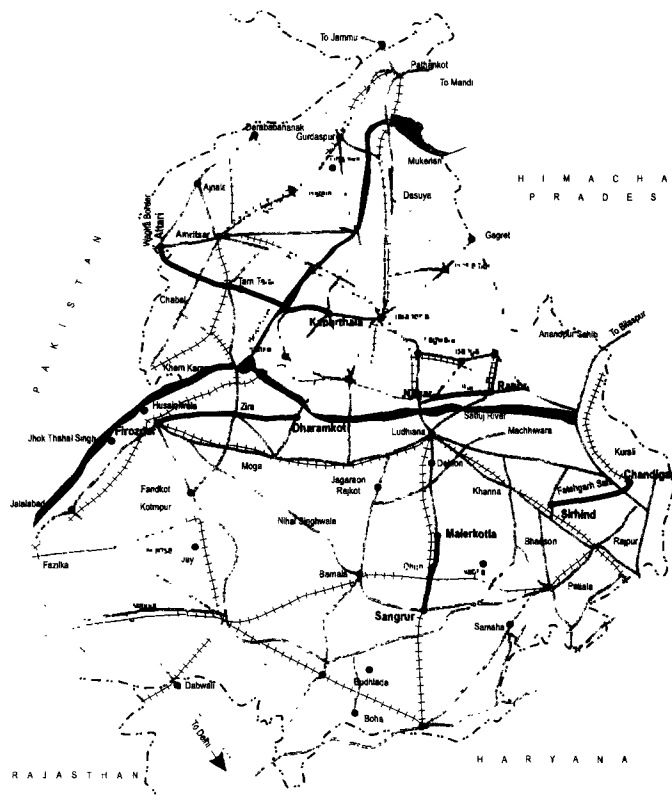


Punjab Roads and Bridges Development Board
Punjab State Road Sector Project

Consultancy Services for Project Preparatory
Studies for Package II (Phase I) for
Detailed Project Report for Rehabilitation
of about 254.00 Km Road Length

E1370
VOL. 15



Final Report
Volume IV-C: Environment Management Plan
(Malerkotla - Dhuri - Sangrur)



Intercontinental Consultants and Technocrats Pvt. Ltd.

A-8, Green Park, New Delhi - 110 016, India

in joint venture with



TECHNOLOGY AND MANAGEMENT LTD.

