Punjab State Road Sector Project (PSRSP)

Variation Works for OPRC Network

Environmental Assessment/ Environmental Management Plan

Final Report

Prepared By:

Punjab Roads & Bridges Development Board

SCF 61-61, Phase 2, Mohali (Pb.)-160055

ABBREVIATIONS

SOS	Strategic Option Study
PWD	Public Works Department
SH	State Highway
MDR	Major District Road
IMD	India Meteorological Department
SPM	Suspended Particulate Matter
RPM	Respirable Particulate Matter
CPCB	Central Pollution Control Board
PPCB	Punjab Pollution Control Board
EMP	Environmental Management Plan
MoEF	Ministry of Environment and Forest
FHWA	Federal Highways Authority
EIA	Environmental Impact Assessment
ODR	Other District Road
COI	Corridor of Impact
ROW	Right of Way
AADT	Annual Average Daily Traffic
DoE	Department of Environmental
EIA	Environmental Impact Assessment
PUC	Pollution under Control Certificate
ASI	Archaeological Survey of India.
NOC	No Objection Certificates
PIA	Project Impact Area
RH	Relative Humidity
AAQ	Ambient Air Quality
PAP	Project Affected Person
RAP	Resettlement Action Plan
OMC	Optimum Moisture Content

Table of Contents

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

1.1.1 General

The Punjab Roads and Bridges Development Board (PRBDB), Government of Punjab (GoP) is implementing the Punjab State Road Sector Project (PSRSP) with World Bank (WB) loan assistance. Under the PSRSP, 1698 km of roads were identified by the PRBDB for improvements and upgradation. Phase -1 of the Project stands completed and Phase-2 of the Project is under implementation.

Additional road length is identified under the PSRSP for improvement. Total 126 km length has been identified for improvement works.

1.1.2 Present Study

This report relates to variation works to be executed under the OPRC Project under Punjab State Road Sector Projects. This report includes the Environmental Impact Assessment (EIA) for all proposed variation works such as 4 laning sections and bridges widening. The present study was done in addition to study was conducted earlier for OPRC network.

1.2 CATEGORIZATION OF THE PROJECT

With reference to the EIA notification dated 14th Sept 2006 **(Published in the Gazette of India, Extraordinary, Part-II, and Section 3, Sub-section (ii))**, Item No. 7(f) of Schedule (Highway Projects), Environmental Clearance are not required from the MoEF, Govt. of India.

However as per the World Bank Policy (i.e. OP 4.01) this project has been categorized as **Category 'B',** due to cumulative impacts from the Project. The impacts are air pollution, noise pollution and safety of road users. Accordingly, Environmental Assessment has been carried out.

1.3 THE STUDY METHODOLOGY

Methodology adopted for the Environmental Impact Assessment was in accordance with the World Bank Operational Policies on Environmental Assessment (OP 4.01, BP 4.01, GP 4.01).

The environmental impact assessment was undertaken simultaneously with detailed design of the project. The important findings of the assessment gave important feedback to the design consultant, especially in terms of the junction improvements, safety enhancement etc.

The methodology adopted for the EIA is as follows:

1.3.1 Environmental Screening

Environmental Screening exercise was carried out by Project Manager (Environment), PRBDB. Findings of environmental screening ensured that the proposed variation works are not passing through any sensitive zone like reserve forests, national park and sanctuaries.

Other environmental and safety issues in this project are, air and noise pollution, flooding at low lying area at few places and improvement of junctions etc.

1.3.2 Review Policy, Legal and Administrative Framework

This step discusses the policy, legal framework within which the Environmental Impact Assessment (EIA) is prepared and also reviewed the existing institutions and legislations relevant to the project work, at the national and state level.

1.3.3 Surveys for Collection of Baseline Data

The CMU staff and the Project Manager (Environment, PRBDB) has visited the selected alignment and gathered information regarding various environmental components of soil, climate, geology, hydrology, water quality, flora and fauna, habitat, demography, land use, cultural properties etc, to establish the baseline environmental setup.

1.3.4 Testing and Monitoring

In order to assess the baseline situation in different sections of the proposed variation works, monitoring and analysis has been done for Air, Water, Noise and Soil. The detail is given in Chapter 4.

1.3.5 Environmental Impact Assessment of the Project

The detailed design of the project has been closely coordinated with the preparation of an Environmental Impact Assessment (EIA) Report and Environmental Management Plan. The EIA preparation led to identification of potential environmental hazards and their feasible remedies (including avoidance, mitigation and enhancements).

1.3.6 Analysis of Data

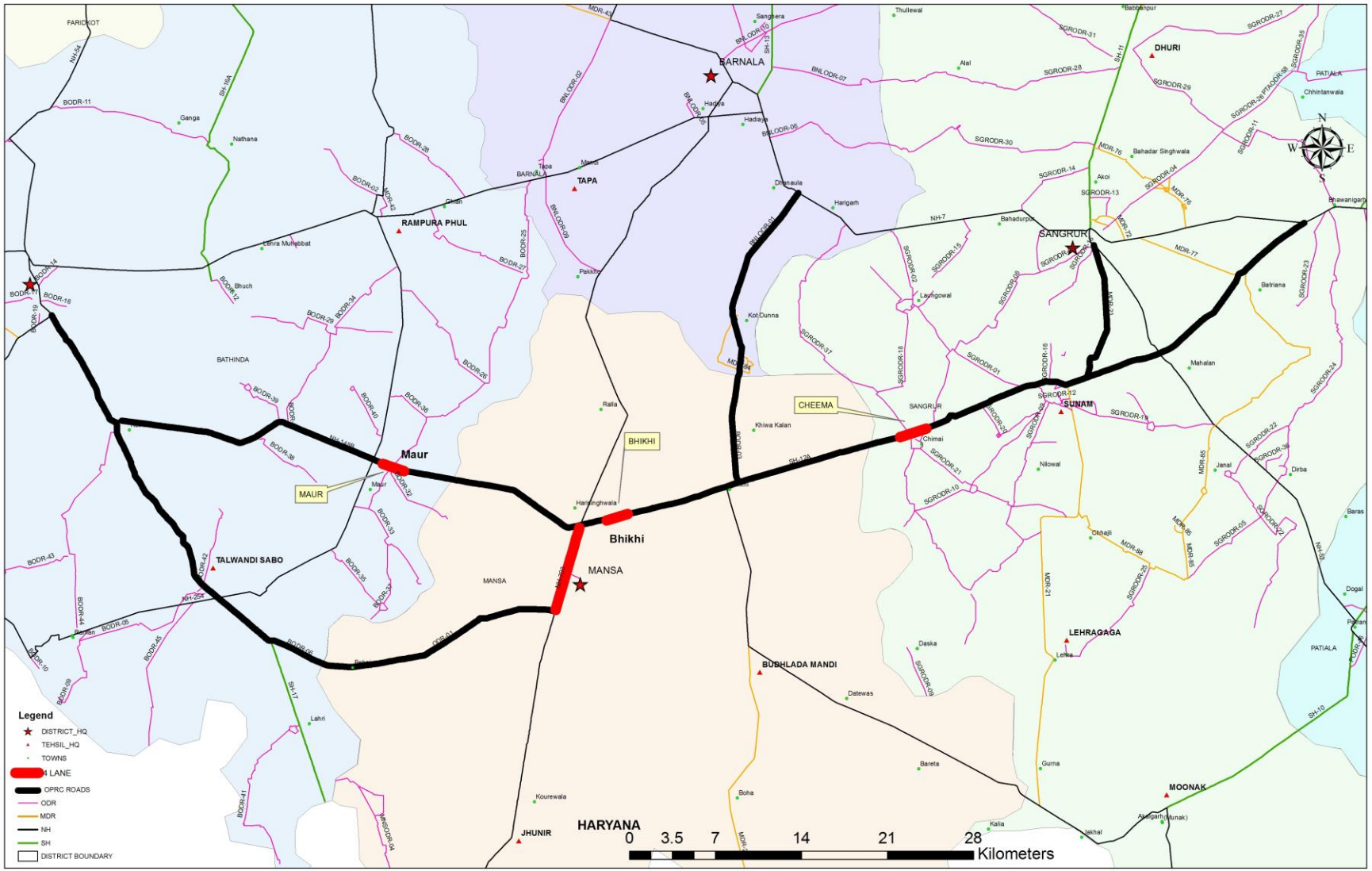
Qualitative analysis was done for more descriptive data. The documentation of the baseline conditions was completed.

1.3.7 Community/Public Consultations

Consultation with likely affected groups, of the villages at Mansa, Cheema and Bikkhi have been undertaken and information at different levels was collected to determine public opinion regarding the proposed project and associated impacts.

Fig. 1 Project Location Map

VARIATION WORKS (4 LANE)



1.3.8 Mitigation and Enhancement Measures

Positive and suitable actions have been determined for adopted alignment, not only to avoid adverse impacts, but also to capitalize on opportunities and to correct environmental degradation or improve environmental conditions. Mitigation measures have been specified where adverse impacts could not be avoided. Enhancements by landscaping near junctions have been identified.

1.3.9 Preparation of the Environmental Management Plan

The Environmental Management Plan (EMP) is a stand-alone document and has been prepared specifically for variation works. This EMP is in addition to EMP prepared for OPRC network The EMP includes responsibilities assigned for the various actions identified to limit the adverse impacts of the project and budget allocations made for the funds required for mitigation as well as enhancement measures. The environmental management plan covers the three phases namely pre-construction, construction and operation (Post Construction).

1.4 STRUCTURE OF THE OF REPORT

The report has been divided into 9 chapters including this Introduction as follows:

Chapter 2: Project Description. In this section Project road details are described from an environmental perspective with salient features such as ROW, roadway improvements proposed, cross sections, cross drainage structures etc.

Chapter 3: Policy, Legal and Institutional Framework within which the project is set. The major stakeholder departments of the State and Central Governments with their specific roles along with applicable Acts and Laws are described. At the end of this chapter clearance requirements are presented.

Chapter 4: **Baseline Environmental situation** includes the meteorological baseline, components of the biophysical and natural environments.

Chapter 5: Public Consultation was carried out during by the contractor during execution of OPRC works.

Chapter 6: Potential Environmental Impacts on each of the environmental components due to the proposed project.

Chapter 7: Mitigation, Avoidance and Enhancement Measures for the adverse impacts identified in earlier section. This section forms the basis for Environmental Management Plan.

Chapter 8: Environmental Management Plan for the implementation of the environmental component of the project.

CHAPTER 2: DESCRIPTION OF THE PROJECT

1.1 PROJECT BACKGROUND

The World Bank aided Punjab State Road Sector Project consists for rehabilitation / up gradation and Periodic Maintenance of 1,330 km (approx.) road length at an estimated cost of about US$ 412 million out of which the state share would be 20% (US $ 82 million). It is the largest ever road sector project being undertaken in Punjab. Punjab Roads & Bridges Development Board (PRBDB) is the overall implementing agency for the proposed project on behalf of the Government of Punjab.

The project has been divided into two phases, namely:

Phase I: This includes

152 km of roads for Up gradation, 205 km of roads for Rehabilitation and 354 km of roads for Periodic Maintenance.

The physical works on Phase I roads have commenced from June 2006 and stands completed.

Phase II: This includes

A new concept of Output and Performance Based Road Contracting (OPRC) has been introduced in which the payments to the Contractor shall be made upon the performance of the road instead of the quantity of work executed. The road network of Sangrur-Mansa-Bathinda of 203.68 km road length is being Upgraded and Rehabilitated under this contract.

Table 2.1: List of Roads under PSRSP II

Road Section No.	Road Section Name	Classification	Length (km)	Type of Intervention
S1	Sangrur-Sunam (MDR 21)	MDR	11.30	Rehabilitation
S2	Bhawanigarh-Sunam-Bhikhi (SH 12A)	SH	106.13	Upgradation
S3	Barnala-Mansa (SH 13)	SH	7.29	Rehabilitation
S4	Mansa-Talwandi Sabo (ODR 9)	ODR	24.97	Upgradation
S5	Dhanaula-Bhikhi (MDR 14)	MDR	25.34	Rehabilitation
B8	Bathinda-Kotshamir-Talwandi Sabo (SH 17)	SH	28.65	Rehabilitation
Total Contract Road Length of OPRC Network				203.68

1.2 DESCRIPTION of the proposed Variation works

a) Widening of existing roads into 4 lanes:

The lind S2 of OPRC network passes through important cities/towns/villages of Punjab. Bhawanigarh, Gharachon, Mehlan Chowk, Mard Khera, Sunam, Cheema, Bhikhi, Khaila Kalan, Khilchian, Mansa, Bhaini Bagha, Maiser Khana, Kotshamir etc. are located on its way. Presently S2 is a 2 lane road in its major length of 103.930 km and only 2.2 km of length is configured in 4 lane with divided carriage way. Widening of existing carriage way from 7.0 meter to 10 meter is in progress and at Cheema, Bhikhi and Maur 4 lane has been proposed.

The OPRC network road link S2 is a combination of Bhawanigarh – Suman – Bhikhi – SH 13 intersection - Kot Shamir section of SH12A. The project road S2 is 106.130 Km long and starts from Bhawanigarh and ends at Kot Shamir in SH 17 junction. The project road S3 on Barnala to Mansa section of SH-13 is 7.29 Km long and starts from Km. 119+640 at Intersection of SH 12 A and end at intersection of Talwandi Sabo of ODR 9 at Km 126+930. The proposed length of the project road is also 7.29 Km. The detail of 4 lanning sections is given in **Table 2.2**.

Table -2.2 :-Proposed Chainages for 4 Lanining					**Type of Intervention**
Sl .No	**Location**	**Chainage**		**Length (Km)**	
		From	**To**		
1.	Cheema (S2)	39+300	40+700	1.4	Widening/Upgradation
2.	Bhikhi (S2)	54+030	55+700	1.67	Widening/Upgradation
3.	Maur.(S2)	84+030	86+060	2.03	Widening/Upgradation
4.	Mansa (S3)	182+640	189+900	7.26	Widening/Upgradation
Total Length (km)				**12.36**	

The proposed widening has been carried out considering social and environmental aspects of the project. Concentric widening has been proposed in built-up portion to save acquisition of road side residential and commercial structures. Typical cross section of 4 lane section of S2 is given in **Fig. 2.1.**

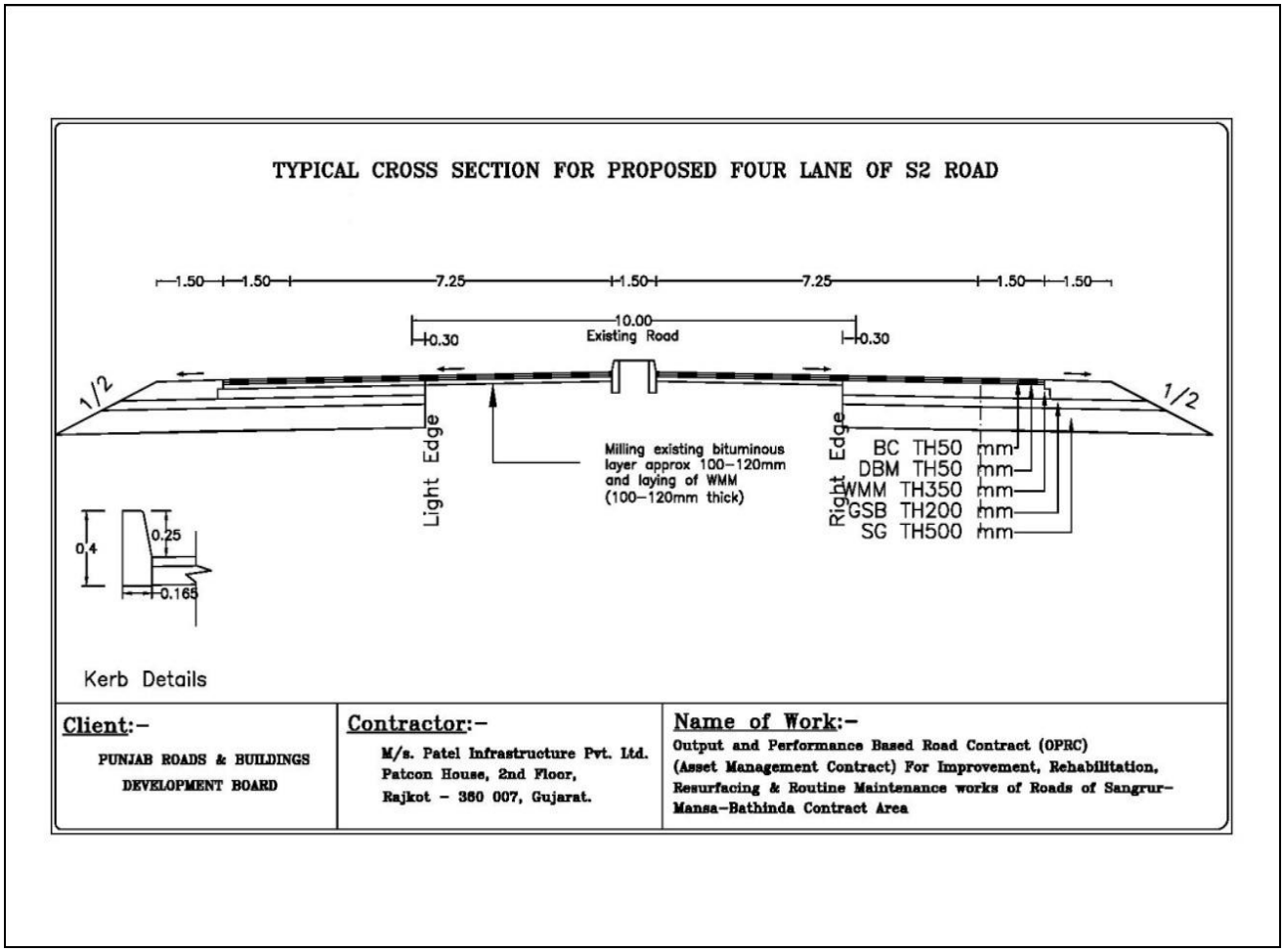


Fig 2.1 Typical X-SECTION OF 4 lane sections of S2 and S3

As indicated above, the project development envisages for construction of 4 lanes at Cheema , Bikhi and Maur section S2 road that will yield a 7.5 m carriageway along with 1.5m paved shoulder, 1.5 m earthen shoulder on both sides from the median of 1.5m. Total formation width is 20.5m.

