E1. EXEXUTIVE SUMMARY

E1.1. INTRODUCTION

Govt. of Punjab through Government of India has sought the assistance of the World Bank for the improvement and Rehabilitation of State Highways (SH) and other State Roads. A Strategic Option Study conducted by the Public Works Department (PWD) has prioritized for improvement from 1698 km of State Highways, Major Districts Roads and Other District roads. Technical and Economic feasibility studies for the Punjab State Road Project are being undertaken separately. The Government of Punjab has pre-selected approximately 369[1] km of roads for Phase-I (comprising approximately 254 km roads for rehabilitation and another 115 km for up gradation works). The screening study was carried out by Consulting Engineering Services (I) Pvt. Ltd, Package I consultant. M/S ICT Pvt. Ltd. and BCEOM Societe Francaise D'ingenierie JV Aarvee in association with BCEOM India Pvt. Ltd. and MDP Consultants have been appointed for preparation of detailed project report for Package II and III of Phase I respectively. Environmental Impact Assessments have also been carried out on the basis of Environmental Screening and subsequently Environmental Management Plan has been prepared for Package II and III by the respective consultants.

E1.2. PROJECT DESCRIPTION

The road improvements under the present project consist of the following:

Rehabilitation:

- Strengthening of existing pavement,
- Reconstruction of severely damaged section without widening of existing embankment

Upgradation:

- Widening to two lanes from existing intermediate lane width,
- Raising the formation level,
- Providing paved shoulders and pavement strengthening of existing two lane roads,
- Upgradation of certain urban reaches of roads to four lanes and / or provision of drains sidewall, parking, etc.
- New alignment and / or realignment in some cases

DPR Packages 2 and 3 had been identified for Rehabilitation and Up-gradation respectively. However, subsequently during the design phase fe

w corridors in either package were converted to the other category. The project roads included as part of the Package 2 and Package 3 for rehabilitation and up-gradation are presented in Table 1.1. (Figure 1.1).

[1] The program has been packaged as follows:

- Package 2 : DPR for 254 km road for Rehabilitation
- Package 3 : DPR for 115 km road for Upgrading