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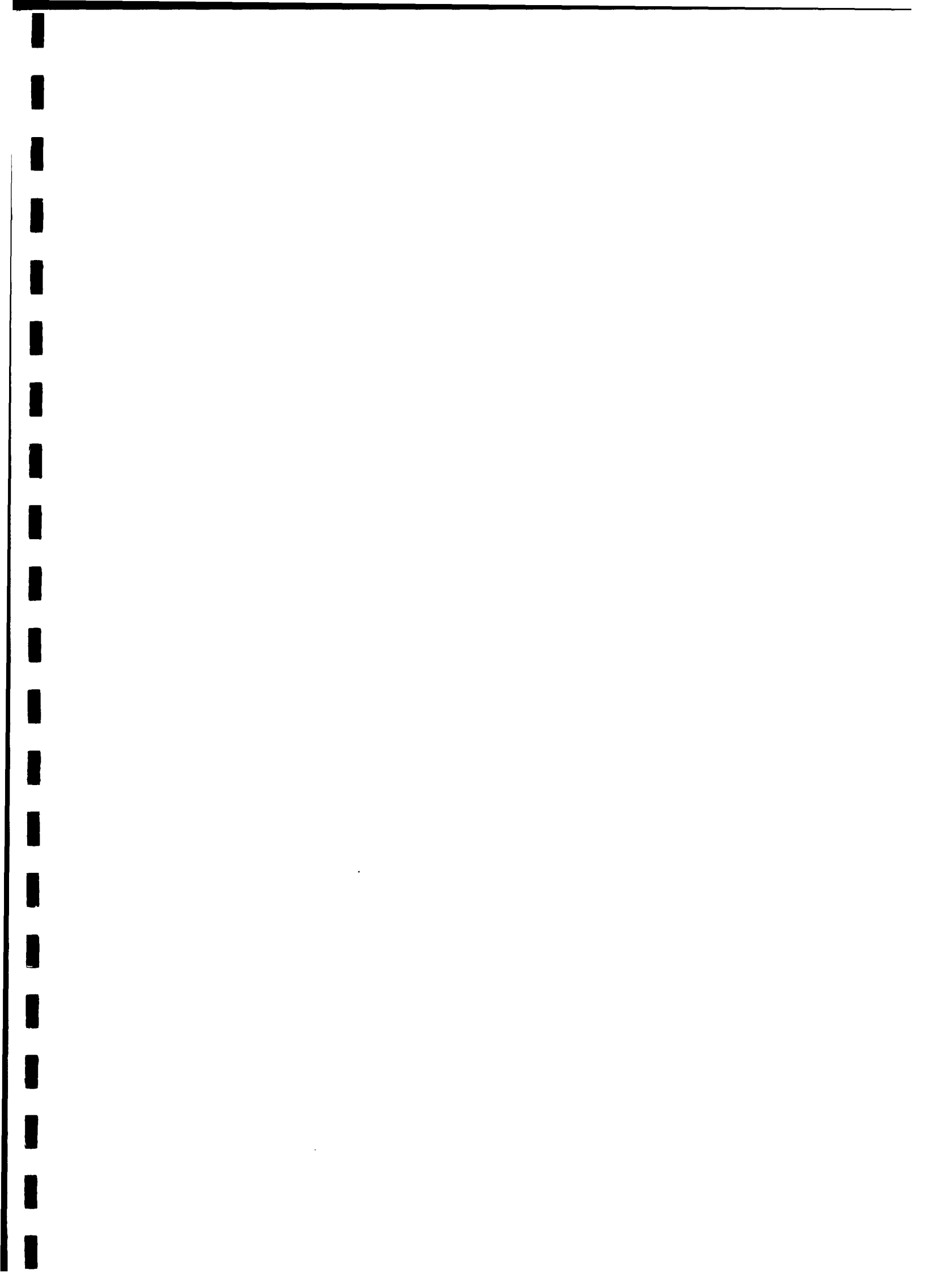
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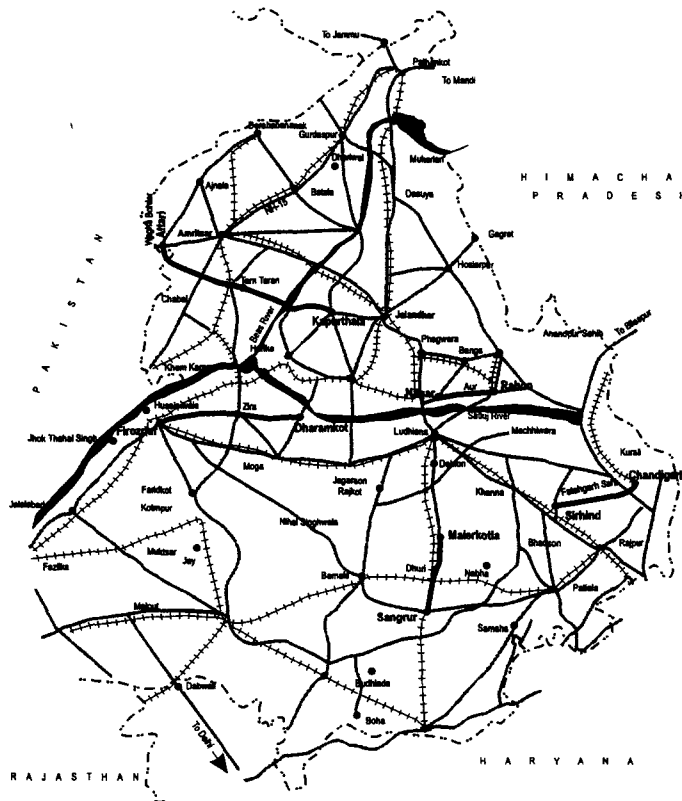
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List of Acronyms

LIST OF ACRONYMS

AAQM	Ambient Air Quality Monitoring
AAS	Atomic Absorption Spectrophotometer
ASI	Archaeological Survey of India
BA	Borrow Area
BIS	Bureau of Indian Standards
BOD	Biochemical Oxygen Demand
BOQ	Bill of Quantities
CO	Carbon Mono oxide
COD	Chemical Oxygen Demand
COI	Corridor of Impact
CPCB	Central Pollution Control Board
CPWD	Central Public Works Department
DO	Dissolved Oxygen
DOEF	Department of Environment & Forest
DPR	Detailed Project Report
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
HC	Hydrocarbon
ICT	Intercontinental Consultants & Technocrats Pvt. Ltd.
ILO	International Labour Organization
INR	Road Rupees
IRC	Indian Road Congress
IS	Indian Standards
LS	Left Side
MCW	Mother and Child Welfare
MOEF	Ministry of Environment & Forest
MOST	Ministry of Surface Transport
MPN	Most Probable Number
NAQMS	National Air Quality Monitoring Series
NGO	Non Government Organization
NO _x	Nitrogen oxides
NRPM	Non Respirable Particulate Matter
NTU	Nephalo Turbidity Unit
OB	Over Burden