Table 2.3 Existing ROW and required Formation Width of the Road

Link	Corridor	Existing ROW[1] (m)	Required Formation width (m)	Remarks	Reference/ Chainage
1	S2	45.72	20.5	7.5 m carriageway along with 1.5m paved shoulder, 1.5 m earthen shoulder on both sides from the median of 1.5m	Ref. table 2.2
2	S3	30.05	20.5	7.5 m carriageway along with 1.5m paved shoulder, 1.5 m earthen shoulder on both sides from the median of 1.5m	Ref. table 2.2

b) Widening of existing bridges on S2 link of OPRC:

Table 2.4 Detail of Bridges for widening on OPRC network				
Sl .No	**OPRC Link**	**Chainage**	**Type of Bridge**	**Type of Intervention**
		(Km)		
1.	S2	54.040	Canal (Minor)	Widening
2.	S2	69.800	Canal (Minor)	Widening
3.	S2	73.450	Canal (Minor)	Widening
4.	S2	100.700	Drain (Major)	Widening
5	S2	53.500	Drain (Major)	Widening
6	S1	10.200	Drain (Major)	Widening
7	B8	20.600	Drain (Major)	Widening

All the structures within formation width were examined and poverty and social assessment have been carried out along affected area. Consequently, this report addresses the impacts and outlines the measures, including resettlement of the affected persons, in accordance with the Resettlement and Rehabilitation Policy of Punjab State Road Sector Project.

The environmental impact assessment has been carried out along the alignment by Project Manager (Environment), PRBDB.

2.3 PAVEMENT

Flexible pavement has been proposed for 4 lanning section and on bridges.

2.5 SETTLEMENTS

The details of the settlements along the 4 lane section and bridges site are presented in the Table 2.4.

Table 2.4: List of villages & towns near the roads

S.No.	Location	Type	Stretch	District
1	Cheema	Town	S2	Sangrur
2	Bikhi	Town	S2	Mansa
3	Maur	Town	S2	Bathinda
4	Mansa	City	S3	Mansa
5	Upli Chatte	Village	S1	Sangrur
6	Bhinai Bhaga	Village	S2	Bathinda
7	Kottfatta	Village	S2	Bathinda

2.6 Summary of Project Details

The summary of Project roads is given in Table 2.5 below:

Table 2.5: Summary of Project

S.No.	Description	Quantity
1	Total Length of 4 Lane sections	12.36 km
2	Width of existing ROW along the 4 lane sections on S2	45.72 m
3	Width of existing ROW along the 4 lane sections on S3	30.05m
4	Number of bridges: Major Minor	04 03
5	Total Number of culverts	10
6	Number of Major Intersections	NIL
7	Number of total Intersections	01
8	Number of railway crossings	01
9	Length of railway crossing	NIL
10	Number of Villages/Town near 4 lane sections	07
11	Length of new alignment proposed in agricultural land	Nil

CHAPTER 3: POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

3.1 ENVIRONMENTAL POLICY FRAMEWORK

The chapter presents a review of the existing institutions and legislations relevant to the project at the International, National and State levels. The various statutory clearances from various state and central government authorities and the institutional framework are discussed below.

3.1.2 National Environmental Policy Framework

Development of environmental protection and enhancement measures in India has been determined to a considerable extent by the central legislation. The Ministry of Environment and Forest (MoEF), set up in 1980, is the controlling institution in this regards. The MoEF has two wings as Environment and Forests.

The Central Pollution Control Board (CPCB) is another technical wing of the MoEF entrusted with the responsibilities for detection and abatement of pollution.

The various national environmental policies prevalent in India are listed below:

- The National Forest Policy, 1988
- National Water Policy, 2012
- National Environment Policy, 2006
- National Conservation Strategy
- Wildlife Conservation Strategy, 2002 and Policy Statement on Environment and Development
- National Policy on Resettlement and Rehabilitation for Project Affected Families, 2007

3.2 LEGAL FRAMEWORK

The Government of India has laid out various policy guidelines, acts and regulations pertaining to sustenance of environment. The Environment (Protection) Act, 1986 provides umbrella legislation for the protection of environment. As per this Act, the responsibility to administer the legislation has been jointly entrusted to the Central Ministry of Environment and Forests (MOEF) and the Central Pollution Control Board (CPCB) / State Pollution Control Board (SPCB).

The legislations/acts followed for present study has been summarized in **Table 3.1**.

Table 3.1: Summary of Key Legislations Relevant to the Project

Act or Notification	Year	Objective	Applicable Yes/No	Responsible Agency
The Environment (Protection) Act. The Environment (Protection) Rules	1986	To protect and to improve the quality of the environment and to prevent, control and abate Environmental pollution.	Yes	MoEF, CPCB, PPCB
The Forest (Conservation) Act The Forest (Conservation) Rules as amended in 2003 and 2004	1980	To check deforestation by restricting conversion of forested areas into non-forested areas.	Yes	MoEF, State Deptt. Of Forests
The Wildlife (Protection) Act as amended in 2002	1972	To protect wildlife through creation of National Parks and Sanctuaries.	No	Chief Conservator, Chief Wildlife Warden, Wildlife Wing, DOEF.
The Air (Prevention and Control of Pollution) Act	1972 amended in 1981	To prevent, control and reduce air pollution including noise pollution as per the prescribed standards.	Yes	PPCB & CPCB
The Water (Prevention & Control of Pollution) Act The Water (Prevention & Control of Pollution) Cess Act	1974 1977	To control water pollution and restoration of water quality as per the prescribed standards. To levy and collect Cess from industries based on water consumption.	Yes	PPCB & CPCB
The EIA Notification and its subsequent amendments	2006	To issue environmental clearance to development projects based on EIA report.	No	MOEF, SEIAA
Ancient Monuments and Archaeological Sites and Remains Act.	1958 amended in 2010	Conservation of Cultural and historical remains found in India	No	Archaeological Survey of India and State Department of Archaeology
Notification of use of Fly Ash	2009	Utilization of Fly ash	No	PPCB, MoEF
The Factory Act	1948	To Maintain hygiene and health for workers during the construction period.	Yes	PPCB
The Building and Other Construction	1996	For welfare of Employees/labour/	Yes	State Labour Commissioner

Workers (Regulation of Employment and conditions of services		workers		
Hazardous Wastes (Management and Handling) Rules	2013	For protection against improper handling and disposal of hazardous waste	Yes	PPCB
Chemical Accidents (Emergency Planning, preparedness and response)Rules	1996	Protection against chemical accident while handling any chemical	Yes	PPCB

Other State Level Legislations and Acts

- Consent to Establish (CTE) and Consent to operate (CTO) will be required for setting up hot-mix plants, batching plants, etc., under the Air (Prevention and Control of Pollution) Act of 1981 and the Water (Prevention and Control of Pollution) Act of 1974 from the Punjab Pollution Control Board (PPCB).
- All Construction vehicles and off-road equipment are to be registered with Regional Transport Office as required under Central Motor Vehicles Act and possess appropriate PUC certificate.

3.3 ENVIRONMENTAL CLEARANCE REQUIREMENTS

3.3.1 GOI Requirements

With reference to the EIA notification dated 14th Sept 2006 **(Published in the Gazette of India, Extraordinary, Part-II, and Section 3, Sub-section (ii))**, Item No. 7(f) of Schedule (Highway Projects), Environmental Clearance are not required from the MoEF, Govt. of India as;

a) The project does not fall under any category for the environment clearance as per the EIA notification 2006 (and its subsequent amendments till date)

b) It does not pass through ecologically sensitive areas, and

c) It is not a highway include expressway.

3.3.2 State Level Clearance Requirements

Besides, the GOI environmental clearance requirements, the project also requires clearance from some of the state level agencies as discussed below.

State Pollution Control Board: The Project also requires obtaining 'No Objection Certificate' (NOC) from PPCB in pursuant of the Water (Prevention and 'Control of Pollution) Act of 1974, The Cess Act of 1977 and the Air (Prevention and Control of Pollution) Act of 1981. Consent for the Establishment and Operation has to be taken during the Construction stage of the Project for the operation of all Construction Plants.

State/Central Ground Water Board: Clearance from the State/Central Ground Water Boards/Authorities is required for extraction of ground water.

State Environmental Impact Assessment Authority (SEIAA): Clearance is required from SEIAA for mining of normal earth from borrow areas.

3.3.3 World Bank Requirements

The World Bank environmental impact assessment (EIA) requirements are based on a three- category classification system (Category A, B and C) as defined by the World Bank OP 4.01. A project designated as Category A, requires a full environmental impact assessment (EIA), Category B projects require a lesser level of environmental investigation. Category C projects require no environmental analysis beyond that determination. This project has been classified as **Category 'B'** project due to the cumulative impacts from the project on the environmental and social components.

The various clearances required for proposed works and their applicability viz this project is given in **Table 3.2.**

Table 3.2: Clearances Required for the Project

S. No.	Regulatory Clearances	Corresponding Regulations	Approving Authority	Applicability to the Project	Typical Time Required	Responsibility for compliance	
						Execution	**Supervision**
Pre-Construction Stage							
01	Environmental Clearance	EIA Notification, 2006 and amended till date	State Environmental Impact Assessment Authority or CEIAA in MoEF, GoI	Not applicable	-	-	-
02	Consent to Establish	Water (Prevention and Control of Pollution) Act 1974; Air (Prevention and Control of Pollution) Act 1981	Punjab Pollution Control Board (PPCB)	Subject to establishing Labour camps, Hot mix plants, DG sets units, cement batching plant or any water/air pollution generating units.	3 Months	Contractor	PRBDB/CMU
03	Wild Life Clearance	Wild Life Act 1972	Hon'ble Supreme Court	Not applicable	-	-	-
05	Permission for felling & trimming of trees	Forest (Conservation) Act, 1980 and its amendments;	Regional Office MoEF Chandigarh	Applicable.	-	PWD	PRBDB
Construction Stage							
06	Permission for locating and operating Borrow pits	-	Mining Department/SEIAA, Local Administration – Municipal	Applicable	1 Month	Contractor	PRBDB

S. No.	Regulatory Clearances	Corresponding Regulations	Approving Authority	Applicability to the Project	Typical Time Required	Responsibility for compliance	
						Execution	**Supervision**
			Government/ Panchayat				
07	Permission for Withdrawal of Ground Water	Environment Protection Act 1986	Central Ground Water Board	Applicable, if withdrawal is proposed	1 month	Contractor	PRBDB/CMU
08	Permission for withdrawal of Surface Water from River/Irrigation Canals		Irrigation Authorities for use of water from Irrigation Canal. River Board / Authorities for withdrawal of water from Rivers	Applicable if withdrawal is proposed	1 month	Contractor	PRBDB/CMU
09	Authorization to generate, store, transport and dispose of Hazardous Waste	The Hazardous Wastes (Management, Handling and Trans-boundary Movement) Rules, 2013 and amendments till date	Punjab Pollution Control Board (PPCB)	Applicable, if hazardous waste is generated in the project (disposal of bituminous wastes – verify with PPCB)	2 months	Contractor	PRBDB
10	Consent to Operate	Water (Prevention and Control of Pollution) Act 1974; Air (Prevention and Control of Pollution) Act 1981	Punjab Pollution Control Board	Subject to establishing, Hot mix plants or any water/air pollution generating	3 Months	Contractor	PRBDB/CMU

S. No.	Regulatory Clearances	Corresponding Regulations	Approving Authority	Applicability to the Project	Typical Time Required	Responsibility for compliance	
						Execution	**Supervision**
				units, Labour camps			
11	Traffic Police Clearance for diversion of routine traffic	Local Traffic Police Regulations and Bye-laws	Traffic Police Department	Applicable if diversion is required in urban/semi urban areas	1 Month	Contractor	CMU/PWD
12	NOC from Archaeological Survey of India	The Ancient Monument and Archaeological sites and Remains Act 2010.	Department of Archaeology Govt. of Punjab	Subject to chance finds, if any	2 Months	Contractor	CMU/PRBDB
13	Permission for Sand Mining from river bed	Punjab Mines and Minerals Concession Rules 1969	River Board Authorities/ Department of Mining Govt. of Punjab	Applicable, if river sand is mined	6 Months	Contractor	CMU/PRBDB
14	Permission for Opening of new Quarry sites	Punjab Mines and Minerals Concession Rules 1969	Department of Mining Govt. of Punjab Punjab Pollution Control Board	Applicable only if Contractor opens a new quarry site	6 Months 3 Months	Contractor	PRBDB/CMU

Chapter 4: BASELINE ENVIRONMENTAL STATUS

4.1 GENERAL

As a precursor for the prediction of various types of environmental impacts likely to arise due to implementation of this Project, it is essential to establish the base line environmental status of the physical, natural and socio-cultural environmental parameters along the 4 lanning section and bridges site. Details of the baseline environmental parameters are required for decision making for the Project design, implementation and operation from the environmental point of views.

4.2 METEOROLOGY

The project site lies in the sub-tropical region with four distinct seasons.

The mean daily maximum temperature during June is around 42C and the mean daily minimum around 26C. The heat in summer is intense on individual days; the day temperature may occasionally exceed 47 or 48 C. The cold season from November to march is followed by hot season which lasts till the onset of the south-west monsoon. The monsoon withdraws by 15 September and is followed by the Post-monsoon or the transition period.
The average rainfall over the district as a whole is 183.5 It generally increases from south or south-west to east or north-east. Over 70 per cent of the annual rainfall is received during the monsoon months of July to September. July and August are the rainiest months, together accounting for over 50 per cent of the annual rainfall. Per monsoon rainfall in June constitutes just about 10 per cent of the annual normal

4.2.1 Wind Speed and Direction

Winds are generally light, with some strengthening in force during late south-west and west are more common, with the easterlies and south-easterlies blowing on some days. In the post-monsoon and winter season, south-easterly and westerly are common in the mornings while northerlies and north-western lies are predominant in the afternoons. During summer, winds are from west or south-west in the morning. In the afternoons, winds blow from directions between west and north.
The meteorological data recorded during the study period is very useful for proper interpretation of the baseline information as well as for input to prediction models for air quality dispersion. Historical data on meteorological parameters will also play an important role in identifying general meteorological regime of region.

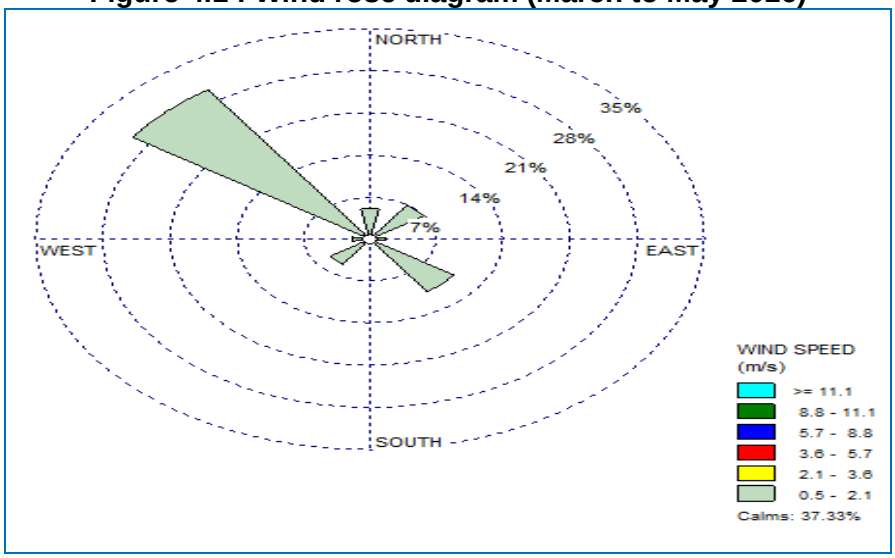
Nearest IMD Station: Bathinda

MSL: 211 Meter

Latitude: 300 10’ N

Longitude: 740 35’ E

Figure 4.1 : Wind rose diagram (March to May 2016)



The wind speed varies from calm to 5.1 km/hr (March to May) in Bhatinda IMD and predominant wind directions were observed from NW and SE in the observatory. The wind rose diagram was prepared by meteorological data generated at nearest IMD station Bathinda

4.3 PHYSICAL ENVIRONMENT

4.3.1 Air Environment

The ambient air quality status of the project area forms the basis for prediction of the impacts due to the proposed project. Degradation of ambient air quality is the most commonly identified adverse impact on the natural and bio-physical environment during the construction and operation of the road projects.