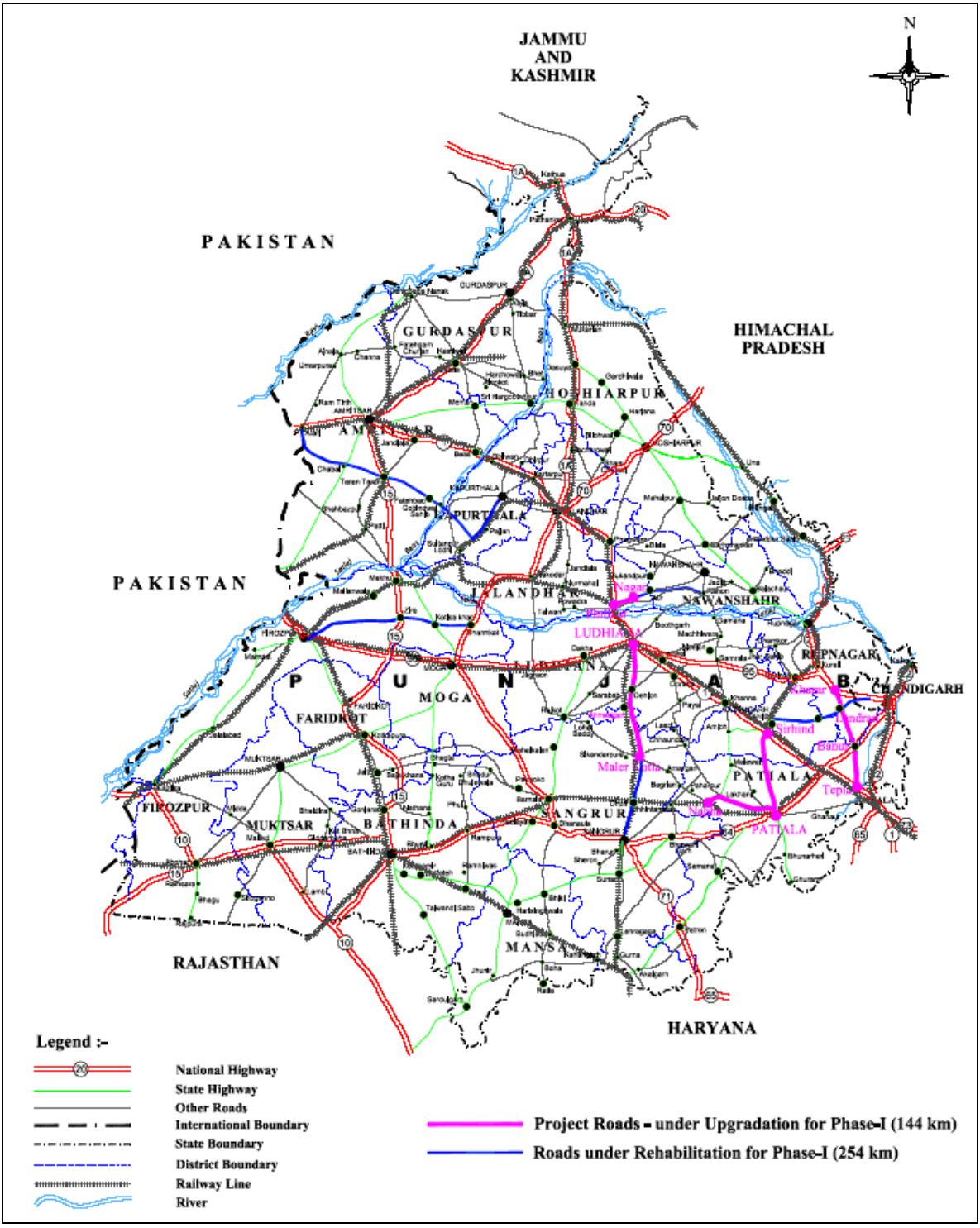

Figure 1.1: Roads under Packages 2 and 3

Table 1-1: Project roads in Package 2 and 3

Sl. No.	Name of the Link	Length (in Km)
Package 2: Rehabilitation		
1	Chandigarh-Landran-Chuni-Sirhind *(2km stretch converted to up-gradation)*	41
2	Nagar-Aur-Rahon	29
3	Malerkotla-Dhuri-Sangrur *(Entire stretch converted to up-gradation)*	33
4	Tarn Taran-Chabal-Attari	41
5	Kapurthala-Fatehbad-Tarn Taran *(1km stretch converted to up-gradation)*	51
6	Dharamkot-Kot Ise khan-Zira-Ferozepur	59
Total Km		**252**
Package 3: Upgradation		
1	Patiala - Sirhind, MDR-31 (*Entire stretch converted to rehabilitation*)	30
2	Kharar - Landran - NH-64 (Banur), ODR 4	39
	NH-64 (Banur) - Tepla/Rajgarh, ODR 18	
3	Phillaur - Nagar (Crossing of Mukundpur - Apra Road), ODR 5 *(Entire stretch converted to rehabilitation)*	6
4	Ludhiana - Ahmedgarh - Malerkotla, SH-11	40
Total Km		**115**

E1.3. FINDINGS OF ENVIRONMENT SCREENINGS

Major findings of Environmental Screening for the project are given below:

- Roadside trees along the project roads (within Right of Way of the roads) are declared as Protected Forest. Road Rehabilitation will involve felling of roadside trees.
- None of the road is passing through eco-sensitive areas like reserve forests and Sanctuaries.
- Schools, hospitals and Temples exits outside the Right of way of the project road.

The project has been categorized as 'Cat A' as per The World Bank policies

E1.4. ENVIRONMENT ASSESSMENT FOR THE PROJECT

The detailed design of the project has been closely coordinated with the preparation of this Environmental Impact Assessment Report and the Environmental Management Plans. The EA preparation led to identification of potential negative environmental impacts and their feasible remedial measures (including avoidance, mitigation and enhancements). Based on these findings Environmental Management Plans (EMPs) have been prepared for the implementation for each construction package. The EMPs detail the potential negative impacts and list specific mitigation measures that are required to be included and will form the part of the contract documents between the Contractor and the Client.

E1.5. THE STUDY METHODOLOGY

- Environmental Screening and Scoping

Environmental screening exercise of the projects roads were undertaken to determine the major environmental issues and define the scope of work for conducting environmental assessment. As per the recommendation of the Environmental Screening report, detailed Environmental Assessment has been carried out for the project

roads. Geographical Boundaries for the project roads were defined as Direct Impact Zone[2] and project influence area[3] to assess the impacts due to project activities.

Adopted methodologies for the project pointed out below:

- Review Policy, Legal and Administrative Framework
- Defining Geographical Boundaries
- Surveys for Collection of Baseline Data (only for up gradation road)
- Testing and Monitoring (only for up gradation roads)
- *Assembly and Analysis of Data*
- *Environmental Assessment of the Project*
- Community Consultations
- Analysis of Alternatives (only for up gradation roads)
- Assessment of Potential Impacts
- Mitigation and Enhancement Measures

E1.6. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

Review of the existing legislation, institutions and policies relevant to the Environmental Impact Assessment for **Punjab State Road Sector Project** at the National and State levels are reviewed and identified the clearance requirement for the project at various stages of the project. The requirement obtaining the clearances for the project at project preparation stages are summarised in Table 1.2.

Table 1-2: Clearance Requirement for the Project at Project Preparation Stage

Sl. No.	Type of Clearance	Required Description	Applicability to the Project
Govt. of India			
1	EIA Clearance From MoEF, Govt of India	The EIA notification of MoEF (1994, 1997 & 2002) states: Environmental Clearance from the MoEF is not required for Highway project relating to improvement work including widening and strengthening of roads if marginal land acquisition along the existing alignment does not exceed a total width of 20 metres on either side of the existing alignment put together. Highways do not pass through ecologically sensitive areas such as National Parks, Sanctuaries, Tiger Reserve, and Reserve Forests etc. Further, it is also clarified that bypasses would be treated as standalone projects and would require environmental clearance if the cost of projects exceed Rs.100 crores each.	Not Applicable as No marginal land Acquisition, no road is passing through eco-sensitive area and bypass cost is not exceeding 100 crores.
2	Forest Clearance	Roadside trees are declared as Protected forest in Punjab. Cutting of these trees require Forest Clearance from MoEF Regional Office, Chandigarh as per the Forest Conservation Act, 1980. Net Present Value of the diverted forest land and two times compensatory plantation cost to paid to the Punjab State Forest Department for the Forests Clearance.	Applicable as roadside trees to be cut due to the up gradation of the project road.
State Level			

[2] Roadside features like roadside religious structures, educational institutions, medical amenities, water bodies, etc. on which impacts of road improvement are generally confined up-to ROW, whereas, Direct impact zone especially for roadside trees is limited upto toe line of the proposed road cross section.

[3] For identification of impacts of road improvement on the sensitive & nationally/ regionally important environmental features like eco-sensitive areas (reserve forests, national parks, sanctuaries, bio-sphere reserves, sacred groves, protected areas, wetlands, major rivers etc.), cultural heritage & archaeological sites, as well as for defining general environmental setup like topography, climate, air, water & noise quality etc. the project influence area (or the study corridor) has been defined as the area falling within 7 km on either side of the project roads. However, for the roadside features like roadside religious structures, educational institutions, medical amenities, water bodies, roadside trees etc. on which impacts of road improvement are generally confined within few meters of the ROW, the project influence area has been taken as 100 m on either side of the project road.

