indicators show a dramatic increase in accidents, then the project authorities must design an appropriate solution such as making cycle and bullock-cart tracks.	Depends on measures adopted if this situation arises.	Depends on strategy adopted.	To be checked every six months following the substantial completion of upgrading.	Checked and reported by Consultant Environmental Specialist with collaboration by TRES.	Too early to determine.	Too early to determine.	No problem identified.

Identified hazard	Baseline extent and severity (quantified indicators)	Checked extent and severity (THIS VISIT)	Mitigation measures	Responsibility for compliance	Timing of compliance schedule	Monitoring check schedule	Responsibility for checking and reporting	Performance of mitigation measures	Effectiveness of project in complying with regulations	Action to be taken if any problem is identified
East-West Highway: Part 2: Hazards and their mitigation										
Grazing of cattle on embankment slopes interferes with traffic flows, and gives rise to dangerous traffic situations.	About 200 cattle (counted during drive over survey) moving freely close to the road gives rise to high risk of accidents for faster running vehicles.	No change from baseline.	If this situation arises, the RNDP Consultants' Social Development team will make an investigation of the issue with a view to identifying suitable solutions.	Depends on measures adopted if this situation arises.	Depends on strategy adopted.	To be checked every six months throughout project implementation.	Checked and reported by Consultant Environmental Specialist with collaboration by GEU.	Too early to determine.	Too early to determine.	No problem identified.
Unacceptable levels of noise pollution following upgrading.	Not applicable.	No change from baseline.	Speed control measures should be introduced in the affected areas.	Depends on measures adopted if this situation arises.	Depends on strategy adopted.	To be checked every six months following substantial completion of upgrading works.	Checked and reported by Consultant Environmental Specialist.	Too early to determine.	Too early to determine.	No problem identified.