4.3.2 Ambient Air Quality in Study Area

The results of analysis of air samples are presented in the following tables. In general, for all monitoring stations the PM10 values were monitored in the range 101-108 µg/m3.While comparing with the National Ambient Air Quality (NAAQ) Standard of 100 by the Central Pollution Control Board (CPCB), all the monitored PM10 values were found to be near the limit (slightly higher). This is because of high

vehicular location and dryness of the areas. PM2.values were ranging from 38-42 While comparing with the NAAQ Standard of 60 the monitored PM2.5 values were found to be well within the limit. Similarly monitored values for SO, NO and CO is also found within the limit.

Table 4.1: Air Quality Monitoring Results for Bathinda AAQM Station

Sl.No.	Parameters	Cheema (Ch:39+400)	Bikhi (Ch:54+300)	Mansa (Ch:184+850)	Maur (Ch:85+800)	Prescribed limit	Protocol
Date of AAQ Monitoring 05.08.2016 to 06.08.2016							
A01	PM_{10} , µg/m^3	101	108	84	86	100	IS: 5 1 82, (Part-23) 2006
A02	$PM_{2.5}$, µg/m^3	38	42	41	36	60	IS: 51 82, (Part-23) 2006
A03	SO_2, µg/m^3	10.2	10.8	11.6	10.4	80	IS: 5 1 82, (Part-2), 2001
A04	NO_X, µg/m^3	19.7	17.2	20	18	80	IS: 5 1 82, (Part-6), 2006
A05	CO mg/m^3	BDL	BDL	BDL	BDL	*4.0	IS:5182 (Part-10) 1999, RA 2003

The maximum SO2 and NOx levels monitored were 11.62/m3 and 20 µg/m3 respectively. While comparing with the NAAQ Standard (80 µg/m3), the monitoring results were found to be well within the limits.While comparing the NAAQ Standard, the monitored CO levels were found to be well within the limit.(24-hourly).

4.3.2 Water Environment

The water resources of the Project Area are summarized in **Table 4.2**

Table 4.2: Surface and Groundwater Sources in the Project Area

Sl.No	Hand Pump	Water Tap	Pond	Public Water Tank
S2 Road				
1	39+910	40+130		40+030
2	40+015	40+170		54+416
3	40+195	40+070		

4.	40+210			
5.	54+030			
6.	54+320			
7.	84+210			
8.	85+618			
9.	184+100			
S3 Road				
Total	**09**	**03**	**NIL**	**02**

4.3.3.3 Water Quality

Water quality is a concern for the numerous surface water sources and the groundwater sources.

The characteristics of the ground water and surface water samples are required to be well within the standard limits specified for the water quality characteristic for the desirable limits as specified in BIS10500: 2012.

4.3.4 Land Environment

Land and soil constitute the basic components of the physical environment. The alignment of a road may cause changes in land, land use, soil and denudation processes in different intensities. However, the project roads are existing roads and construction of 4lane does not involve in any change in alignment.

4.3.4.1 Geology and Soils

Geology and Soil Types of the Area: Punjab has five land form regions, three major river systems, three climatic regions with varied temperatures, moisture regimes and type of vegetation. Punjab lies on the alluvial plains of the tributaries of Indus river, namely Sutlej and Beas. The state is bounded on the north and north-east by the Shivalik Ranges of the lower Himalayas. The alluvial deposits of the rivers can run very deep and are very fertile. Based on the interdependence of all these factors, spreading over time resulted in the formation of various types of the soils. The land use along the road sections under study is predominantly agricultural.

The district Bathinda has two type of Soils, the arid brown soil and siezoram soils. The arid brown soils are found in mostly eastern parts of the district and siezoram soils are found in the western parts of the district. The major soil types in Mansa is Clayey Loam sandy loam.

The soil of the area is sandy to clay. In general, there is a deficiency of nitrogen and organic matter in the soils, but the phosphorus content ranges from low to medium. It is, therefore, evident that, for obtaining good yields,

the soils need heavy manure with nitrogenous and phosphate fertilizers soils along with irrigation facilities. The district Mansa mainly consists of flat and level plains interrupted by sand dunes in south-western part. All of the soil sampling locations identified along the project road are agricultural land since the nature of land use of the study area is predominantly agricultural

Table 4.3 : Details of Soil Sample

	Road Section No.	Location	Land Use	Sampling Date
1	S2-: Bhavanigarh-Sunam-Mansa-Kotsamir	Cheema	Agricultural	05.08.2016
2	S2-: Bhavanigarh-Sunam-Mansa-Kotsamir	Bhiki	Agricultural	05.08.2016

Results & Analysis of Soil Quality

The texture of the soil is mostly loamy. Bulk density of soil in the study area varied between 1.29 - 1.31 gm / cm3. The moisture content was moderate. The soil samples were slightly alkaline with the pH range varying within 7.62 to 7.90. Most of the nitrogen is available in the form of nitrates, nitrites, NH4 and organic nitrogen. The soil samples were poor in Organic Carbon content, with the values ranging within 1.09% to 1.18%.

Table 4.4: Physico-chemical Analysis of Soil Quality

Sl. No.	Parameters	Unit	Concentration	
			Cheema	Bhikhi
1	pH	-	7.90	7.62
2	Conductivity	umhos/cm	109	116
3	Bulk Density	g/cm3	1.29	1.31
4	Porosity	%	36.80	37.42
5	Infiltration Rate	cm/hr.	1.68	1.52
6	Soil Texture	-	Silty clay loam	Silty clay Loam
7	Clay	%	22	19
8	Silt	%	54	59
9	Sand	%	17	19
10	Soil Colour	-	Grey	Grey
11	Organic Carbon	%	1.18	1.09
12	Organic Matter	%	2.07	1.82
13	Moisture	%	1.9	1.6

Source: Field Monitoring

4.3.4.3 Land use

The land use pattern in the project area is generally agricultural followed by built-up stretches. Generally, these lands are devoted for two season crops which include Cotton, wheat and paddy.

Table 4.5 : Land Use Pattern in Project Area

Land use	Built Up	Water body	Agricultural	Industrial	Barren	Total
Percentage	8.1	0.69	90.51	0.70	0	100

4.3.5 Noise Levels

Ambient Noise Standards

Ambient noise standards were established as per the CPCB/MOEF Gazette Notification dated 26th December 1989. It is based on the 'A' weighted equivalent noise level, Leq

Table 4.6: National Ambient Noise Standards

Area Code	Category of Area	Limit dB (A) (Leq)	
		Day Time (6.00 AM to 10.00 PM)	Night Time (10.00 PM to 06.00 AM)
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

Monitoring locations & results

The Noise measurement has to be carried out continuously for 24 hours on both time with reading of 15 second interval for 15 minutes every hour and then averaged.

Table 4.7: Equivalent Noise Level Data.

Sl.No	Name of Location	Date Of Monitoring	Category of the Area.	Leq dB(A), Day	Leq dB(A), Night
1.	Cheema (Ch:39+400)	05.08.2016	Commercial	51.2	49.8
2.	Bikhi (Ch:54+300)	05.08.2016	Commercial	52.3	48.9
3.	Mansa (Ch:184+850)	05.08.2016	Educational	46.9	39.6
4.	Maur (Ch:85+800)	05.08.2016	Commercial	46.3	38.1

4.3.5 Natural Resources Consumption

Detailed analysis of the availability of construction material such as selected soil, hard rock, fine aggregates and coarse aggregates was carried out as part of detailed engineering design. Details of each type of materials are detailed in the following section:

4.3.5.1 Borrow Areas

Borrow Areas shall be identified by the contractor meeting the required specifications. The necessary regulatory environmental clearances shall also be obtained by the contractor.

4.3.5.2 Stone Quarries, Bituminous, Cement and Gravel.

The contractor shall procure the material from the approved sources and copy of the valid environmental consents/clearances should be obtained from the material supplier. This may be checked by the employer/PRBDB at any stage.

4.4 ECOLOGICAL RESOURCES

Ecological resources are among the most important resources may be impacted by construction activities for 4lane construction. In this section baseline details of the flora and fauna are presented.

4.4.1 Flora

The ecological studies have been carried out to understand the present status of terrestrial and aquatic ecosystem within 10km distance, on either side, from the ROW of proposed project. The information provided is based on physical surveys and secondary sources such as information collected from forest department. The prominent species include teak mixed with Bamboo, Palm and Kadamb Banyan trees. Other trees include Neem, Peepal, Mango, etc. There are no endangered species of flora in the area.

4.4.2 Fauna

The wild animals which are found in this area include the nilgai (Boselaphus tragocamelus), antelok (Anelok cervicapra), pig (Sus scrofa), wolf (Canis lupus), jackal (Conis aureus), fox (Vulpes bengalensis), hare (Lepus ruficandatus), monkey (Macaca mulatta), wild cat (felis bengalensis) and the porcupine (Hystric leucura) .The game birds of the area include the usual varieties found through out the plains. Among themmention may be made of the peafowl (Pavo cristatus), the black partridge (frencolinus francolinus) and the gray partridge (francalinus pondicervanus).The area is famous for the number and variety of water fowls which visit it during the winter season. The goose (Anser anser), common teal (Anas crecca), red-cristed pochard duck(netta rufina), whiteeyed pochard (aythya rufa) and widgeon (mareca penelope) visit the area only in winter and inhabit the fringes of rivers, lakes and swamps..

4.5 SOCIO-CULTURAL ENVIRONMENT of Punjab

4.5.1 Demographic & Socio-economic Profile

Punjab is unarguably one of the most wonderful states in India with regards to the climate. The state has fabulous weather throughout the year which is also conducive for the growth of a variety of crops. The state has seen a lot of ups and downs during the years of freedom struggle and has developed to be one of the strongest states in India with respect to the economical conditions. Some of the most influential

and powerful leaders of the country have emerged from this state and the current Prime Minister of the country also hails from the state of Punjab. The state of Punjab is the highest producer of Wheat in the country and a huge percentage of the country's army is represented by the wonderful state of Punjab.

The Population of Punjab according to the 2011 census stands at about 27 million, making it the 15th most populated state in India. The state is spread over an area of about 50000 sq. km. making it the 19th largest state in the country in terms of area. The density of population per sq. Km. is about 550 which is inevitable given the opportunities of growth and development in the state. The state has a growth rate of about 13% which is below the national average of 17%. The population of the state is rising considerably due to rapid efforts towards development and progress. The literacy rate in the state is about 73% a figure that has improved tremendously in the last few years due to the consistent efforts of the government. The sex ratio in Punjab leaves a lot to be desired as it lags behind the national average by a lot of points. The statistics in the Punjab Census 2011 reveal facts that can be instrumental in planning for a better development plan for the state. The languages spoken in the Punjab state includes Punjabi and Hindi. In total Punjab (PB) state comprises 20 districts. The ISOCODE assigned by International Organization for Standardization for Punjab state is PB.

Table 4.8 : Demographic Profile of the Project Area.

District	Area (Sq.km)	Total Population	Density (per.sq.km)	Male	Female	Sex Ratio
Sangrur	3610	1655169	457	878029	777140	885
Mansa	2171	769751	350	408732	361019	883
Bathinda	3385	1388525	414	743197	645328	868
PUNJAB	**50362**	**27743338**	**551**	**14639465**	**13103873**	**895**

As per details from Census 2011, Punjab has population of 2.77 Crores, an increase from figure of 2.44 Crore in 2001 census. Total population of Punjab as per 2011 census is 27,743,338 of which male and female are 14,639,465 and 13,103,873 respectively. In 2001, total population was 24,358,999 in which males were 12,985,045 while females were 11,373,954.

The total population growth in this decade was 13.89 percent while in previous decade it was 19.76 percent. The population of Punjab forms 2.29 percent of India in 2011. In 2001, the figure was 2.37 percent.

Literacy rate in Punjab has seen upward trend and is 75.84 percent as per 2011 population census. Of that, male literacy stands at 80.44 percent while female literacy is at 62.52 percent. In 2001, literacy rate in Punjab stood at 69.65 percent of which male and female were 79.66 percent and 60.53 percent literate respectively. In actual numbers, total literates in Punjab stands at 18,707,137 of which males were 10,436,056 and females were 8,271,081.

Total area of Punjab is 50,362 sq. km. Density of Punjab is 551 per sq km which is higher than national average 382 per sq km. In 2001, density of Punjab was 484 per sq km, while nation average in 2001 was 324 per sq km.

Sex Ratio in Punjab is 895 i.e. for each 1000 male, which is below national average of 940 as per census 2011. In 2001, the sex ratio of female was 874 per 1000 males in Punjab.

Summary of Socio-economic characteristics of Punjab is as follows:

SL. No.	Indicator	Details
1	Literacy Rate (Overall)	75.84%
2	Female/Male literacy rate	62.52/80.44%
3	% of ST population to total population	0%
4	% of SC population to total population	31.9%
5	Sex ratio (female to 1000 males)	895
6	Total workers to total population	34.3%
7	Decadal growth rate	13.89
8	Density of population (Number of people in sq.km)	551
9	I.M.R. (Number per 1000)	44
10	% Below Poverty Line (BPL) population	8.26%
11	Main Occupation	Cultivation
12	Population above 60 years of age (% of total population)	15.8%
13	Population of child up to 6 years	22.14%
14	% of land under irrigation	97.4%

*Source- Census of India 2010-2011

CHAPTER 5: PUBLIC CONSULTATION

5.1 INTRODUCTION

The project will bring overall benefits to the people in the area as well as to those living close to the work site. However, a few are likely to experience negative impacts, which can be overcome through proper mitigation measures. Throughout the process of consultation, the focus was on understanding community impacts and to obtain their feedback to effectively establish appropriate road design and implementation.

5.2 METHODOLOGY ADOPTED FOR PUBLIC CONSULTATIONS

5.2.1 Levels of Public Consultations and Profile of Stakeholders

Public consultation was conducted at project preparation stage. Public consultations have been held at the levels as follows:

Local level:

Public consultations in the project area were held at local level. The following steps have been adopted for carrying out public consultations in this project:

- Interaction with local people for disseminating the project information.
- Sharing the opinions and identify the local environmental issues.

5.3 CONSULTATION PROGRAMME

The community consultation/disclosure was taken place with the aim to get the suggestions for facilitating temporary relocation during the construction on **30.08.16 & 01.09.16** at Mansa. During the meeting Social and Environment concerns of the project has also been discussed thoroughly and dissemination of project information were done which include dissemination of R&R Policy, technical details of the project, social issues and environment issues. The consultations were undertaken with Head of the household likely to be impacted and cluster of PAPs. Some individual contacts were made with the local people for collection of secondary data. The detail is given in **Table 5.1.**

Table 5.1 Detail of Consultation Programme

Date of Consultation	Number of Participant	Location
30.08.16	23	Markert Area, Mansa
01.09.16	16	Bhikhi, Cheema

5.4 KEY FINDINGS OF THE CONSULTATION

- People were well aware of the project
- People were convinced about the importance of 4 lane since it will reduce the traffic congestion and incidence of accidents as well
- People consented to cooperate
- People were shown interest to work in construction activity.

People suggested that adequate safety arrangements should be provided such as signage's, speed breakers etce during public consultations and their redress has been presented in **Table 5.2.**

Table 5.2: Address of General Issues and Concerns Under the Project

Issue/Concern	**Redress Under the Project**
Road Safety	Traffic calming measures at crossing points have been proposed for the safety of local people. Hazard markers, RRPM, road marking etc have also been provided. Traffic control measures during construction will be taken as per IRC SP 55:2014.
Increase in Air Pollution	Necessary measures i.e use of low emission vehicle and necessary precautionary measures will be adopted.
Impact on Health	Waste Management will be done at work site and necessary precautions will be taken to reduce the spillage of hazardous waste.
Utilities and Basic Infrastructure	All the utilities and basic infrastructures to be impacted will be relocated under the project cost.
Employment During Construction	The locals will be given preference for employment during construction provided they meet job requirements.

5.5 PHOTOGRAPHS

CHAPTER 6: ENVIRONMENTAL IMPACTS

6.1 GENERAL

Due to the activities of the proposed improvement there will be some potential impacts on the surrounding environment of varying magnitude. Impacts have been assessed based on the information collected from field surveys, baseline data collection studies and additional secondary data collected as part of the study.