3	NOC From Punjab Pollution Control Board	No Objection Certificate (NOC) from Punjab Pollution Control Board in pursuant to the Water (Prevention and Control of Pollution) Act of 1974, and the Air (prevention and Control of Pollution) Act of 1981. Generally at project preparation stage this NOC is needed if project requires EIA clearance from MoEF, GOI.	Applicable, To ensure the applicability, PRBDB will apply for the NOC from Punjab Pollution Control Board.

E1.7. BASELINE FEATURES

The baseline data of Physical, Natural and Socio cultural environment was collected and is summarized in **Table 1.3.**

Table 1-3: Summary of Environmental Baseline Scenario

Environmental Parameters	Package 2						Package 3			
	Chandigarh-Landran Chuni-Sirhind Road	**Nagar-Aur-Rahon Road**	**Tarn Taran-Chabal-Attari Road**	**Kapurthala-Fatehabad-Tarn Taran Road**	**Dharamkot-Kot Ise Khan-Zira-Ferozepur Road**	**Malerkotla-Dhuri-Sangrur**	**Patiala - Sirhind, MDR-31**	**Kharar -Tepla**	**Phillaur - Nagar**	**Ludhiana - Ahmedgarh - Malerkotla, SH-11**
Physical Environment										
Terrain & Geology	Monotonous and Flat	Slightly undulating	Slightly undulating	Slightly undulating	Slightly undulating	Flat terrain	**Flat Terrain**	Flat Terrain	Flat Terrain	Flat Terrain
Geology	Quaternary alluvial deposits	Quaternary alluvial deposits	Quaternary alluvial deposits	Quaternary alluvial deposits	Quaternary alluvial deposits	Quaternary Alluvium	Quaternary alluvial	Quaternary alluvial	Quaternary alluvial	Quaternary alluvial
Soil Type	Seriozems and Kandi soil	Loamy soil	Loamy, Seriozems soil	Loamy, Seriozems and bet soil	Bet soil	Seriozem, loamy	Seriozem, loamy	Seriozem loamy	Seriozem loamy	Seriozem loamy
Surface water bodies crossing/ along the road: Canal/Stream/Ponds	3 Nos. of irrigation Canal one waste water drain and 5 Ponds	3 Ponds	9 Nos. of irrigation Canal, 2 nos. of waste water drain and 10 Ponds	9 Nos. of irrigation Canal, Beas river and 5 Ponds	7 Nos. of irrigation Canal	7 Canals, 2 Drains, 2 Ponds	4 Streams	2 Canals	1 canal	1 Stream
Ground Water Bodies along the road: HP/TW	5 HP	26 HP	23 HP	21 HP, 17 TW	5 HP, 17 TW	10 HP / 35 TW	94 HP / 52 TW / 13 W	217 HP / 62 TW / 39 W	82 HP / 38 TW / 19 W	25 HP / 4 TW / 1 W
Surface & Ground Water Quality	Within permissible limit as per standard	Within permissible limit as per standard	To Be monitored in Pre-construction stage	Within permissible limit as per standard	Within permissible limit as per standard	Within permissible limit	Within permissible limit	Within permissible limit	Within permissible limit	Within permissible limit
Air Quality	Higher SPM and RSPM	Higher SPM and RSPM	To Be monitored in Pre-construction stage	Within permissible limit as per standard	Higher SPM and RSPM	SPM RSPM-Higher than permissible limit	Only SPM-Higher than permissible limit	Only SPM-Higher than permissible limit	Within permissible limit	Only SPM-Higher than permissible limit
Noise Level	To Be monitored in Pre-construction stage	To Be monitored in Pre-construction stage	Within permissible limit as per standard	Within permissible limit as per standard	Higher Noise Level	Higher than permissible limit	Higher than permissible limit	Higher than permissible limit	Higher than permissible limit	Higher than permissible limit
Natural Environment										
Forest Along the Road	Road side trees declared as Protected Forest in Punjab	Road side trees declared as Protected Forest in Punjab	Road side trees declared as Protected Forest in Punjab	Road side trees declared as Protected Forest in Punjab	Road side trees declared as Protected Forest in Punjab	Road side trees declared as Protected Forest in Punjab	Road side trees declared as Protected Forest in Punjab	Road side trees declared as Protected Forest in Punjab	Road side trees declared as Protected Forest in Punjab	Road side trees declared as Protected Forest in Punjab
Eco-sensitive area within 7km	Nil	Nil	Nil	Nil	Nil	Bir Sanctuary	Nil	Nil	Nil	Nil

Avenue Trees along the road	14705 Nos	10090 Nos.	17226 Nos.	18849 Nos.	28985 Nos.	12675 Nos.	11200 Nos.	14190 Nos.	1250 Nos.	7500 Nos.
Socio-Cultural Environment										
Settlements Along the road	14 Nos.	10 Nos.	12 Nos.	10 Nos.	16 Nos.	9 .	15 Nos.	15 Nos.	02 Nos.	10 Nos.
Religious Properties along the road	13 Nos	11 Nos.	18 Nos.	11 Nos.	12 Nos.	13.	Temple-12 Nos., Dargah-2 Nos.	Temple-16 Nos., Gurudwara-8 Nos., Mosque-3 Nos., Dargah-4 Nos.	Gurudwara-4 Nos.	Temple-6 Nos., Gurudwara-1 Nos.
Educational Institutes Along the road	9 Nos	9 Nos.	9 Nos.	9 Nos.	21 Nos.	10 Nos.	7 Nos.	17 Nos.	11 Nos.	11 Nos.