The impacts on the natural, biological and social environment can be direct or indirect. Areas of pollution generated include the Corridor of Impact and Operational Facilities of the Contractor. Environmental Impacts due to the project are summarized in **Table 6.1.**

Table 6.1: Environmental Impact Summary for Improvement Works of Project Roads.

S. No.	Parameter	Total
I. Negative Impacts		
1	Hand Pumps/Tube wells Relocation (Nos.)	NIL
2	Pond Area (sq.m)	Nil
3	Relocation of Religious properties	Nil
4	Transfer of Agricultural land (acr.)	Nil
5	Borrow Earth (Cum)	12424
6	Quarry Material (Cum)	10176
7	Water (cum)	8460
8	Nos of trees to be felled	1200 approx.
II. Positive Impacts		
1	**Enhancement sites**	
A	Vegetative Screen Barrier (Nos.)	Nil
B	Tree Saving (Nos.)	Nil
C	Surface Water Bodies	
	Water Reuse	
	Sitting Arrangement	
	Enhancement of Bus bays	
2	**Proposed Plantation**	
A	Landscaping with fine grass and shrubs (m2)	NA
3	**Road safety Measures**	
A	Junction improvement (nos.)	NA
B	Proposal for Rotary Junctions (nos.)	NA
C	Intersections / Access improvement (nos.)	08

D	Bus Bays (nos.)	NA
E	Pedestrian Crossing (locations)	At all intersections
F	Street lighting (Nos)	Nil
G	Signage boards (nos.)	-
H	Side walk (locations)	NIL
I	Traffic calming measures (locations)	All intersections
J	Four lane sections (length in Km)	NIL
K	Crash barrier/Guardrail (Locations)	
L	Crash Barrier/Guardrail (length)	

6.2 IMPACTS ON PHYSICAL ENVIRONMENT

6.2.1 Impact on Soil

Loss of Productive Soil

As part of the proposed works, no land acquisition is involved.

Some temporary loss of soil may also be envisaged during construction stage, if construction plant, offices, worker's camps, stockyards, borrow areas etc are located on fertile areas and if haul roads and traffic detours during construction etc are routed through agricultural lands.

Soil Erosion *Construction Stage*

Slopes of the roads are relatively stable as the embankments of the roads are not high compared to the adjacent lands.

Operation Stage

There will not be any soil erosion during the operation stage as slope of embankments will be protected with appropriate slope protection measures.

Compaction of soil

Compaction of soil may occur, particularly on haul roads during site clearance due to movement of heavy machinery and vehicles and during setting up of construction camps and stockyards. During construction, there is a possibility of compaction beyond the COI, due to the movement of vehicles and heavy machinery.

Contamination of Soil during the Construction Stage

In this project contamination of the soil may take place, from the following activities at the construction zones, construction labour camps, construction plant sites and other auxiliary facilities required for the construction. Details of the activities from which the contamination can occur are presented below;

- Scarified bitumen wastes.
- Maintenance of the machinery and operation of the diesel generator sets on site.
- Oil Spill from the operation of the mechanical workshops, diesel pumps and diesel storage, during transportation and transfer, parking places, and diesel generator sets.
- Operation of the emulsion sprayer and laying of hot mix.
- Operation of the residential facilities for the labour and officers.
- Storage and stock yards of bitumen and emulsion.
- Excess production of hot mix and rejected materials.

Table 6.2 gives the details of debris generated and reused. From the table it can be observed that scarified bituminous material will be generated in huge quantity which will be required proper disposal or reuse. The quantity of earth will be procured from approved borrow areas.

Table 6.2: Details of the Quantities of Debris and Spoil

Excavated Material	**Qty. likely to be generated (Cum)**	**Qty. Required for Embankment Fill (Cum)**	**Debris Unused/ disposal qty (Cum)**	**% Used**
Scarified Bituminous	3360	3360		100%
Concrete	NIL		Nil	
Spoils/earth/other debris	NIL		Nil	
Total	**3360**		Nil	

6.2.2 Impact on Water Resources

Due to the proposed works, the direct impacted water resource is 07 nos hand pumps and 04 nos of other drinking water sources which are being impacted by 4laning. The detail is given in **Table 6.3**.

Table 6.3 Detail of Impacted on Water bodies

Location	Type of Water body	Distance from CL	Ref. Chainage
Bhikhi	Hand Pump	11m	54+030 (LHS)
Bhikhi	Hand Pump	12m	54+320
Bhikhi	Water Tank	12m	54+416
Mansa	Hand Pump	12m	186+680
Mansa	Hand Pump	14m	184+100
Maur	Hand Pump	14m	84+210
Maur	Hand Pump	10m	85+618
Cheema	Water Tank	8.5m	40+030
Cheema	Water Tap	10m	40+130
Cheema	Water Tap	10m	40+170
Cheema	Hand Pump	12m	40+195

Impacts on Water Quality

The sources of water pollution from the construction activities are as follows:

- Water flow from scarified bitumen materials.
- Oil spills from the Maintenance of the machinery and operation of the diesel generator sets on site.
- Oil Spill from the operation of the mechanical workshops, diesel pumps and diesel storage, transportation and transfer, parking places, and diesel generators.
- Operation of the emulsion sprayer and laying of hot mix.
- Operation of the residential facilities for the labour and officers and offices.
- Storage and stock yards of bitumen and emulsion.

Degradation of water quality is also possible due to accidental discharges into watercourses from drainage of workers camps and from spillages from vehicle parking and/or fuel and lubricant storage areas.

Water requirements for construction

With the following assumptions the approximate water quantity required for the Project has been calculated.

1. 7-8% of weight of soil for sub grade construction
2. 5-6% of weight of GSB materials for GSB and WMM
3. 150 litres/ cum for concrete

Domestic requirement of 100 litres per worker/day has been assumed. For these projects total 50 resident workers have been considered. Details of the water requirement assessed for the project is presented in **Table 6.4.**

Table 6.4: Requirement of Water for Proposed Construction Works

S. No.	Purpose	Qty. (Cum)
1	Permanent works (Total quantity in cum)	45
2	Dust Suppression at work zone in (cum/day)	15
3	Curing (cum/day)	8
4	Laboratory (cum/day)	7
5	Haul Roads (cum/day)	10
6	Crusher (cum/day)	Nil
7	Plant Cleaning and workshop washing in (cum/day)	11
8	Domestic Purpose in (cum/day)	45
Total Requirement (cum/day)		**141**

Daily water requirement for the permanent works has been calculated based on time period for completion of work i.e. 2 Months.

6.2.3 Impact on Air Environment

There will be direct impacts during the preconstruction, construction and operation phases on surround air environment.

The Air pollution sources and types has been described in **Table 6.5**

Table 6.5: Summary of Air Pollution during different stages

Likely Impacts	Reasons/Activities for Impacts	Remarks
<u>Pre-Construction Stage</u>		
• Dust	• Scarification/Site	• The

Generation	clearance • Transportation of Man and Material • Construction of Stock Yard and office buildings • Installation of Construction plants • Activities performed in Dry Weather	impacts are temporary and location specific. • The width of impact is limited.
<u>Construction Stage</u>		
• Increases the level of PM10 and PM2.5. • Increases the Gases Pollutant level (i.e. CO, SOx and NOx) • Carbon based emission from HMP • Impact on agricultural land having crops, vegetation etc.	• Clearing and grubbing, material dumping, drying of material etc. • Movement of vehicles in Construction camp, • Transportation of quarries/aggregate and soil from borrow area. • Operation of HMP, WMM and Batching Plant. • Emission of fine dust/ rejected material from bag filters of HMP. • Material Storage and handling (loading and uploading). • Construction machinery and vehicle uses.	• The impact area is particularly near working zones, plant sites.
<u>Operation Stage</u>		
• Dust generation • Emission from vehicular tyres. • Increase the gases pollutant from diesel vehicles (i.e. trucks, buses, cars, utilities etc.)	• Increases the Vehicle moment in proposed road due to improvement in road condition. • Abrasive action of tyres on roads.	• The impact is permanent and impact areas are villages/to wn near the project roads.

6.2.4 Noise Environment

The impacts of noise due to the project will be of temporary significance locally in the construction phase and slight increase may occur during the operation stages. The impact is tabulated in **Table 6.6**

Table 6.6 Summary of Noise Impacts at different stages

Likely Impacts	Reasons/Activities for Impacts	Remarks
Pre Construction Stage		
• Noise level/exposure will increases for the local communities near 4 lane site at S2 & S3 road.	• Use of heavy Machinery and Equipments for Site Clearance/Grubbing/ Scarification. • Transportation of Man and Material • Construction of plant sites.	• The impacts are temporary and location specific. • The width of impact is limited and not significant.
Construction Stage		
• The impacts of noise exposure will be on the community residing near to the work zones. • The activities of plants (i.e HMP,WMM etc.) and DG sets shall produce significaly high noise level.	• The use of machinery involved in the construction operation i.e. dozer, roller, grader, paver, tractors, brooms/rotary brushing, tippers, generators, excavators etc. • Operation of HMP, WMM, Batching Plant and DG sets.	• The impact area is particularly near work sites, plant sites and will also vary for different receptors. • The impact will be quite significant but will be localized to the plant

		sites.
Operation Stage		
• Possibly Higher Ambient Noise level on Day and Night time in agricultural and rural residential area near to proposed work sites.	• Uninterrupted movement of heavy and light vehicle on high speed.	• The impact is permanent and impact area is surrounding of villages (i.e. agricultural and residential area).

The impact on village noise pollution may be significant caused by through traffic and any increase in traffic will exacerbate this situation. Therefore, measures are required to reduce noise from traffic passing through near villages and rural residential areas.

6.3 NATURAL ENVIRONMENT IMPACT ON ROAD SIDE TREE

The major impact in this project on flora involves the removal of trees to permit construction and to provide clear zone for safety of the road users.

Pre-Construction Stage

There will be a significant, direct impact on cutting of the roadside trees during the pre-construction stage.

A total of about 1785 trees are required to be cut for the proposed project. The major trees affected are Kikar, Shisham, Toot, Eucalyptus etc. The girth size of tress to be cut varies from 300mm to 900mm**.**

Table 6.7: Details of Diverted Protected Forest Area and Trees to be cut within ROW

Location	Protected Forest Area (within ROW) to be Diverted (hct.)	Number of trees to be cut (Nos.)

Maur (S2 Road)	2.7038	**218**
Bhikhi (S2 Road)	5.5110	**170**
Cheema (S2 Road)	4.6200	**140**
S3 Road	11.5267	**1257**
Total	**24.3615**	**1785**

Construction Stage

No tree will be cut beyond the proposed toe line. Cutting of trees for fuel by workers, especially near their camps is of major concern. Therefore, adequate training of the workers and availability of their fuel requirements are to be ensured by the Contractor.

Operation stage

The visual and aesthetics view of roads will be changed by the end of the construction stage and will be improved during the operation stage.

6.4 IMPACT ON SOCIO-CULTURAL ENVIRONMENT

6.4.1 Economic Impacts

The direct economic benefits from the strengthening of the state road transport infrastructure include:

- Reduction of Vehicle Operating Cost.
- Lower transport costs by reducing road roughness and improved alignment.
- Improving financial sustainability for road development and maintenance.
- Increased vehicle speeds.
- Reduced passenger time costs.

The relatively short-lived economic impacts of the construction

stage are likely to be experienced in local communities for the duration of construction as workers make everyday purchases from local market. This is likely to give a short-lived stimulus to these vendors that will disappear as soon as the construction is complete.

6.4.2 Impact on Religious and Historic Sites

There is no impact identified on cultural, heritage and religious structures of National and State importance near the project roads. However, the detail of religious and historic sites has been already mentioned in EIA prepared by PIPL for S2 and S3 road.

6.4.3 Impact on Common Properties Resources and Private Properties

There is no impact identified on CPR and Private Properties. However, the detail of CPRs have been already given in EIA prepared by PIPL for S2 and S3 road.

6.5 IMPACT ON SAFETY AND PUBLIC HEALTH

6.5.1 Impact on Safety

Construction stage

During the road construction operations there will be some discomfort, even after providing proper safety measures, to the pedestrians, community residing near the construction zone. The levels of discomfort can be reduced with proper planning of construction works and providing required construction zone safety measures, special attention must be given while working on Major Junctions.

Operation stage

After construction of roads there will be some negative impacts. The negative impacts are due to increase of traffic volumes and speeds, which would have a direct bearing on the risk exposure to accidents. There will be potential for increased collisions between vehicular traffic travelling at higher speeds from proposed and between traffic travelling through link roads as well as pedestrians using the roads.

6.5.2 Impact on Public Health

Pre-Construction and Construction Stage

The following health hazards will result due to the project activities:

- Due to the influx of the workers for the construction works there will be some discomfort to the local environmental system if the proper sanitation facilities are not constructed and operated. These include setting up of labour camps near the road alignment, at construction plant sites. There will also be some increased demands on the local infrastructure such as electricity, water supply and medical facilities.
- Due to migration of the workers from other places there is possibility of transmission of the communicable diseases. During the construction stage work, crews and their dependents may bring with them a multitude of communicable diseases including sexually transmitted diseases (STDs) like AIDS. This is likely, as the project requires more male-workers, who have migrated from other parts of the state or country.
- During roads construction and its allied activities dust will be generated, which will create discomfort to the local people.
- Noise generated during the construction activities may cause temporary local nuisance to nearby communities.

Operation stage

After the completion of the project there will be both positive and negative impacts on the public health. The positive impacts include increased speed of accessibility to local and regional health centers and other community support facilities. The adverse impacts may be on public health that can result in absence of adequate safety measures.

7. AVOIDANCE, MITIGATION AND ENHANCEMENT MEASURES

7.1 OVERVIEW

The best way of impact mitigation is prevention but this would stop all development. As far as possible avoidance and reduction of adverse impacts approaches were adopted during the design stage with consideration of the views of environmental and social experts. This is reflected in the designs of the cross sections, construction methods, construction materials and alignment.

The main impacts identified have been addressed during design wherever possible and will be further mitigated by the construction procedures and specific measures provided in the contract drawings and specifications. These are summarized in **Table 7.1**

Table 7.1: Key Environmental Impacts and Management in the Project

Issue	Addressed in design	Addressed in Implementation	Operation
Tree removal	Tree cutting largely unavoidable. Minimize to zero due to resurfacing and rehabilitation works on existing alignment.	Control construction activities to minimize the possibility of damage to nearest plants/ shrubs during construction stage.	Monitor plantation programme and check survival rates
Erosion	Identification of erodible soils. Treatment of embankment slopes and stream inlet and outlet.	Close control of timing of embankment treatment after earthwork operations.	Monitor and maintenance.
Borrow Areas	Minimized borrow requirements with reuse of the excavated material /earth in embankment formation.	Select suitable sites with land owners and cultivators Rehabilitate with topsoil.	No action required
Road Safety	Provided traffic calming measures near junctions, schools, college and village area. Provided pedestrian crossings. Provide high standard of road signs, pavement marking RRPM, hazard marker and markings as per relevant IRC codes.	Provide safe traffic management methods as specified in IRC:SP:55-2014	Monitor Accidents
Air Pollution	Good Pavement Condition will reduce use of unpaved	Siting of work areas/camp site etc away from sensitive	National Motor Vehicle emission controls.

	shoulders.	receptors. Modern well maintained construction equipment with PUC certificates. Dust suppression measures on plant i.e maximum paved area, sprinkling of water etc, diversions and haul roads.	
Noise Pollution	Impossible for project to lower existing high noise levels. Selected flexible pavement. Vegetation barrier for noise reduction at source	Sitting o f work areas a w a y from sensitive receptors. Use of well-maintained construction equipment and machinery. Acoustic enclosures for DG sets.	No action required
Aggregate / Sand	Use only controlled renewable resources	Conform to regulations	No action required
Debris disposal	Minimized the debris generation.	Use scarified material and spoils in embankment fill/shoulder as per the requirement.	No action Required
Land	Project Roads will be constructed in existing alignment.	Reinstate site working areas on completion of works	No action Required

7.2 PHYSICAL ENVIRONMENT

7.2.1 Environmental Management at Quarries

The Contractor will ensure that the quarries have all appropriate licenses.

7.2.2 Soil

Erosion Control

For control of the soil erosion from the embankments the slopes have been restricted to 1 vertical: 2 horizontals for entire sections;

Surface erosion is prevented and controlled by adopting following methods:

- Turfing: covering the slope surface with grass and bushes, by simple planting of grass roots and saplings;

Protection of embankment slopes: Embankment soils in the corridors are clays of high to intermediate plasticity. These soils are relatively resistant to surface erosion. Accordingly, it is

proposed that to control surface erosion, newly formed slopes should be planted with locally growing shrubs and grasses.

Protection of Outfall Slopes: Surface runoff water will be discharged into natural outlets in the agricultural field. Wherever the level difference between natural outlet and surface runoff difference exceeds one meter, the outlet shall be lined or an outfall chute provided.

Soil Contamination

For the prevention of the soil contamination the following control measures shall be implemented effectively:

Construction Stage

- Impervious concrete base and a sump will be constructed at all the fuel, waste oil and bitumen, emission and chemical storage yards. A berm will also be constructed along the periphery of the concrete platforms. An oil interceptor will be constructed for providing for treating the oil wastes collected in the sumps
- All non-toxic wastes generated from the construction sites shall be used appropriately in the Project construction.
- Some of the wastes can be reused for the development of the access roads to the construction plant sites, labour camps, internal roads, access roads to the soil borrow areas, granular sub base quarries and quarries and for any other auxiliary sites.
- Landfills of contaminated soils with the bitumen, oil and chemicals shall be avoided as far as possible, these materials shall be buried in the construction of slopes or shoulders.
- Proper collection, storage and disposal mechanism shall be in place for the solid and liquid wastes generated from site facilities during the construction stage.
- All petroleum products and chemicals meant for construction shall be stored in accordance with guidelines provided in Materials Safety Data Sheet (MSDS).
- Procedures and Plans shall be in place for cleaning up of any accidental spills.
- Checks for ensuring erosion control structures are in place before earthworks are started.
- Concrete platforms will be constructed for the parking bays.

- Washing bay with oil interceptor will be constructed for the effective collection of oil spills generated during washing.
- Platforms of the workshop shall be paved for the effective collection of oil spills.
- Oil trays shall be used for the collection of oil spills during emergency repairs of the machinery on site.

Operation Stage

During the operation stage, the probability of contamination of soil is only from spillage and road runoff. Provision has been made in the design for the collection and discharge of the runoff from the 4lane sites into nearest water bodies through well-designed lateral drains.

Loss of Productive Top Soil

Efforts have been made for the minimization of the use of the soil from good agricultural soil areas. As far as possible the soil excavated from the roadside will be used for the construction of embankments and sub grade construction. The borrow areas; construction camp locations; traffic detours during the construction and other construction sites shall be selected to minimize loss of the agricultural land. To conserve the productive topsoil in affected areas, the following mitigation measures will be adopted:

- The topsoil from all areas to be restored as borrow areas shall be stripped to 150 mm and stored in stockpiles.
- The stockpile shall be designed such that the slope does not exceed 1:2 (vertical to horizontal), and the height of the pile will be restricted to 2m.
- Stockpiles will not be surcharged or otherwise loaded and multiple handling will be kept to a minimum and stock pile shall be covered with gunny bags or tarpaulin.
- It shall be ensured that the topsoil will not be trafficked either before stripping or when in stockpiles.
- To prevent any compaction of soil in the adjoining productive lands, the movement of construction vehicles, machinery and equipment will be restricted to CoI as far as possible.
- The stored topsoil will be utilized for; covering all disturbed areas including for the redevelopment of borrow areas after filling and dressing of the slopes of road

embankment.

Borrow Areas Management:

The usage of soil borrow areas is at the discretion of the Contractor who may identify set of borrow areas based on the haulage and suitability of materials. Location of source of supply of material for embankment or sub-grade and the procedure for excavation or transport of material shall be in compliance with the environmental requirements of the MoRTH specifications and as specified in IRC: 10-1961.

The contractor shall evolve site-specific redevelopment plans for each borrow area location, which shall be implemented after the approval from PRBDB.

The Contractor has to comply with the regulatory compliance for excavation of earth from borrow area and also to the World Bank is guidelines for use and redevelopment of borrow areas.

7.2.3 Water Environment

Impact on Ground Water Supply Sources/Surface Water bodies

There are 07 hand pump and 04 other water source are being effected due to widening of existing road section into 4 lane. These water bodies will be shifted by the contractor.

Minimize the use of natural water resources

The water required for construction will be extracted in such a manner that there will be very little disruption to the local community. The total quantity required for the Project is about 141 cum/day.

Mitigation for water quality degradation:

Oil Interceptor: Oil and grease from polluting run-off is another major concern. During construction, discharge of Oil and Grease is most likely from workshops, oil and waste oil storage areas, diesel oil pumps, vehicle parking areas from the construction camps.

The source is well defined and restricted. Gravity separation technique will be used for the separation of oil and water. Enough detention time is provided to allow oil to float to the surface.

For each construction camp one oil interceptor will be constructed. Wastewater contaminated with oils and waste oils and grease will be treated in the oil interceptor to remove all oil and grease spills

before discharging appropriately. As far as possible the ground will be leveled in such manner that the wastewater will flow in one direction. The wastewater channels will be constructed with a slope of 1: 150 to ensure that wastewater flows into the interceptor before discharge. Oil and grease of the oil interceptors will be cleaned once in a fortnight from outside by skimming of oil film over the surface. **Figure 7.1** provides the details of the arrangement for the oil interceptor for the removal of oil and grease.

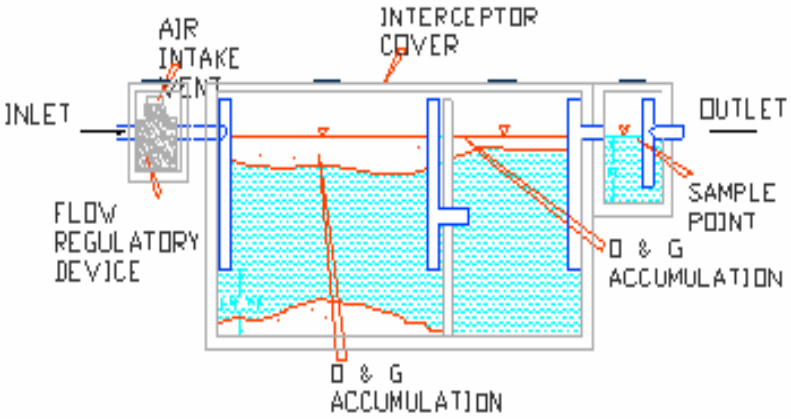


Figure 7.1: Oil Interceptor

The location of all fuel storage and vehicle cleaning areas will be at least 300 m from the nearest drain/ water body. In addition, the maintenance and repairs of vehicles will be carried out in such a way that contamination of water bodies and drainage channels can be avoided. The slopes of embankments leading to water bodies will be modified and re channeled to prevent entry of contaminants into the water body.

7.2.4 Air Environment

From the impact analysis it was observed that the expected levels of pollutants emitted from different sources over and above the contribution from back ground sources reflected that major air pollutants of concern are dust and gaseous pollutants.

Details of the mitigation measures proposed are detailed below.

<u>The specific mitigation measures for working zone include:</u>

- Vehicles delivering fine materials like soil and fine aggregates shall be covered to reduce spills on existing roads.
- Water will be sprayed on earthworks, temporary haulage and detours on a regular basis.
- All vehicles, equipment and machinery used for construction will be regularly maintained to ensure that the emission levels conform to the SPCB/CPCB norms.
- Air pollution monitoring plan has been delineated for construction phase separately for checking the effectiveness of the mitigation measures adopted during the construction phase of the Contract.

Mitigation Measures for Plant Sites:

- HMP plant should be well mounted with Exhaust control and dispersion system.
- Batch type hot mix plants fitted with the bag filter / cyclone and scrubber will be installed for the reduction of the air pollution
- Plant sites shall be located at a significant distance from nearest human settlement in the predominant down wind direction.
- Regular sprinkling of water should be done on plant site.
- The maximum area within the camp site should be paved to reduce the possibility of dust generation at camp site.

7.2.5 Noise Environment

An integrated strategy is proposed for the prevention and control at different stages for the reduction of noise propagation from sources to receptors. The first step is to control emission of noise at the source itself, followed by noise control within the sound transmission path and lastly is the option of protection at the receiving end like construction of the masonry walls.

Details of noise prevention and control measures for the proposed Project are described in the following sub sections.

Construction Stage

The impacts due to noise and vibration will be significant during construction stage where the settlements are located near the project roads. For the reduction of the noise levels during the construction stage the following mitigation measures will be implemented.

- Noise standards will be strictly enforced for all site vehicles, plants, equipment, and construction machinery.
- Machinery and vehicles will be maintained regularly, with particular attention to silencers and mufflers, to keep construction noise levels to minimum. Workers in the vicinity of high noise levels must wear earplugs/ earmuffs and be engaged in diversified activities to prevent prolonged exposure to noise levels of more than 90dB(A) per 8-hour shift.
- Construction camps shall be located at about 1000 m from settlement areas. No hot mix, batching and aggregate crushing plants shall be located within 1000 m on the down wind direction of sensitive land uses such as schools, hospitals etc. In unavoidable circumstances, the time of the operation of the plant shall be limited. All the diesel generator sets to be used for the Project shall be fitted with the noise control systems such as acoustic enclosures.

7.2.6 Construction Camp

7.2.6.1 Layout of Construction Camp

The construction camps for labour accommodation, offices and construction plant sites shall be identified based on the PPCB guidelines and World Bank Guideline for Setting out of Construction Camp.

Typical layout of construction camp is already given in EIA prepared for S2 link of OPRC network.

7.2.6.2 Facilities at Workers Camps

During the construction stage of the Project the construction Contractor will construct and maintain necessary (temporary) living accommodation and ancillary facilities for labour. It will be ensured that all the temporary accommodation will be provided with uncontaminated water for drinking, cooking and washing. Adequate washing and bathing places shall be provided, and kept in clean and drained condition. Construction camps will be sited away from vulnerable people and adequate health care will be provided for the work force.

Sanitation Facilities: Construction camps shall be provided with sanitary latrines and urinals. Closed drainage systems and the proper treatment systems according to the local conditions should be constructed for the proper flow and effective treatment. The

sewage system built for the camp will be operated properly to avoid health hazard, ground water and soil pollution. Compost pits will be constructed for the disposal of the garbage and other biodegradable wastes generated from the camps. Proper collection, transportation and disposal of the wastes will be ensured.

Shelter at Workplace: At such workplaces where the duration of the works will prevail for more than one month some form of shelters will be provided for meals, resting, change of clothes and for keeping the tools of the work and personal protective equipment. The height of shelter shall not be less than 3m from floor level to lowest part of the roof. Sheds shall be kept clean and the space provided shall be on the basis of at least $1m^2$ per head.

Canteen Facilities: A cooked food canteen on a moderate scale shall be provided for the benefit of workers wherever it is considered necessary. All the wastes generated from the canteen will be treated/ disposed of as detailed in the other sections of waste disposal.

Health Care Facilities: Health problems of the workers should be taken care of by providing basic health care facilities through a health center set up at the construction camps. The health center will have at least a doctor (part time), nurses, duty staff, medicines and minimum medical facilities to tackle first-aid requirements for minor accidental cases. Some arrangements will be made with the nearest hospital to refer patients of major illnesses or critical cases.

The design layout of construction camp will be provided in the EMP for ensuring the implementation of effective pollution control measures at the construction base camps and construction plant sites, redevelopment/ closure plans for the closure of these sites will be made part of the Environmental Management Plan of the construction Contract.

7.3 NATURAL ENVIRONMENT

The environment along the 4 lane section and bridges shall be enhanced, principally through plantation of various types of shade and ornamental trees along with shrubs and grasses. Tree plantations have manifold benefits. During the construction stage, all precautions will be taken to ensure that the trees outside the CoI will not be removed. To compensate for the tree cutting, if any, two times of the diverted protected forest area will be afforested in accordance with the Forest

(Conservation) Act, 1980.

7.4 ENHANCEMENT MEASURES

There are no enhancement measures have been proposed for the 4 lane section and bridges.

7.5 SAFETY MEASURES

7.5.1 Health/Safety Measures for Labors

Fist Aid Boxes will be placed at all work places and in the Construction Camp. Some of the workers should have received First Aid training to respond to the emergencies at the working zones and at auxiliary sites. Arrangements with nearby health centers and local doctors should be made for treating injuries. During the construction phase, workers should be provided personal protective equipment's based on the nature of the work. Details of the personal protective equipment which are to be given to the workers are presented in **Table 7.4.**

Table 7.4: List of Personal Protective Equipment

S. No.	Part of the Body	Personal Protective Equipment
1	Eye	Safety Glasses, Goggles
2	Face	Face Shields,
3	Nose	Nose Masks/ Dust mask
4	Head	Helmets
5	Feet	Safety Shoes
6	Hands and arms	Gloves
7	Bodies	Vests
8	Hearing	Earplugs, Earmuffs

7.6 Traffic Safety Plans

Design Stage

Safety of vulnerable road users i.e pedestrians, cyclist, school children etc. as well as vehicles on the road will be of highest importance and adequate measures have been incorporated in the design of the Project. For the safety and convenience of the local people, traffic calming measures, school zone treatment, village gate treatment, traffic control systems and unpaved shoulders for pedestrians in the village areas has been incorporated. IRC 67 2012 and IRC 35-2015 have been refered for sign boards and pavement marking. The details of Road Safety measures adopted along the project roads are presented in **Table 7.5**. The standard drawings for the road safety measures is provided in **Annexure 7.1**

Table 7.5: Locations of Traffic/Road Safety Measures

Code	Location	Type of Measures
RS-01	Side Road	STOP marking, Sing board, flat gradient
RS-02,03,04,05	Curve	Road Sign, Road marking, Chevron Sign, Cat eyes, Delineators etc.
RS-06	Hazardous reach Gateway Treatment	Vibratory rumble strips, sign boards, road marking
RS-07	Pedestrians Crossing	Road marking, sing boards, stop line
RS-08	Object Hazard	Hazards Markers/ AFP Sheeting
RS-08	School Zone	Rumble strips, road marking, sign boards, speed limit
RS-09	Two lane road	Longitudinal marking and road studs (cat eyes)

Construction Stage

Safety during the construction will be considered as an integral part and high priority element of the road Project. All precautions required will be taken to ensure closure of the road is for minimum period and traffic delay is as limited as possible. It will also be ensured that inconvenience to the road users, community residing near the work site and the work crew and machinery will be minimized.

All safety precautions will be ensured during temporary and permanent works for the road construction.

The safety practices, therefore, are oriented towards reducing the conditions that lead to such hazards and consequent stress on the driver, so as to control and regulate his behavior as warranted by the site conditions through the construction zone.

Components of the Construction Zone

- **Construction Zone** is the area of the road which is affected by the works and which affects traffic flow resulting in a conflict

between the road users and the construction activities.

- **Work Zone** is the area where workmen are working i.e. excavation, overlaying improvements etc.
- **Working Space** is the space around the work area that allows the workmen to move around to do the job and will include space required for storing excavated material, plant and equipment and clear space required for swinging of equipments and excavation arms.
- **Safety Zone** is provided to protect the workmen from the moving traffic. This includes providing lateral and longitudinal buffer zones.
- **Traffic Control Zone** includes those areas in advance of the actual work site that are required for advance working as well as safety zones, the transition zones and the working zones itself.
- For providing all required safety precautions specific traffic management plans will be prepared and implemented during construction in accordance with the IRC: SP: 55-2014(Guidelines on Safety in Road Construction Zones). Some guiding drawings for the general safety measures are provided below:

Though each construction zone will pose unique problems there is a basic layout that should be followed for all schemes but that will need to be amended to suit local conditions. These will be influenced by:

- Environment: Rural, Urban;
- Type of Carriageway such as single-lane, two-lanes, 4-lanes, multi-lanes, divided carriageway;
- Traffic Volume and Speed, with and without work in progress on road;
- Type of Traffic such as mixed or segregated;
- Available Sight Distance in construction zone; and
- Mobility of Work Zone, that is, for minor pot hole repairs, lane marking etc. the workers and equipment may move along the road.

Figures 7.3 ,7.4 & 7.5 below shows the basic layout that would permit two-way working of traffic past the working zone, temporary traffic diversions.