E1.8. PUBLIC CONSULTATIONS

Discussions were held with most of the stake holders with different type of consultations such as formal, informal and group discussions. All of the concerns were considered at the feasibility stage and design stage. One concern that could not be addressed in the project is the possible grade separation at junctions with National Highways and a bypass for Kharar as this will be considered as part of a separate National Highway program.

Key Stakeholders

- Affected Communities;
- Selected Govt. agencies; and
- Other stakeholders.

Public consultations have been carried out for identification for need of bypass, to raise public awareness and to identify stakeholder concerns. The Central point of discussion in the public consultations was to ascertain what alternatives were possible and for bypasses which option was considered preferable. For other alignment, drainage problem, cutting of roadside trees, enhancement of the bus stops and road safety issues consultations were held at many villages along the roadside. Most of the concerns are taken care in the design and provided bypasses, lined and covered drains, bus stops etc. public consultations details are summarised as below:

Table 1-4: Summary of details of Stakeholders Local level Consultations

Project Corridor	Number of consultations	Number of participants	Typical issues	Remarks
Package-II				
Chandigarh-Landran-Chunni-Sirhind	6	114	Enhancement Sites Road Safety	
Nagar-Aur-Rahon	4	41	Enhancement Sites Road Safety	
Tarn Taran-Chabal-Attari	4	91	Enhancement Sites Road Safety	
Kapurthala-Fatehabad-Tarn Taran	6	115	Enhancement Sites Road Safety	
Dharamkot–Kot Ise Khan-Zira-Ferozepur	5	77	Enhancement Sites Road Safety	
Malear Kotla Sangrur	4	87	Provision of wayside amenities like bus shelter, footpath, toilet and provision of drinking water	Issues considered in design except request for toilets. The RoW also is limited to accommodate this issue
Package-III				
Kharar-Tepla	6	135	Relocations of the structures Drainage problem Road Safety Bus stop	Issues considered in design
Ludhiana-Malerkotla	5	125	Bypasses and Realignments Relocations of the structures Drainage problem Road Safety Bus stop Land	Issues considered in design
Phillaur - Nagar	2	40	Junction improvement Drainage problem Road Safety Bus stop	Issues considered in design
Patiala – Sirhind	3	40	Road Safety Bus stop	Issues considered in design

Table 1-5: Issues Discussed during Stakeholders Consultation

Issues Raised in Public Consultation			
1	Provision of signages and traffic calming measures	2	Parking Facilities
3	Improvements of Junctions and Intersections	4	Provision of Bus stops
5	Street Light in Urban area	6	Provision of Footpaths in urban areas
7	Service Roads	8	Provision of Pedestrian Crossings
9	Enhancement of religious structures	10	Roadside drainage
11	Covered drains in urban areas		
Issues Addressed in Design			
1	Road safety, Place identification signage's provided	2	Parking Facilities in Urban commercial areas provided
3	Traffic calming measures provided at educational institutes and settlements	4	Provision of Bus stops
5	Junctions and Intersections improved	6	Provision of Footpaths in urban areas
7	Street Light in Urban area provided	8	Roadside drainage provided
9	Enhancement of religious structures and crematorium has been suggested in Environment Management Plan	10	Provision of Pedestrian Crossings
13	Covered drains in urban areas provided		

E1.8.1. Continued Participation Mechanism

Package 2: Two stages consultation was carried out in Project Corridor. In first stage consultation Information about the project was disseminated to the local people and their views/Grievances/ Suggestions were solicited. These suggestions were incorporated into the design to the extent possible and Second round of consultation was carried out with a objective to inform the people about the design, suggestions which could be addressed and reasons thereof and communities were shown enhancement drawings and briefed about the enhancement measures and this will continue through out the construction period.

Package 3: Regarding alignment issues, the follow up consultations for three times held at Dehlon and one time at Ahmedgarh. At Dehlon, the effort was made in minimising the acquisition of Gurudwara land and to avoid temple. The alignment has been revised thrice and discussed with the local public with different alignments and come to one conclusion with most preferred option. The bypass alignment proposed at Pohir village was discussed at with Ahmedgarh municipality chairman and other representatives. Effort was made in convincing about the alignment proposed for Pohir in terms of techno-feasible option.

E1.8.2. Information Disclosure

As required by World Bank Policy on involuntary disclosure, the R&R Policy of Punjab State Road Sector project (PSRSP) was disclosed at Ludhiana on 12th May, 2006 at the an auditorium in Guru Nanak Dev Engineering College and at Mohali on 15th May, 2006 in a Community Hall, Phase3B-1.

E1.9. ANALYSIS OF ALTERNATIVES

Analysis for alternatives was carried out for different parameters as given below:

E1.10. WITH AND WITHOUT PROJECT ALTERNATIVES

Package 2 & 3: Development of transport infrastructure facilities in the project area will result in increased revenue generation from the agricultural industry, which will lead to enhanced economic growth. The project area has a high incidence of road accidents. With the widening of the road, provision of a median and adoption of traffic calming and road safety measures, the accident rate may reduce. Keeping in view the site conditions and the scope of development of the area, the 'With' and 'Without' project scenarios have been compared and detailed out in this section.

Package 3 involves widening and upgradation work. Details of these alternative analysis for package 3 is given below:

E1.10.1.Analysis of Alternative Options for Widening of Existing Roads

The choice of widening options depend to large extents on site constraint and construction methodology. It has been endeavour of consultant to propose widening option keeping in view minimising interference with religious structures such as temples, mosques, churches, crematories, mazar etc., minimum impact on residential and commercial property abutting the corridor, Land use and availability of land, optimum utilisation of existing pavement and ROW at location of curve improvement, drainage consideration, construction problems, least disturbance to traffic during construction and minimum impact on the environment.