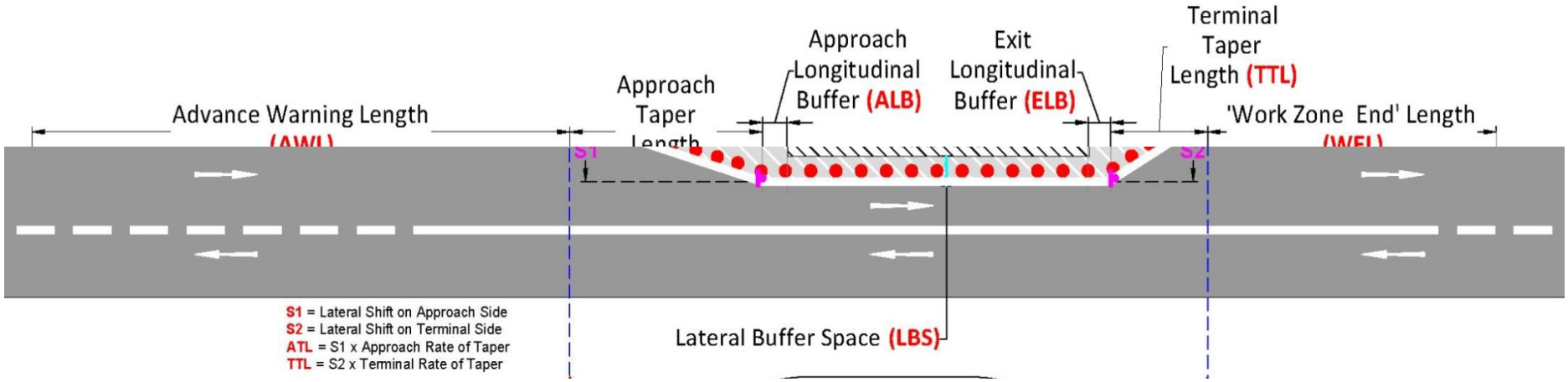


Figure 7.2: Traffic Control Zone

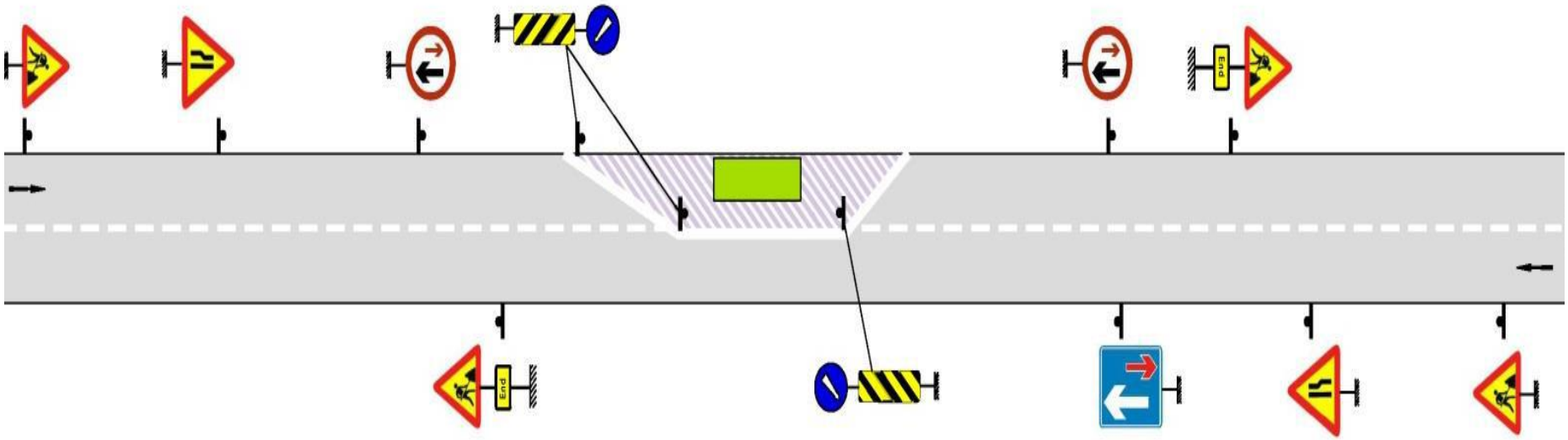


Fig. 7.3 Basic layout with priority sign boards

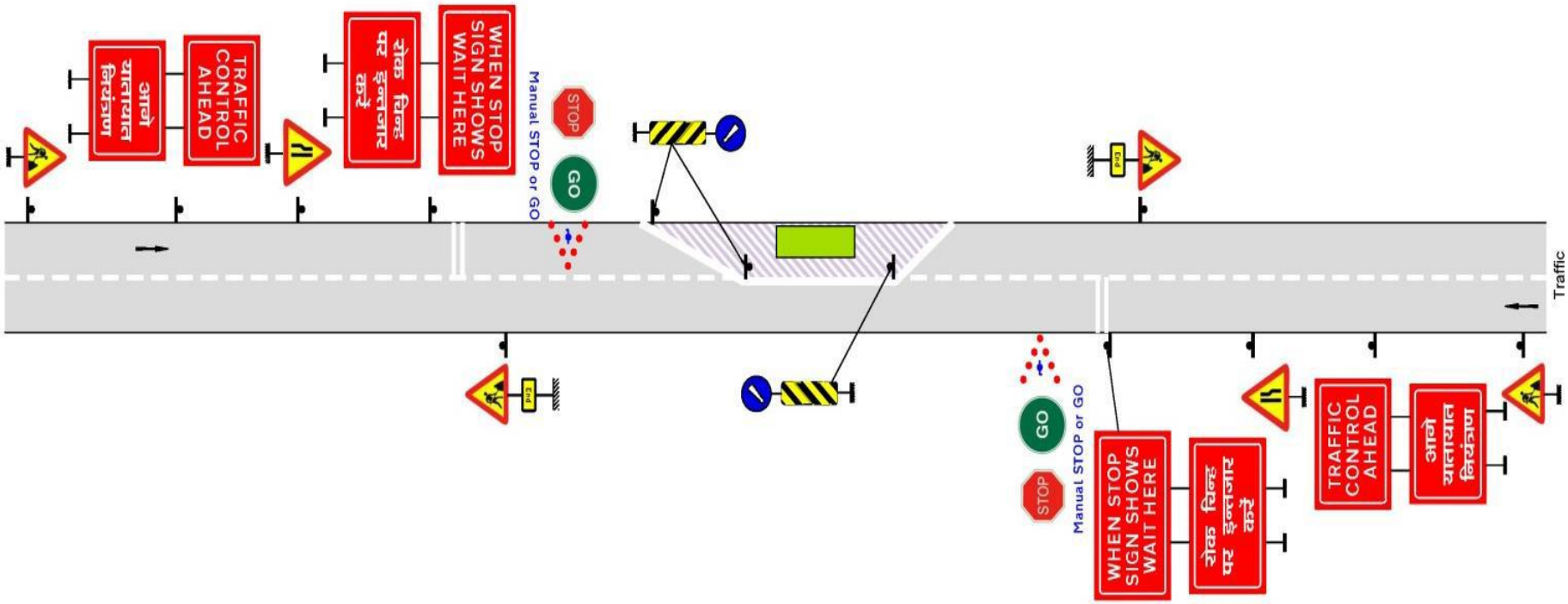


Figure 7.4: Basic Layout with STOP/GO sings

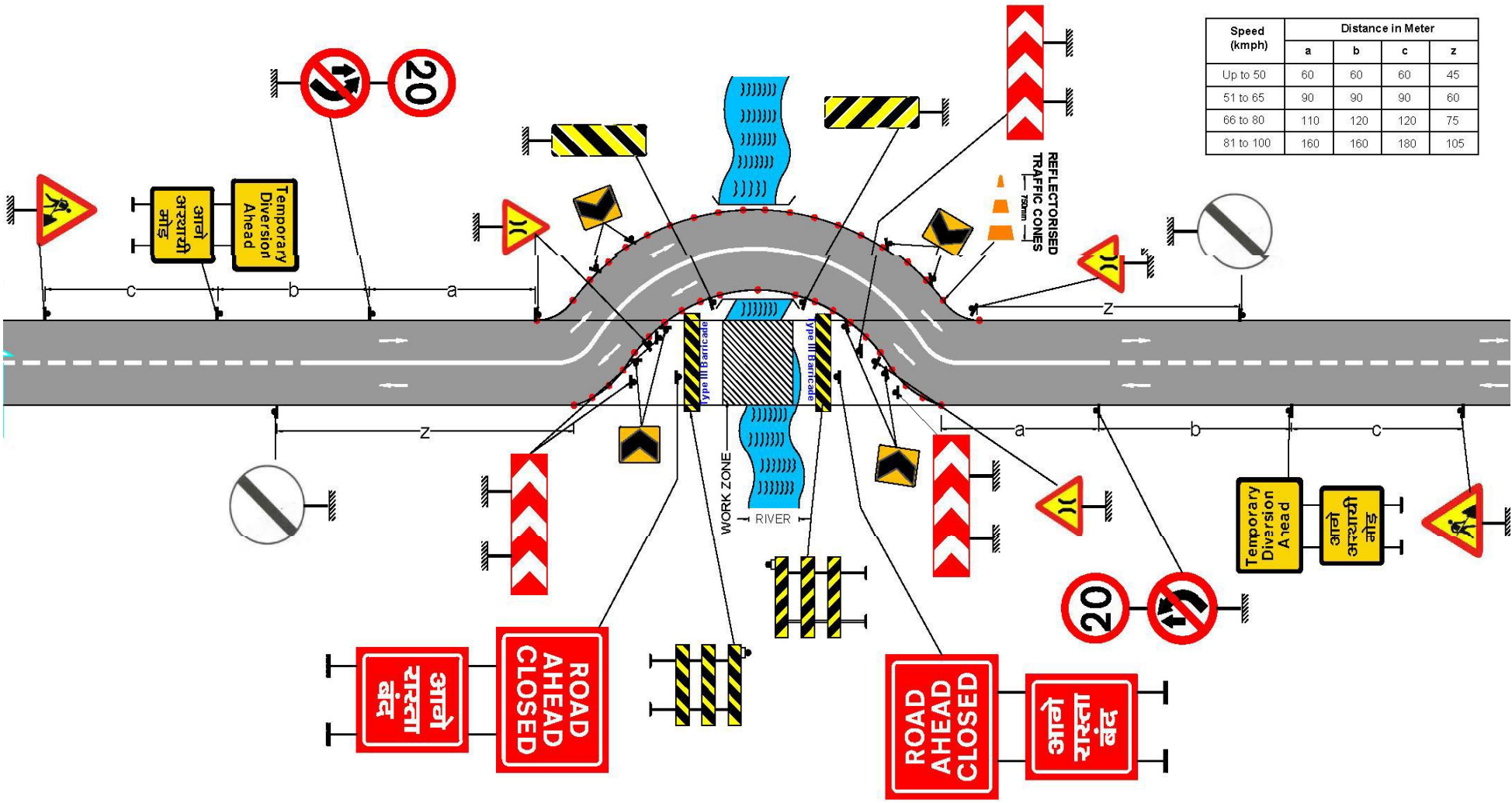


Figure 7.5: Basic Layout for Traffic Diversion

7.7 Handling of Petroleum Products

Petroleum products such as petrol, diesel, light diesel oil, bitumen and emulsion will be handled, stored and used in accordance with the relevant rules, acts and guidelines to avoid any damage to the environment and reduce the probability of the occurrence accidents. Wastes generated from the use of the petroleum products will also disposed of safely as detailed in the relevant rules, regulations and guidelines. The rules and regulations applicable for the handling of these products are listed below;

- Environmental Protection Act, 1986
- Petroleum Act, 1934
- Petroleum Rules, 2002

Chapter 8 ENVIRONMENTAL MANAGEMENT PLAN

8.1 Introduction

Environmental Management Plan (EMP) has been prepared for 4 lane section and bridges and will be followed with terms and conditions given in OPRC contract. It is expected that implementation of all the environmental measures proposed in the EMP are adopted. The implementation actions, responsibilities and timeframes have been specified for each component and adverse impact anticipated.

EMP as the Table 8.1 called 'EMP' lists those measures, which are for this road for the improvement work lists those measures which are specific to this link.

8.2. Objective of EMP

The EMP is a plan of action for mitigation / management / avoidance of the negative impacts of the project and enhancement of the project road. Table 8.1 explains the environmental issues and the avoidance/ mitigation/ minimization or enhancement measures adopted and/or to be adopted during different phases of the project. It also provides the references for the suggested measures, responsible agency for its implementation/ management as well as its time frame.

8.3. Compliance with the EMP

A copy of the EMP must be kept at the construction site office during the construction period at all times. The EMP will be made binding on contractor operating on the site and must be included as Contractual Clauses in any contractual agreement for the Contractor.

- All persons employed by the contractor or his sub-contractors will abide by the requirements of the EMP.
- Contract conditions to include measures to be taken.
- The Contractor will not direct a person to undertake any activity which would place them in breach of the specifications contained within the EMP.
- Should the Contractor be in breach of any of the specifications contained in the EMP, the PRBDB/PWD will in writing, instruct the Contractor responsible for the incidence of non-compliance regarding corrective and/or remedial action required, specify a timeframe for implementation of these actions, implement a penalty and/or indicate that work could be suspended should non-compliance continue.

- Should non-compliance continue, further written notification will be forwarded to the contractor responsible for the incident of non-compliance outlining the required corrective and/or remedial action, the timeframe for implementation, penalties and/or work could be suspended as specified previously.
- Contracts with contractor to include Clauses to hold the contractor responsible for the cost of any delays, corrective or remedial actions required as a result of non-compliance with the specifications and Clauses of the EMP.
- Reporting of compliance shall be in line with the Part 2B: Specification of ESMF of Contract Agreement.

8.4. Non-Conformance and Corrective Action

- The Non Conformance shall be recorded as per Part 2B: Specification of ESMF of Contract Agreement.

Table 8.1: ENVIRONMENTAL MANAGEMENT PLAN

<table>
<tr><th rowspan="2">Sl. No.</th><th rowspan="2">Environmental Issue</th><th rowspan="2">Management Measures</th><th>Responsibility</th><th></th></tr>
<tr><th>Planning and Execution</th><th>Supervision/ Monitoring</th></tr>
<tr><td colspan="3">PRE-CONSTRUCTION STAGE</td><td></td><td></td></tr>
<tr><td colspan="3">Pre-construction activities by PWD (B&R)</td><td></td><td></td></tr>
<tr><td>P.1</td><td>Clearance & Approvals</td><td>Secure the following clearances & NOCs prior to start of construction activity:
<table>
<tr><th><u>Type of Clearances</u></th><th><u>Applicability</u></th></tr>
<tr><td>NOC & Consents for Air, Water & Environment Protection Acts and Noise rules from PSPCB.</td><td>For Establishment of Construction Camp</td></tr>
<tr><td>Consent to Operate (CTO) and Consent to Establish (CTE) from PSPCB.</td><td>For establishment & Operating Construction Plant and HMP.</td></tr>
<tr><td>Explosive License from Chief Controller of Explosive</td><td>For Storing Fuel, Lubricant, Diesel etc.</td></tr>
<tr><td>NOC from State Ground Water Board</td><td>For utilization of Ground Water.</td></tr>
<tr><td>Labor Licenses</td><td>Engagement of Labor</td></tr>
</table></td><td>Contractor</td><td>Employer/PRBDB</td></tr>
</table>

Sl. No.	Environmental Issue	Management Measures	Responsibility	
			Planning and Execution	Supervision/ Monitoring
P.2	Preservation of Trees	Diversion of 24.3615 hct forest land is involved which included 1785 number of trees to be cut down. All efforts will be made to preserve trees including evaluation of minor design adjustments/alternatives to save trees. Specific attention will be given for protecting giant trees, green tunnels and locally important trees (religiously important etc.). Tree cutting is to proceed only after all the legal requirements including attaining of In-principle and Formal Clearances from the Forest Dept./DoEF/MoEF are completed and subsequently a written order is issued to the Contractor. In the event of design changes, additional assessments including the possibility to save trees shall be made. Stacking, transport and storage of the wood will be done as per the relevant norms. Systematic corridor level documentation for the trees cut and those saved will be maintained with "PWD/ PRBDB".	PWD (B&R)	Employer/PRBDB
P.3	Relocation of Community Utilities and Common Property Resources	All community utilities and properties i.e., water supply lines, sewer lines, hand pumps will be relocated before construction starts, on any section of the project corridor. Seven (07) Hand Pumps and Four (04) other drinking water source will be relocated in Bhikhi, Cheema, Maur and Mansa before the initiation of Civil Work. Environmental considerations with suitable/required actions including health and hygiene aspects will be kept in mind while relocating all community	Contractor	Employer/PRBDB

Sl. No.	Environmental Issue	Management Measures	Responsibility	
			Planning and Execution	Supervision/ Monitoring
		utilities and resources.		
P 4	Clearance of Encroachment/Squatters	Advance notice shall be given to affected squatters (221 numbers) present, who need to be relocated as per RAP. All R&R activities will be completed prior to initiation of civil works.	PWD/PRBDB	Employer/PRBDB
P.5	**Field Verification and Modification of the Contract Documents**			
P.5.1	Joint Field Verification	The Environmental Expert of PRBDB and the Contractor will carry out joint field verification to ascertain any additional possibility to saving trees, environmental and community resources. The verification exercise should assess the need for additional protection measures or changes in design/scale/nature of protection measures including the efficacy of enhancement measures suggested in the EMP. Proper documentation and justifications/reasons shall be maintained in all such cases where deviation from the original EMP is proposed.	Contractor/ Environmental Expert of PRBDB/PWD	Employer/PRBDB
P.5.2	Assessment of Impacts due to Changes/Revisions/ Additions in the Project Work	The Environmental Expert of PRBDB will assess impacts and revise/modify the EMP and other required sections of the project document/s in the event of changes/revisions (including addition or deletion) in the project's scope of work.	Contractor/ Environmental Expert of PRBDB/PWD	Employer/PRBDB

Sl. No.	Environmental Issue	Management Measures	Responsibility	
			Planning and Execution	Supervision/ Monitoring
P.5.3	Crushers, hot-mix plants and Batching Plants Location	Hot mix plants and batching plants will be sited sufficiently away from settlements and agricultural operations or any commercial establishments. Such plants will be located at least 1000 m away from the nearest village/settlement preferably in the downwind direction. The Contractor shall submit a detailed layout plan for all such sites and approval of Environmental Expert of PRBDB shall be necessary prior to their establishment. Arrangements to control dust pollution through provision of windscreens, sprinklers, dust encapsulation will have to be provided at all such sites. Specifications of crushers, hot mix plants and batching plants will comply with the requirements of the relevant current emission control legislations and Consent/NOC for all such plants shall be submitted to the "PRBDB/ PWD. The Contractor shall not initiate plant/s operation till the required legal clearances are obtained and submitted. The engineer will ensure that the regulatory and legal requirements are being complied with. Form P4 shall be used for reporting to Engineer/Employer.	Contractor	Employer/PRBDB
P.5.4	Other Construction Vehicles, Equipment and Machinery	All vehicles, equipment and machinery to be procured for construction will confirm to the relevant Bureau of India Standard (BIS) norms. The discharge standards promulgated under the Environment Protection Act, 1986 will be strictly adhered to. Noise limits for construction equipment's to be procured such as compactors, rollers, front loaders concrete mixers, cranes (moveable), vibrators and saws will not exceed 75 dB (A), measured at one meter from	Contractor	Employer/PRBDB

Sl. No.	Environmental Issue	Management Measures	Responsibility	
			Planning and Execution	Supervision/ Monitoring
		the edge of the equipment in free field, as specified in the Environment (Protection) Rules, 1986. The Contractor shall maintain a record of PUC for all vehicles and machinery used during the contract period, which shall be produced for PRBDB/ PWD's verification whenever required. Mobile equipment shall be placed at least 100metres away from the nearest dwelling. Form C1 shall be used for reporting to Engineer/Employer.		
P.6	**Identification and Selection of Material Sources**			
P.6.1	Borrow Areas	Finalizing borrows areas for borrowing earth and all logistic arrangements as well as compliance to environmental requirements, as applicable, will be the sole responsibility of the contractor. The Contractor will not start borrowing earth from select borrow area until the Environmental Clearance obtained from SEIAA and formal agreement is signed between landowner and contractor and a copy is submitted to the "PRBDB/ PWD through the Engineer. Planning of haul roads for accessing borrow materials will be undertaken during this stage. The haul roads shall be routed to avoid agricultural areas as far as possible (in case such a land is disturbed, the Contractor will rehabilitate the land as per Borrow Area Rehabilitation Guidelines) and will use the existing village roads wherever available. Reporting will be as per the Reporting Format for Borrow Area and will include a reference map. Form P3 shall be used for reporting to Engineer/Employer.	Contractor	Employer/PRBDB

Sl. No.	Environmental Issue	Management Measures	Responsibility	
			Planning and Execution	Supervision/ Monitoring
P.6.2	Quarry	Contractor will finalize the quarry for procurement of construction materials after assessment of the availability of sufficient materials, quality and other logistic arrangements. The contractor will procure the material from authorized/approved quarry sites. Contractor will also work out haul road network and report to PWD/PRBDB.	Contractor	Employer/PRBDB
P.6.3	Arrangement for Construction Water	Contractor can use the ponds, which are not in use by community or identified to fill up for the project, but in that case, before using any pond water contractor will obtain written consent from the owner and submit then to PWD. To avoid disruption/disturbance to other water users, the contractor will extract water from fixed locations and consult the Environmental Expert of PRBDB before finalizing the locations. The Contractor will provide a list of locations and type of sources from where water for construction will be used. The contractor will seek approval from the Environment Expert of PRBDB prior to the finalization of these locations. Form P6 shall be used for reporting to Engineer/Employer. The contractor will not be allowed to pump from any irrigation canal and surface water bodies used by community. The contractor will need to comply with the requirements of the State Ground Water Department and seek their approval for doing so and submit copies of the permission to "PRBDB/ PWD " prior to initiation of any construction work.	Contractor	Employer/PRBDB

Sl. No.	Environmental Issue	Management Measures	Responsibility	
			Planning and Execution	Supervision/ Monitoring
P.7	Labor Requirements	The contractor preferably will use unskilled labor drawn from local communities to give the maximum benefit to the local community. The contractor would notify requirement of unskilled labours in nearby/surrounding village Panchayats.	Contractor	Employer/PRBDB
P.8	Construction Camp Locations – Selection, Design and Lay-out	Siting of the construction camps will be as per the guidelines given below. Locations identified by the contractor will be reported. Form P2 shall be used for reporting to Engineer/Employer. Construction camps will not be proposed within 1000 m from the nearest settlements to avoid conflicts and stress over the infrastructure facilities with the local community applies only in case where a construction camp doesn't house plant sites. Location for stockyards for construction materials will be identified at least 1000 m from watercourses. The waste disposal and sewage system for the camp will be designed, built and operated such that no odor is generated.	Contractor	Employer/PRBDB
P.9	Arrangements for Temporary Land Requirement	The contractor as per prevalent rules will carry out negotiations with the landowners for obtaining their consent for temporary use of lands for construction sites/hot mix plants/traffic detours/borrow areas etc. The Contractor will submit a copy of agreement to the PRBDB/PWD. The Environmental Expert of PRBDB will be required to ensure that the clearing up of the site prior to handing over to the owner (after construction or completion of the activity) is included in the contract.	Contractor	Employer/PRBDB

Sl. No.	Environmental Issue	Management Measures	Responsibility	
			Planning and Execution	Supervision/ Monitoring
P.10	Orientation of Implementing Agency and Contractors	The Contractor shall organize orientation sessions and regular training sessions during all stages of the project. This shall include on-site training (general as well as in the specific context of a sub-project). These sessions shall involve, field level implementation staff of PWD and Contractor, Environmental Experts of PRBDB and Contractors. The contractor will ensure that his staff including engineers, supervisors and operators attend the training sessions.	Contractor	Employer/PRBDB

S. No.	Environmental Aspect/Issue	Management Measures	Responsibility	
			Execution /Civil Work	Supervision/ Monitoring
CONSTRUCTION STAGE				
Activities to be Carried Out by the Contractor				
C.1	**Site Clearance**			
C.1.1	Clearing and Grubbing	Vegetation will be removed from the construction zone before commencement of construction. All works will be carried out such that the damage or disruption to flora other than those identified for cutting is minimum. The Contractor under any circumstances will not cut trees other than those identified for cutting and for which he has written instructions from the PWD. The PWD will issue these instructions only after receiving all stages of clearances from the Forest Department/ MoEF. Vegetation only with girth of over 30 cm will be considered as trees and shall be compensated, in the event of PWD's instruction to undertake tree cutting. ➢ The sub grade of the existing pavement shall be used as embankment fill material. ➢ The existing base and sub-base material shall be recycled as sub-base of the haul road or access roads. ➢ The existing bitumen surface may be utilized for the paving of cross roads, access roads and paving works in construction sites and campus, temporary traffic diversions, haulage routes etc.	Contractor	Employer/PRBDB

C.1.2	Disposal of debris from dismantling structures and road surface	The contractor shall identify disposal sites. The identified locations will be reported to the PWD/PRBDB. These locations will be checked on site and accordingly approved by Environmental Expert of PRBDB prior to any disposal of waste materials. All arrangements for transportation during construction including provision, maintenance, dismantling and clearing debris, will be considered incidental to the work and will be planned and implemented by the contractor as directed by the Environmental Expert of PRBDB. The pre-designed disposal locations will be a part of Comprehensive Solid Waste Management Plan to be prepared by Contractor in consultation and with Environmental Expert of PRBDB. Debris generated from pile driving or other construction activities shall be disposed such that it does not flow into the surface water bodies or form mud puddles in the area. *Form P1 shall be used for reporting to Engineer/Employer.*	Contractor	Employer/PRBDB
C.1.3	Other Construction Wastes Disposal	The pre-identified disposal locations will be a part of Comprehensive Waste Disposal Solid Waste Management Plan to be prepared by the Contractor in consultation and with approval of Environmental Expert of PRBDB. Location of disposal sites will be finalized prior to initiation of works on any particular section of the road. The PRBDB/PWD will approve these disposal sites after conducting a joint inspection on the site with the Contractor. Contractor will ensure that any spoils of material unsuitable for	Contractor	Employer/PRBDB

		embankment fill will not be disposed off near any water course, agricultural land, and natural habitat like grass lands or pastures. Such spoils from excavation can be used to reclaim borrow pits and low-lying areas located in barren lands along the project corridors (if so desired by the owner/community and approved by PWD/PRBDB). All waste materials will be completely disposed and the site will be fully cleaned and certified by Environmental Expert of PRBDB before handing over. The contractor at its cost shall resolve any claim, arising out of waste disposal or any non-compliance that may arise on account of lack of action on his part.		
C.1.4	Stripping, stocking and preservation of top soil	The topsoil from all areas of cutting and all areas to be permanently covered will be stripped to a specified depth of 150 mm and stored in stockpiles. A portion of the temporarily acquired area and/or Right of Way will be earmarked for storing topsoil. The locations for stock piling will be pre-identified in consultation and with approval of Environmental Expert of SC. The following precautionary measures will be taken to preserve them till they are used: (a) Stockpile will be designed such that the slope does not exceed 1:2 (vertical to horizontal), and height of the pile is restricted to 2 m. To retain soil and to allow percolation of water, silt fencing will protect the edges of the pile. (b) Stockpiles will not be surcharged or otherwise loaded and multiple handling will be kept to a minimum to ensure that no compaction will occur. The stockpiles shall be covered with	Contractor	Employer/PRBDB

		gunny bags or vegetation. (c) It will be ensured by the contractor that the topsoil will not be unnecessarily trafficked either before stripping or when in stockpiles. Such stockpiled topsoil will be utilized for - ➢ covering all disturbed areas including borrow areas only in case where these are to be rehabilitated as farm lands (not those in barren areas) ➢ top dressing of the road embankment and fill slopes ➢ filling up of tree pits, in the median and ➢ in the agricultural fields of farmers, acquired temporarily. Residual topsoil, if there is any will be utilized for the plantation at median and side of the main carriageway.		
C.1.5	Accessibility	The contractor will provide safe and convenient passage for vehicles, pedestrians and livestock to and from work sites and property accesses connecting the worksites, providing temporary connecting road. The contractor will also ensure that the work on / at existing accesses will not be undertaken without providing adequate provisions as per IRC:SP:55:2014.	Contractor	Employer/PRBDB
C.1.6	Planning for Traffic Diversions and Detours	A temporary diversion route has been identified by the PWD and is to be upgraded/rehabilitated as per provisions given in Schedule-B. The contractor will disclose local community for changes in traffic routes, conditions and pedestrian access arrangements with assistance of PWD.	Contractor/PWD	Employer/PRBDB
C.2	**Procurement of Construction Material**			
C.2.1	Earth from Borrow Areas for	No borrow area will be opened without EC obtained from the SEIAA. The location, shape and size of the designated borrow	Contractor	Employer/PRBDB

	Construction	areas will be as recommended by SEIAA and in accordance to the IRC recommended practice for borrow pits for road embankments (IRC 10: 1961). The unpaved surfaces used for the haulage of borrow materials, if passing through the settlement areas or habitations; will be maintained dust free by the contractor. Sprinkling of water will be carried out thrice a day to control dust along such roads during their period of Execution. Contractor will rehabilitate the borrow areas as soon as borrowing is over from a particular borrow area as suggested by Environmental Expert of PRBDB. *Form C4 shall be used for reporting to Engineer/Employer.*		
C.2.2	Quarry Operations	The Contractor shall obtain materials from new quarries only after the consent of the Department of Mining / PPCB/ District Administration or will be use the existing approved sources of such materials. A copy of the consent/ approval for opening or use of a quarry source will be submitted to Environmental Expert and PWD**.** The quarry operations will be undertaken within the rules and regulations in force.	Contractor	Employer/PRBDB
C.2.3	Transporting Construction Materials and Haul Road Management	The Contractor will maintain all roads (existing or built for the project), which are used for transporting construction materials, equipment and machinery. • In case of spillage of material during transportation, the contractor is liable for undertaking all remedial measures, including ensuring safe operations involving other road users/public and to rectify or resolve the issue at his own cost. All existing highways and roads used by vehicles of the contractor	Contractor	Employer/PRBDB

		or any of his sub-contractor or suppliers of materials and similarly roads, which are part of the works, will be kept clear of all dust/mud or other extraneous materials dropped by such vehicles. Contractor will arrange for regular water sprinkling as necessary for dust suppression of all such roads and surfaces with specific attention to the settlement areas. The unloading of materials at construction sites/close to settlements will be restricted to daytime only.		
C.2.4	Construction Water	Contractor will arrange adequate supply and storage of water for the whole construction period at his own costs. The Contractor will submit a list of source/s from where water will be used for the project to PRBDB through the Engineer. The contractor will source the requirement of water preferentially from ground water but with prior permission from the Ground Water Board. A copy of the permission will be submitted to PRBDB through the Engineer. The contractor will take all precaution to minimize the wastage of water in the construction process/ operation.	Contractor	Employer/PRBDB
C.3	**Construction Work**			
C.3.1	Disruption to Other Users of Water	While working across or close to any perennial water bodies, contractor will not obstruct/ prevent the flow of water. Construction over and close to the non-perennial streams shall be undertaken in the dry season. If construction work is expected to disrupt users of community water bodies, notice shall be served well in advance to the affected community by the contractor.	Contractor	Employer/PRBDB

C.3.2	Drainage	The Contractor will ensure that construction materials like earth, stone, fly ash are disposed off so as not to block the flow of water of any watercourse and cross drainage channels. The Contractor will take all necessary measures to prevent the blockage of water flow. In addition to the design requirements, the Contractor will take all required measures as directed by the Environmental Expert to prevent temporary or permanent flooding of the site or any adjacent area. *Form O1 shall be used for reporting to Engineer/Employer.*	Contractor	Employer/PRBDB
C.3.3	Siltation of Water Bodies and Degradation of Water Quality	The Contractor will not excavate beds of any stream/canals/ any other water body for borrowing earth for embankment construction. The Contractor will ensure that construction materials containing fine particles are stored in an enclosure such that sediment-laden water does not drain into nearby water course.	Contractor	Employer/PRBDB
C.3.4	Slope Protection and Control of Soil Erosion	The contractor will take slope protection measures as per design, or as directed by the Environmental Expert to control soil erosion and sedimentation. All temporary sedimentation, pollution control works and maintenance thereof will be deemed as incidental to the earth work or other items of work and as such as no separate payment will be made for them. Contractor will ensure the following aspects: ➢ During construction activities on 4lane sections and bridges the side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and shrub as per design specifications. ➢ Turfing works will be taken up as soon as possible provided	Contractor	Employer/PRBDB

		the season is favorable for the establishment of grass sods. Other measures of slope stabilization will include mulching netting and seeding of batters and drains immediately on completion of earthworks. ➢ In borrow pits, the depth shall be so regulated that the sides of the excavation will have a slope not steeper than 1 vertical to 2 horizontal, from the edge of the final section of the bank. ➢ Along sections abutting water bodies, stone pitching as per design specification will protect slopes.		
C.4	**Pollution**			
C.4.0	**Pollution Monitoring**	The periodic monitoring of the ambient air quality, noise level, water (both ground and surface water) quality, soil quality at/near Bikhi Cheema, Maur and Mansa locations will be done as per MoEF and CPCB guidelines. *Form C3 shall be used for reporting to Engineer/Employer.*	Contractor	Employer/PRBDB
C.4.1	**Water Pollution**			
C. 4.1.1	Water Pollution from Construction Wastes	The Contractor will take all precautionary measures to prevent the wastewater generated during construction from entering into streams, water bodies or the irrigation system. Contractor will avoid construction works close to the streams or water bodies during monsoon. All waste arising from the project is to be disposed off in the manner that is acceptable and as per norms of the Punjab State Pollution Control Board.	Contractor	Employer/PRBDB
C.4.1.2	Water Pollution from Fuel and Lubricants	The contractor will ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refueling sites will be located at least 500 m from rivers and irrigation canal/ponds.	Contractor	Employer/PRBDB

		All location and layout plans of such sites will be submitted by the Contractor prior to their establishment and will be approved by PRBDB/ PWD'. Contractor will ensure that all vehicle/machinery and equipment operation, maintenance and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. Oil interceptors will be provided for vehicle parking, wash down and refueling areas as per the design provided. In all, fuel storage and refueling areas, if located on agricultural land or areas supporting vegetation, the top soil will be stripped, stockpiled and returned after cessation of such storage. Contractor will arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites and approved by PRBDB. All spills and collected petroleum products will be disposed off in accordance with MoEF and PSPCB guidelines.		
C.4.2	**Air Pollution**			
C.4.2.1	Dust Pollution	The contractor will take every precaution to reduce the level of dust from crushers/hot mix plants, construction sites involving earthwork by sprinkling of water, encapsulation of dust source and by erection of screen/barriers at 4lane site. All the plants will be sited at least 1 km in the downwind direction from the nearest human settlement. PM2.5, PM10, SO2 and NOx should be in permissible limit as stated in National Ambient Air Quality Standards during the construction phase. Dust screening vegetation will be planted on the edge of the 4lane site. Hot mix plant will be fitted with dust extraction units.	Contractor	Employer/PRBDB