Based on the above factors, the following cross sections have been adopted:

- Provision of four lanes as a divided dual carriageway, each 7.0 m, with 1.5 m Median (plus kerb shying of 0.25 m) and 2.5 m shoulders (1.5 m paved and 1.0 m granular material), in rural areas;
- Widening and rehabilitation of narrow 2 lane carriageways to 7.0 m and the construction of 3.5 m shoulders (2.5 m paved and 1.0 m granular material), in rural areas;

Provision of a four lane cross-section in densely settled areas with sidewalks (footpaths), covered drainage channels and median.

E1.10.2.Analysis of Alignments for Bypasses

The project road passes through the congested towns of Gill and Pohir, where the options of providing bypasses were studied in details by the Consultants. The various alternative alignments were studied keeping in view of the avoidance marshy ground, steep terrain, unsuitable hill features and areas subject to flooding and inundation, shorter route length, minimum impact on existing settlements, businesses and public utilities, improvement in geometrics, avoid conflict with future planned developments, integrate with existing roads to important towns and villages, optimization of traffic capacity and road safety, minimum impact to the environment.

E1.10.3.Technology and Engineering Alternatives

There are no real major alternatives to following the existing road Right of Way (ROW) as any completely new alignment would mean extensive land acquisition of valuable agricultural land and the consequent redundancy of the old road alignment.

There are some minor design alternatives that have been considered. The basic road cross section is dictated by the traffic projections and the necessary road capacity. The vertical alignment is dictated by the standards for minimum sight distances (road safety) and the requirements to raise the road where flooding is a problem that cannot be solved by wider bridges at the same level or increased cross culverts. The horizontal alignment is dictated by the design speed and maximum super-elevation.

Pavement alternatives include the choice of rigid or flexible pavement. Both use the same aggregate sources and similar quantities so this environmental impact is very similar for each. However rigid pavements generate considerably more traffic noise and any defects can be very expensive in terms of repair and maintenance costs. For the 15-year design life the flexible alternative is the most economic and with the noise considerations is the preferred option.

All the project roads show a high incidence of accidents due to excessive speed in busy / confined stretches and reckless driving like overtaking on undivided roads. In all major villages with high approach speeds traffic calming measures have been proposed. It is also proposed to implement a high standard of road signs and road markings placed at appropriate locations and bridge approaches will be provided with proper safety barriers. In addition pedestrian crossings and well-located bus bays will be provided, and segregation of traffic and pedestrians will be encouraged through design details.

E1.11. PREDICTION OF IMPACTS

Key Environmental Issues along the Project Road:

Major issues in the project area are given below:

- Roadside Tree Cutting and diversion of roadside protected forest areas
- Existing drainage is not adequate
- Relocation of Religious structures
- Diversion of fertile agricultural land
- Need for minimise traffic noise impacts

Due to activities of proposed improvements there will be some potential in the surrounding improvements. The assessment of impacts on various environmental components from the project roads is summarised below:

Table 1-6: Summary of Impacts

Sl. No.	Parameter	Package 2						Package 3			
		Chandigarh-Landran Chuni-Sirhind Road	Nagar-Aur-Rahon Road	Tarn Taran-Chabal-Attari Road	Kapurthala-Fatehabad-Tarn Taran Road	Dharamkot-Kot Ise Khan-Zira-Ferozepur Road	Malear Kotla Sangrur	Kharar - Tepla	Ludhiana - Ahmedgarh - Malerkotla, SH-11	Phillaur - Nagar	Patiala - Sirhind, MDR-31
	Negative Impacts										
1	*Hand Pumps Relocation*	8	18	14	14	5	6	50	90	11	0
2	Nos of trees to be felled	131	776	66	253	380	1532	7055	9365	803	0
3	Impact on Religious structures	0	1	1	0	2	0	4	2	0	0
4	Water for Construction (Kl)	5815	6193	9840	5915	11593	11733	103680	123120	14850	10000
5	Aggregates required (cum)	137184	120748	50615	115376	299049	248105	515000	621000	70000	21000
6	Debris Disposal	32394	111583	66317	33027	31593		180000	279870	3600	2125
7	Earth required (cum)	81586	79596	102731	113100	212661		456000	630000	61000	39000
	Positive Impacts										
1	Enhancement sites	33	30	42	47	48	35	16	29	4	5
A	Cultural / Religious Properties	3	2	4	3	1	2	2	3	1	1
B	Surface water body	2	3	3	3	3	1	5	7	1	1
C	Educational Institute	0	0	1	0	1	1	2	2	1	2
D	Safe Access to educational institution	9	10	9	14	21	10	7	17	1	1
E	Enhancement of Bus bays	18	10	20	24	20	14	20	18	5	8
F	Village gate	0	1	0	1	0	2	2	2	1	1
G	Sitting Arrangement	0	1	5	2	2	4	4	6	2	3
	Road safety Measures										
A	Junction Improvement	3	3	4	6	1	4	3	1	1	1
B	Rotary	0	0	0	0	4	1	0	4	0	0
C	Intersections	0	11	15	19	28	31	50	59	10	57
D	Bus Bays	18	12	20	24	20	14	20	18	5	8
E	Raised Pedestrian Crossing	4	5	5	7	11	6	29	29	4	0
H	Crash Barriers										
i	Nos.	4	2	1	9	4	4	8	10	3	6
ii	Length (m)	600	95	330	15640	1140	1552	4790	3725	910	1220
I	Earth Quantity Saved	32393	35260	59974	27036	73761		159000	262035	23450	35750
J	Traffic Calming Measures (Nos. of locations)	24	15	20	30	37	15	8	7	3	5
	Mitigation Measures										
A	Silt Fencing										
i	No.	2	3	2	2	4	10	3	6	1	1
ii	Metre	40	60	70	80	40	80	200	250	50	50
B	Debris reuse (Quantity in Cum)	32393	35260	59974	27036	73761	159000	159000	262035	23450	35750
C	Compensatory Afforestation (Ha)	17.68	17.40	18.126	23.50	13.75	14.6	74.2	102.8	10.9	0.0
D	Vegetative Screen Barrier/ Wall Noise Barrier	1	0	0	0	0	1	1 & 3	4 & 5	0 & 2	1 & 1

E1.12. AVOIDANCE, MITIGATION AND ENHANCEMENT MEASURES

As far as possible avoidance and reduction of adverse impacts approaches were adopted during the design stage with consideration of the views of local communities and the design team including engineers, environmental and social experts. This is reflected in the finalization of the cross sections, construction methods, construction materials and alignment. Avoidance measures are summarised in Table 1.7.