C.4.2.2	Emission from Construction Vehicles, Equipment and Machineries	Contractor will ensure that all vehicles, equipment and machinery used for construction are regularly maintained and confirm that pollution emission levels comply with the relevant requirements of PSPCB. The Contractor will submit PUC certificates for all vehicles/ equipment/machinery used for the project. Monitoring results will also be submitted to PRBDB.	Contractor	Employer/PRBDB
C.4.3	**Noise Pollution**			
C.4.3.1	Noise Pollution: Noise from Vehicles, Plants and Equipments	The Contractor will confirm the following: ➢ All plants and equipment used in construction (including the aggregate crushing plant) shall strictly conform to the MoEF/CPCB/PPCB noise standards. ➢ All vehicles and equipment used in construction will be fitted with exhaust silencers. ➢ Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced. ➢ Limits of noise emission for construction equipment used in the project such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB (A) (measured at one meter from the edge of equipment in the free field), as specified in the Environment (Protection) rules, 1986. ➢ Maintenance of vehicles, equipment and	Contractor	Employer/PRBDB

		machinery shall be regular and up to the satisfaction of the Environmental Expert to keep noise levels at the minimum. At the construction sites within 150 m of the nearest habitation, construction work such as crushing, concrete mixing, batching will be stopped during the night time between 9.00 pm to 6.00 am. No construction activities will be permitted around educational institutes/health centers (silence zones) up to a distance of 100 m from the sensitive receptors i.e., school, health centers and hospitals between 9.00 am to 6.0 pm.		
C.5	**Occupational Health & Safety**			
C.5.1	Personal Safety Measures for Labour	➢ The Contractor will provide: ➢ Protective footwear and protective goggles to all workers employed on mixing asphalt materials, cement, lime mortars, concrete etc. ➢ Welder's protective eye-shields to workers who are engaged in welding works ➢ Protective goggles and clothing to workers engaged in stone breaking activities ➢ Earplugs to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation. ➢ Adequate safety measures for workers during handling of materials at site. ➢ The Contractor will comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, harness, stairwells, excavations, trenches and safe means of entry and egress. ➢ The Contractor will comply with all the	Contractor	Employer/PRBDB

		precautions as required for ensuring the safety of the workmen as per the International Labor Organization (ILO) Convention No. 62 as far as those are applicable to this contract. The Contractor will not employ any person below the age of 14 years for any work and no woman will be employed on the work of painting with products containing lead in any form. The Contractor will also ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint.He will provide facemasks for use to the workers when paint is applied in the form of spray or a surface having lead paint is rubbed and scraped. Luminous jacket, Regulation (industrial or safety) shoes and hard hats shall be made mandatory for all workers at site. The Contractor will mark 'no smoking' in high risk areas and enforce non-compliance of use of PPE with zero tolerance. These will be reflected in the Construction Safety Plan to be prepared by the Contractor during mobilization and will be approved by Engineer and PRBDB.		
C.5.2	Traffic and Safety	The Contractor will take all necessary measures for the safety of traffic during construction as per IRC:SP:55:2014 and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings and as required by the Environmental Expert for the information and protection of traffic approaching or passing through the section of any existing cross roads. The Contractor will ensure that all signs, barricades, pavement markings are provided as per the MoRTH specifications or as	Contractor	Employer/PRBDB

		directed by the Engineer. Before taking up construction on any section of the existing lanes of the highway, a Traffic Management Plan will be devised and implemented to the satisfaction of the Environmental Expert and the Engineer. Rash driving by the Contractor's vehicle drivers must be strictly controlled. *Form P5 shall be used for reporting to Engineer/Employer.*		
C.5.3	Risk from Electrical Equipment(s)	The Contractor will take all required precautions to prevent danger from electrical equipment and ensure that - ➢ No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. ➢ All necessary fencing and lights is provided to protect the public in construction zones. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, are free from patent defect, are kept in good working order, regularly inspected and properly maintained as per IS provision and to the satisfaction of the Environmental Expert .	Contractor	Employer/PRBDB
C.5.4	Risk Force Measure	The Contractor will take all reasonable precautions to prevent danger to the workers and public from fire, flood etc. resulting due to construction activities. The Contractor will make required arrangements so that in case of any mishap all necessary steps can be taken for prompt first aid treatment.	Contractor	Employer/PRBDB
C.5.5	First Aid	The contractor will arrange for - ➢ a readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in work zone ➢ availability of suitable transport at all times to take injured or	Contractor	Employer/PRBDB

		sick person(s) to the nearest hospital ➢ equipment and trained nursing staff at construction camp		
C.5.6	Informatory Signs and Hoardings	The contractor will provide, erect and maintain informatory/safety signs, hoardings written in English and local language, wherever required as per IRC:67:2012 , IRC:SP:55:2014 and MoRTH specifications.	Contractor	Employer/PRBDB
C.5.7	Prevention of Mosquito Breeding	• Measures shall be taken to prevent breeding at site. The measures to be taken shall include: • -Empty cans, oil drums, packing & other receptacles, which may retain water shall be deposited at a central collection point & shall be removed from the site regularly. • -Still waters shall be treated at least once every week with oil in order to prevent mosquito breeding. • -Contractor's equipment & other items on the site, which may retain water, shall be stored, covered or treated in such a manner that water could not be retained. • -Water storage tanks shall be provided. -Posters in Hindi, Punjabi & English which draw attention to the dangers of permitting mosquito breeding shall be displayed prominently on the site. -Contractor periodic interval shall arrange to prevent mosquito breeding by fumigation / spraying of insecticides		Employer/PRBDB
C.5.8	Transmission of Diseases & HIV/ AIDS prevention & control	• The Contractor shall conduct an HIV/AIDS awareness programme via an approved service provider or specialized NGO to reduce the risk of the transfer of the HIV virus between and among the contractors' personals and local community. • The contractor shall throughout the contract period – (i) Conduct information, education and consultation communication (IEC) campaigns, at least every alternate	Contractor	Employer/PRBDB

		month. • (ii) Provide male or female condoms for all workforce as appropriate; • (iii) Provide for Sexually Transmitted Infections (STI) and HIV/AIDS screening, diagnosis, counseling and referral to a dedicated national STI and HIV/AIDS program.		
C.6	**Flora and Fauna: Plantation/Preservation/ Conservation Measures**			
C.6.1	Flora and Chance found Fauna	The Contractor will take reasonable precaution to prevent his workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal. If any wild animal is found near the construction site at any point of time, the Contractor will immediately upon discovery thereof sensitize the Environmental Expert and carry out the ENGINEER's instructions for dealing with the same. The Environmental Expert will report to the nearby forest office (range office or divisional office) and will take appropriate steps/ measures, if required in consultation with the forest officials.	Contractor	Employer/PRBDB
C.6.2	Chance Found Archaeological Property	All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as per provisions of the relevant legislation. The Contractor will take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. He will, immediately upon discovery thereof and before removal acquaint the Environmental Expert of such discovery and carry out the Engineer's instructions for dealing with the same, waiting which all work shall be stopped.	Contractor	Employer/PRBDB

		The Engineer will seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence the work in the site.		
C.7	**Labor Camp Management**			
C.7.1	Accommodation	The Contractor will follow all relevant provisions of the Factories Act, 1948 and the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labour camp. The location, layout and basic facility provision of each labour camp will be submitted to Engineer and PIU prior to their construction. *Form P2* shall be used for reporting to Engineer/Employer. The Contractor will maintain necessary living accommodation and ancillary facilities in functional and hygienic manner and as approved by the Engineer.	Contractor	Employer/PRBDB
C.7.2	Potable Water	The Contractor will construct and maintain all labour accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing. The Contractor will also provide potable water facilities within the precincts of every workplace in an accessible place, as per standards set by the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996. The contractor will also guarantee the following: a) Supply of sufficient quantity of potable water (as per IS) in every workplace/labor camp site at suitable and easily accessible places and regular maintenance of such facilities. b) If any water storage tank is provided that will be kept such	Contractor	Employer/PRBDB

		that the bottom of the tank at least 1mt. from the surrounding ground level. c) If water is drawn from any existing well, which is within 30mt. proximity of any toilet, drain or other source of pollution, the well will be disinfected before water is used for drinking. d) All such wells will be entirely covered and provided with a trap door, which will be dust proof and waterproof. e) A reliable pump will be fitted to each covered well. The trap door will be kept locked and opened only for cleaning or inspection, which will be done at least once in a month. Testing of water will be done as per parameters prescribed in relevant IS Standards.		
C.7.3	Sanitation and Sewage System	The contractor will ensure that - ➢ the sewage system for the camp are designed, built and operated in such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place ➢ separate toilets/bathrooms, wherever required, screened from those from men (marked in vernacular) are to be provided for women ➢ adequate water supply is to be provided in all toilets and urinals all toilets in workplaces are with dry-earth system (receptacles) which are to be cleaned and kept in a strict sanitary condition.	Contractor	Employer/PRBDB
C.7.4	Waste Disposal	The Contractor will provide segregated garbage bins in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as per the Comprehensive Solid Waste Management Plan approved by the Environmental Expert. *(Form C2* shall be used for reporting to Engineer/Employer*)*	Contractor	Employer/PRBDB
C.9	**Contractor's Demobilization**			

C.9.1	Clean-up Operations, Restoration and Rehabilitation	The clean-up and restoration operations are to be implemented by the Contractor prior to demobilization. The Contractor will clear all temporary structures, dispose all garbage, night soils and POL waste as per Comprehensive Waste Management Plan and as approved by Engineer. All disposal pits or trenches will be filled in and effectively sealed off. Residual topsoil, if any will be distributed on adjoining/ proximate barren land or areas identified by Environmental Expert in a layer of thickness of 75 mm-l50 mm. Environmental Expert will certify in this regard. All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, at the contractor's expense, to the entire satisfaction to the Environmental Expert. *Form O2* shall be used for reporting to Engineer/Employer.	Contractor	Employer/PRBDB

8.8.1 Monitoring Plans

To ensure the effective implementation of the EMP, it is essential that an effective monitoring program be designed and carried out.

Various physical, biological and social components identified as of particular significance in affecting the environment at critical locations in various stages of the Project have been suggested as Performance Indicators (PIs). These are listed below and shall be the focus for monitoring.

- Air quality (PM10, PM2.5, NOx, SO2,Pb and CO);
- Water quality (Physical, chemical and Biological parameters)
- Noise levels around sensitive locations/residential area
- Plantation success / survival rate.

The monitoring plans during construction and operation stages have been described in detail in the EMP documents and summary of monitoring plan is presented in **Table 8.2 & Table 8.3.** For each of the environmental components, the monitoring plan specifies the parameters to be monitored; location of monitoring sites; frequency and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising responsibilities.

Table 8.2: Environmental Monitoring Plan

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation	Monitoring/
Air	Construction	CO, NOx, SPM, PM2.5,PM10 and SO2	High volume sampler to be located 50 m from the plant in the downwind direction.	Air (prevention and Control of Pollution) Rules, CPCB, 1994	Quarterly	24 hours Sampling	Ref. Table No. 8.7	Contractor	PRBDB
Water	Construction	All essential characteristics and some of desirable characteristics as decided by the PRBDB	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Indian Standards for Inland Surface Waters (IS: 2296, 1982) and for Drinking Water (IS : 10500 - 1991)	Quarterly	Grab Sampling	Ref. Table No. 8.7	Contractor	PRBDB
Noise	Construction	Noise levels on dB (A) scale	Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement Equivalent noise levels using an integrated noise level meter	MoEF Noise Rules, 2000	Quarterly	Leq in dB(A) of day time and night time	Ref. Table No. 8.7	Contractor	PRBDB

Soil	Construction	Monitoring of Pb, SAR and Oil & Grease	Sample of soil collected to acidified and analysed using absorption spectrophotometer	Threshold for each contaminant set by IRIS database of USEPA until national standards are promulgated	Once in Six Months	Grab Sampling	Ref. Table No. 8.7	Contractor	PRBDB
Borrow area	Construction	As per Guidelines	Visual Observation	-	Once in a Month	-	Borrow area location	Contractor	CMU/PRBDB
Tree plantation	Operation stage	As per Rehabilitation Plan			Quarterly	-	Areas where plantation is being done	-	CMU/PRBDB

Table 8.3: Environmental Monitoring Locations

Environmental Component	S. N.	Location	Remarks
Air Quality	1.	Construction Zone	Rural Residential/ Commercial
	2.	HMP camp Site	Residential/Commercial
	3.	Construction Zone	Rural Residential
Water quality	1.	HMP Camp Site	Surface water / Ground water
	2.	Water body near to roads	Surface water / Ground water
Noise monitoring	1.	HMP Camp site	Residential/Commercial
	2.	Construction Zone	Rural Residential
	3.	Construction Zone	Rural Residential
Soil quality	1.	Near Construction Zone	Agricultural
	2.	HMP Plant site	Agricultural

8.8.2 Reporting System

The Monitoring and Evaluation of the management measures envisaged are critical activities in implementation of the Project. The rationale for a reporting system is based on accountability to ensure that the measures proposed as part of the Environmental Management Plan get implemented in the Project. Detailed formats are provided in **Annexure 8.1**.

8.8.3 Environmental Budget

An indicative estimate of the cost component involved in mitigation of impacts, enhancements (through landscaping or specific enhancement measures), road safety, monitoring and evaluation of various components in pre-construction, construction and operation period has been estimated.

A summary of the environmental budget is presented in **Table 8.4**. Environmental budget is also included in BOQ of the construction contract.

Table 8.4: Environmental Budget

S.N.	Component	Description	Unit Rate (Rs.)	Quantity	Amount (Rs.)
1	Forest Clearances	Diversion of Forest land	887000	24.3615 hec.	Included in DPR
Total (A)					
2.	**Mitigation Measures**				
2.1	Air Pollution	Dust Management measures, Covers for vehicles transportation of construction material etc	Lump sum	-	Included in DPR
2.3	Oil Inceptor	Provision at workshop in construction camp site			85000
Total (B)					**85000/-**
3.	**Enhancement Measures**				
Total (C)					**NIL**
4.	**Road Safety Measures**				
4.1	Junction Improvement	Traffic Calming measures, Pedestrians crossing facilities			Included in DPR
4.2	Road Safety Furniture	Road Safety signs/boards, hazard markers, RRPM, delineators, safety cones etc.			Included in DPR
Total (D)					----
5.	**Environmental Monitoring Cost**				
5.1	Air	Sampling, monitoring & analysis of ambient air quality and gaseous pollutant.	5000	6 Nos.	30000
5.2	Water	Sampling, monitoring & analysis of surface & drinking quality.	3000	4 Nos.	12000
5.3	Noise	Sampling, monitoring & analysis of ambient noise quality.	1500	6 Nos.	9000
5.4	Soil	Sampling, monitoring & analysis of Soil quality.	2500	2 Nos.	5000
Total (E)					**56000/-**
6	**Miscellaneous Cost**				
6.1	Logistics and Administrative	Uses of vehicle for environmental cell , data processing, environmental experts remuneration ,administrative support, stationary etc.	Lump sum		500000/-

Total (F)			**500000/-**
Total Environmental Budget (A+B+C+D+E+F)			**641000/-**
Contingency @ 5 % on Total Environmental Budget			32050/-
GRAND TOTAL			**673,050/-**

8.9 EXISTING INSTITUTIONAL ARRANGEMENTS

8.9.1 Existing Institutional Capacity in PRBDB

The Punjab Roads and Bridges Development Board (PRBDB) has been entrusted the responsibility of successful implementation of the Punjab State Road Sector Project funded by the World Bank

The PRBDB comes under the Secretary Public Works. Presently, PRBDB is headed by the Chief Engineer. The Chief Engineer is assisted by the Joint Secretary. The Chief Engineer is responsible for the successful implementation of the Project. Executive Engineers and his supporting staff are responsible as Employers representatives for the project implementation. Board has appointed Project Manager (Environment) for the supervision/monitoring of environmental issues for project executed under the PSRSP.

8.10 PROPOSED Implementation Setup

The proposed set up for implementation of EMP is given in Figure 8.1.

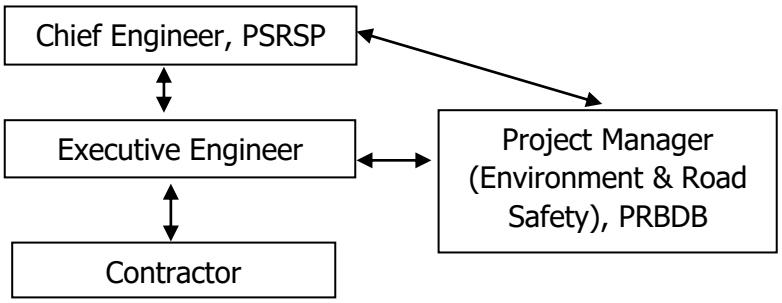


Fig. 8.1 Implementation Setup

8.10.1 Contractor

The Construction Contractor is responsible for the physical implementation of the mitigation measures proposed in the Environmental Management Plan (EMP). To ensure the effective implementation of the EMP, the EMP will be made as part of the Contract Document between the Construction Contractor and Client. It follows that the Contractor has to have an environmental expert to incorporate environmentally sound construction methods.

ANNEXURE