Table 1-7: Avoidance measure Adopted in the Design

Environmental Parameters	Kharar- Banur-Tepla			Ludhiana- Malerkotla			Phillaur- Nagar		
	Impact as per Standard Design	Impact after Design Modification	Avoided Impacts	Impact as per Standard Design	Impact after Design Modification	Avoided Impacts	Impact as per Standard Design	Impact after Design Modification	Avoided Impacts
Trees (nos.)	8100	7055	1050	11345	9365	1980	980	803	177
Forest Area (ha.)	45.3	37.1	8.2	63.2	51.4	11.8	6.8	5.4	1.4
Ponds (nos.)	5	3	2	4	2	2	1	1	Nil
Tube wells / Hand pumps (nos.)	116	50	66	124	90	34	29	11	18
Open wells (nos.)	8	5	3	7	2	Nil	1	0	1
Religious Properties	7	4	3	6	2	4	1	0	1
Land Acquisition (ha.)	6.2	4.91	1.29	31.0	25.57	5.3	0	0	Nil

The widening of the existing road and construction of new bypasses will have certain negative impacts on environmental components, during all stages of the Project implementation. Cognizant efforts have been made to minimize adverse impacts and enhance the positive impacts to reduce overall negative impacts on the environmental and social components, however certain limited negative impacts are inevitable.

Based on their applicability, both general and case specific measures were incorporated as follows:

Standard: The 'Standard design' of various sections of existing road and bypasses, were arrived at after detailed deliberations between the highway design engineers, road safety and environmental experts.

General measures: To avoid or mitigate impacts on environmental components, general mitigation measures were identified.

Specific: Appropriate **Specific designs have been prepared to mitigate the environmental impacts and enhancement & management measures are provided in details in respective Environmental Management Plan for the project road.** The following sub sections outline the mitigation measures adopted to minimize the adverse impacts envisaged from the proposed Project.

Table 1-8: Key Environmental Impacts and Management Measures

Area	Impacts	Management Measures
Construction Phase		
Topography & geology	• Disfiguration & change in existing profile of the land due to borrow pits & construction of new bypass. • Disturbance on geological setting due to quarrying. • Uncontrolled digging of borrow pits resulting in water accumulation & breeding of vector disease.	• Borrow pits will be restricted to 1 m depth followed by resurfacing of pits. • Road building materials will be procured from approved and licensed quarries only. • Suitable seismic design of the bridge structures will be adopted to mitigate the earthquake impacts.
	• Disruption & loss of productive top soil from agricultural fields due to borrow pits which may reduce crop yield. • Loosening of top soil & loss of vegetative cover along the road due to excavation & back filling which will lead to enhanced soil erosion.	• Adequate measures like adequate drainage, embankment consolidation & slope stabilization will be taken along the road to avoid soil erosion. • Top soils (15 cm) of borrow pit sites will be conserved and restored after excavation is over. • Accidental spillage of lubricants/oil and molten asphalt will be avoided by adherence to good practices.
Land use	• Loss of agricultural land resources due to land acquisition for the road. • Generation of solid waste in the form of construction spoils from construction sites. • Changes in existing land use pattern of the ROW for construction of the road. • Generation of bituminous waste due to scarifying of damaged pavement	• Earth material generated from excavation of roadways & drainage will be reused during site development. • Construction debris will be disposed of in suitable pre-identified dumping areas. • Dumping areas will be biologically reclaimed. • Construction camp will be provided to avoid indiscriminate settlement of construction workers. • Staging of the debris on / along the road will not be allowed. Regular inspection of construction site will be carried out to ensure for this. • Scarified bitumen will be recycled for use below Subgrade under pavement or below GSB under shoulder.
Drainage	• Change in drainage pattern of the land. • Increased incidence and duration of floods due to obstruction of natural drainage courses by the road embankment. • Chances of filling of existing drainage courses during earth filling.	• Adequate lined and covered drains are provided for the project to facilitate its long life, and to avoid soil erosion & land degradation. • Adequate cross drainage works & structures will be provided for smooth passage of runoff to avoid flooding. • Steps at the bridge sites will be provided to inspect, regular cleaning and inspection of these sites. • Filling of existing drainage courses will be strictly avoided. • Suitable drainage at construction site & camp will be provided to avoid water stagnation, soil erosion & mosquito breeding.
Water bodies	• Loss of water resources due to complete or partial filling up of few ponds/water bodies along the road.	• Filling of water bodies along the road alignment will be minimized by providing retaining walls.
Water use	• Impact on the local water sources due to use of construction water.	• Minimum use of existing water sources for construction will be ensured to minimize likely impacts on other users.

Area	Impacts	Management Measures
Water quality	• Increase of sediment load in the run off from construction sites and increase in turbidity in receiving streams/water bodies. • Water pollution due to sewage from construction camps.	• Sediment traps will be provided to reduce sediment load in construction wastewater. • Proper sanitation facilities will be provided in construction camp to prevent health related problems. • All the construction activities will be carried out during dry seasons only.
Air quality	• Deterioration of air quality due to fugitive dusts emission from construction activities like excavation, backfilling & concreting, and hauling & dumping of earth materials & construction spoils, and vehicular movement along unpaved roads. • Deterioration of air quality due to gaseous emissions from construction equipment & vehicular traffic. • Deterioration of air quality due to emission from asphalt and hot mix plants.	• Construction materials will be stored in enclosed spaces to prevent fugitive emissions. • Truck carrying soil, sand and stone will be duly covered to avoid spilling. • Adequate dust suppression measures such as regular water sprinkling on haul & unpaved roads particularly near habitation will be undertaken to control fugitive dust. • Stringent construction material handling/overhauling procedures will be followed. • Low emission construction equipment & vehicles will be used. • It will be ensured that all construction equipment & vehicles are in good working condition, properly tuned & maintained to keep emissions within permissible limits. • Asphalt and hot mix plants will be located at least 500 m away from inhabited areas and 300 m from the road.
Noise level	• Increase in noise level due to construction activities like operation of construction equipment & vehicular traffic.	• Construction camp and temporary labour sheds will be located away from the immediate vicinity of the construction sites and major road traffic. • Protective gears such as ear plugs etc. will be provided to construction personnel exposed to high noise levels as preventive measure. • Low noise construction equipment will be used. • It will be ensured that all construction equipment & vehicles are in good working condition, properly lubricated & maintained to keep noise within permissible limits. • Stationary construction equipment will be placed sufficiently away from inhabited areas and silence zones. • Construction activities carried out near residential area will be scheduled to the day time only so that minimum disturbances are caused to people. • Vegetative and wall barrier provided to minimise the noise level at identified locations (Total 2 noise barrier for package 2 and 17 noise barrier for package 3).
Floral & fauna	• Loss of flora & loss of habitat of avian fauna due to felling of trees along the ROW. • Short term disturbance to avian fauna.	• No tree shall be felled beyond the toe line of proposed cross section. • Two times of area of diverted forest land will be afforested as per direction of forest department. PRBDB will deposit the required amount for afforested as forest department will specify for compensatory plantation. In addition to this NET present value for the diverted forest land will be paid to forest department • Median hedge will be developed to enhance the aesthetic look & reduce headlight glare on the four lane roads. • Cooking fuel should be provided to construction workers to avoid cutting/felling of trees for fuel wood.
Amenities & cultural properties	• Partial or total effect on roadside educational, medical & other amenities, and religious & cultural properties like temples & mosques due to additional land acquisition.	• Affected tube wells, temples & mosques will be suitably relocated. • Compensation will be given for other affected amenities like schools, colleges, hospitals, banks, post-offices & markets.
Rehabilitation & resettlement	• Acquisition of agricultural land which is the source of sustenance of those families. • Demolition of houses & other structures within ROW resulting in displacement of people.	• Adequate & equitable compensation, rehabilitation & resettlement measures for PAPs are provided in RAP prepared for the project.
Construction camp	• Influx of construction work-force & supplier who are likely to construct temporary tents in the vicinity.	• Temporary construction camps with adequate potable water supply, sanitation & primary health facilities and fuel for cooking will be provided to accommodate construction

Area	Impacts	Management Measures
	• Likely sanitation & health hazards & other impacts on the surrounding environment due to inflow of construction labourers.	workers. • It will be ensured that the construction workers are provided fuel for cooking to avoid cutting of trees from the adjoining areas. • Domestic as well as the sanitary wastes from construction camps will be cleared regularly and disposed as per local practice stipulated by local administration (Municipalities, Panchayats etc.).
Occupational health & safety	• Health & safety related problems to construction workers due to inadequate health & safety measures.	• Adequate safety measures complying to the occupational safety manuals will be adopted to prevent accidents/hazards to the construction workers • Periodic health check-up of construction workers will be done.
Road safety	• Increase on incidence of road accidents due to disruptions caused in existing traffic movements.	• Proper traffic diversion and management will be ensured during construction at the interactions and construction areas. • Traffic calming measures are provided at 23 locations.
Operation Phase:		
Land use & Encroachment	• Change of land use by squatter/ encroachment within ROW and induced development outside the ROW.	• Planning agencies and Collector/ Revenue Officer will be made involved for controlled development and prohibiting squatter/ encroachment within ROW.
Drainage	• Filthy environment due to improper maintenance of drainage.	• Drainage system will be properly maintained.
Water quality	• Chances of contamination of water bodies from road surface run off containing oil spills due to traffic movement & accidents.	• Oil interceptor will be provided at construction yard. Contingent actions will be taken for speedy cleaning up of oil spills, fuel and toxic chemicals in the event of accidents.
Air quality	• Air pollution due to vehicular emission from road traffic.	• Vehicular emission will be controlled through enforcement of laws and public awareness. • Truck parking lay-byes and bus bays will be provided at required locations to facilitate smooth traffic flow. • Regular monitoring of air quality at specified locations will be conducted.
Noise level	• Noise pollution due to traffic noise.	• Vehicular noise & use of horns will be controlled through enforcement of laws and public awareness. • Road signs prohibiting the use of horns will be placed at residential areas, sensitive locations & silence zones. • Regular monitoring of noise level at specified locations will be conducted by PRBDB.
Flora & fauna	• Illegal felling of road side plantation. • Effect on aquatic fauna in case of accidental spill of oil, fuel & toxic chemicals into water bodies.	• Plantation along the ROW will be maintained properly and protected from illegal felling. • Contingent actions will be taken in the event accidental spill of oil, fuel & toxic chemicals.
Access	• Significant severance problem on pedestrian & cattle crossing and cross traffic due to widening, partially access control & increase in traffic speed.	• Intersection & approach of existing major cross roads will be upgraded. • Cattle/animal crossings to facilitate smooth traffic & pedestrian movement to avoid accidents. • Access of primary schools will be modified in S shaped to slow down the speed of the primary school children, when they come out. It will avoid chances for accidents of school children. • Bus bays will be provided at suggested suitable locations.
Road safety	• Impacts on human health due to accidents. • Damage of road due to wear & tear.	• Adequate traffic safety measures e.g. crash barriers & pedestrian railings will be provided wherever required. • Proper & adequate road signs, road markings, kerb paintings and road furniture like overhead gantry signs, roadway delineators etc. will be provided. • Adequate illumination will be provided at interchange locations for safe and efficient traffic operations especially during night and inclement weather. • Periodical inspection of the road will be conducted to detect anomalies in pavement. • Emergency telephone communication system, highway patrolling, crane and ambulance facilities will be provided.

E1.13. ENVIRONMENT ENHANCEMENT MEASURES

Environment enhancements have been suggested for various types of structures to provide comfort to road users, for integration of local communities with the project. The brief summary about the various types of measures suggested in Environment Management Plan. is given in **Table 1.9.**

Table 1-9: Summary of Enhancement Sites

Sl. No.	Description	Package 2						Package 3			
		Chandigarh-Landran-Chuni-Sirhind	Nagar-Aur-Rahon	Tarn Taran-Chabal-Attari	Kapurthala-Fatehabad-Tarn Taran	Dharamkot-Kot Ise Khan-Zira-Ferozepur	Malear Kotla Sangrur	Kharar-Tepla	Ludhiana - Ahmedgarh - Malerkotla, SH-11	Phillaur - Nagar	Patiala - Sirhind, MDR-31
1	Religious Structures	3	2	2	2	1	2	2	3	1	1
2	Surface water bodies	2	3	3	3	3	1	5	7	1	1
3	Cultural Properties	0	0	2	1	0	0	0	0	0	0
4	School	0	0	1	0	1	1	7	5	1	2
4	Safe access to Schools	9	10	9	14	21	0	17	17	1	0
5	Enhancement of Bus Bays	18	12	20	24	20	14	20	18	5	8
6	Vegetative Screen Barrier	1	0	0	0	0	0	0	0	0	0
7	Village gate	0	1	0	1	0	2	2	2	1	1
8	Sitting arrangement	0	2	5	2	2	0	4	6	2	3
9	Improvement of School Approach/Junction	0	0	0	0	0	10	0	0	0	0
	Total	**33**	**30**	**42**	**47**	**48**	**30**	**57**	**47**	**12**	**8**

E1.14. INSTITUTIONAL ARRANGEMENT AND CAPACITY BUILDING

The PRBDB is responsible for the effective implementation of all the management measures suggested in EMP and for this the organizational capacity of the PRBDB in environmental sector is to be streamlined & strengthened.

For implementation of EMP/ RAP, Environment Social Development and Resettlement Cell (ESDRC) should be set up in PRBDB. ESDRC shall be headed by Deputy Project Director and will consist of Project Manager (Environment), Project Manager (Social), Project Manager (Co ordination) along with secretariat staff. This cell will report to Project Director for all matters pertaining to environmental and social issues and monitor the implementation of environment management plan apart from interaction with World Bank.

Trainings will be conducted for PRBDB staff, Construction Supervision Consultants / TA consultants and contractors at pre-construction stage, during constructions, before demobilization of contractor and operation stage of the project. The basic objective of giving training to different Stakeholder is to enhance their capabilities for implementation of Environment Management and Monitoring Plan. The modules for training have also been developed and training will be conducted both at HO level and at CMU Level.

E1.15. ENVIRONMENTAL BUDGET

Prepared for On the basis of the recommendation of Environment Management Plan and regulatory requirements a detailed environmental budget for each corridor has been developed, which is summarized in **Table 1.10.**

Table 1-10: Corridor wise Summary of Environment Budget

COST (Rs.)	Package 2						Package 3			
	Chandigarh-Landran-Chuni-Sirhind	Nagar-Aur-Rahon	Tarn Taran-Chabal-Attari	Kapurthala-Fatehabad-Tarn Taran	Dharamkot-Kot Ise Khan-Zira-Ferozepur	Malerkotla – Sangrur	Kharar - Tepla	Ludhiana - Ahmedgarh - Malerkotla, SH-11	Phillaur - Nagar	Patiala - Sirhind, MDR-31
FOREST CLEARANCE	9,724,000	9,570,000	9,969,300	12,925,000	15,125,000	8,030,000	40,810,000	56,540,000	5,995,000	0
MITIGATION	184,756	167,706	179,956	192,206	143,206	311,186	430,800	628,100	213,500	101,400
MONITORING	602,500	631,000	638,500	633,500	635,000	676,500	723,000	775,000	431,000	582,000
ENHANCEMENT	1,007,260	762,000	1,125,610	1,569,980	638,255	897,260	946,510	1,551,060	383,255	529,960
TOTAL	11,518,516	11,130,706	11,913,366	15,320,686	16,541,461	9,914,946	42,910,310	59,494,160	7,022,755	1,213,360
CONTINGENCY	575,925	556,535	595,668	766,034	827,073	495,747	2,145,516	2,974,708	351,138	60,668
TOTAL	12,094,441	11,687,241	12,509,034	16,086,720	17,368,534	10,410,693	45,055,826	62,468,868	7,373,893	1,274,028
Say	12,094,450	11,687,250	12,509,050	16,086,750	17,368,550	10,410,700	45,055,826	62,468,868	7,373,893	1,274,028
Miscellaneous Items for all the roads										
Training	28,50,000					690,000	1,510,000			
Vehicle for Environmental Officer (for 24 months)	720,000									