LIST OF ACRONYMS

PCB	Pollution Control Board
CMU	Contract Management Unit
POL	Petroleum Oil Lubricant
PRBDB	Punjab Road & Bridge Development Board
PSC	Pre Stressed Concrete
PWD	Public Works Department
R&R	Rehabilitation and Resettlement
RAP	Rehabilitation Action Plan
RCC	Reinforce Cement Concrete
RCCT	Reinforced Cement Concrete T-Beam
ROB	Road over Bridge
ROW	Right of Way
RPM	Respirable Particulate Matter
RS	Right Side
RSPM	Respirable Suspended Particulate Matter
RUB	Road under Bridge
SC	Supervision Consultant
SE	Supervisión Engineer
SO _x	Sulphar oxides
SPCB	State Pollution Control Board
SPM	Suspended Particulate Matter
TDS	Total Dissolved Solid
TSS	Total suspended Solid
WB	World Bank

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Introduction

1



1. INTRODUCTION

Govt. of Punjab through Government of India has sought the assistance of the World Bank for the improvement and Rehabilitation of State Highways (SH) and other State Roads. A Strategic Option Study conducted by the Public Works Department (PWD) has prioritized for improvement of 1698 km of State Highways and other roads. The Govt. of Punjab has pre selected 254 kms of road for rehabilitation and 115 km for up gradation under package II of Phase I. 33 kms of stretch from Malerkotla Sangrur which was under Rehabilitation component is now under up gradation package.

Punjab Roads and Bridges Development Board (PRBDB) is the executing agency and the work of preparation of Detailed Project Report has been entrusted to M/s Intercontinental Consultants and Technocrats Private Ltd. (ICT), India in joint venture with Technology and Management (TNM) Ltd, Israel and in association with Consulting Engineering Group (CEG) Ltd.

1.1 PROJECT DESCRIPTION

The work involves up gradation of Malerkotla - Sangrur road which lies in Sangrur district. The length of Project road is 33 km. There are 9 minor bridges on the road out of which 4 bridges are proposed to be widened concentrically and 5 additional 2-lane bridges are also being proposed. The present carriageway width varies from 6.7 to 7.0 m. The Index Map of project road is shown in Fig. 1.1.

1.2 PROJECT INTERVENTIONS

The following activities are proposed to be carried out as detailed in Table 1.1 and 1.2. Typical Cross sections are shown in Figure 1.1 to 1.3 at the end of the chapter.

**Table 1.1: Proposed activities of Corridors
Malerkotla-Dhuri-Sangrur Road**

Sl. No.	Description (Dimensions in meter)	Applicable Design Chainage (km)	Reference	Remarks
1	Carriageway 2x3.5 Paved Shoulder 2x2.5m Earthen Shoulder 2x1m	km 45.00 to km 47.096 km 47.451 to km 50.700 km 51.645 to km 54.625 km 54.977 to km 57.020 km 58.128 to km 59.428 km 59.729 to km 64.595 km 64.956 to km 74.098 km 74.375 to km 77.250	Drg. No. PRBDB/ MAL-SAN /TCS/2/3/R2	Upgradation of Two lane carriageway
2	Carriageway 2x7.25m Paved Shoulder 2x2.5m Earthen Shoulder 2x1m Median 1.5m	km 47.096 to km 47.451 km 50.700 to km 51.645 km 54.625 to km 54.977 km 59.428 to km 59.729 km 74.098 to km 74.375	Drg. No. PRBDB/ MAL-SAN /TCS/1/3/R2	Upgradation of Two lane to 4 lane with side widening
3	Carriageway 2x7.25 Paved Shoulder 2x2.5m Earthen Shoulder 2x1m Median 1.5m	km 57.020 to km 58.128 km 64.595 to km 64.956	Drg. No. PRBDB/ MAL-SAN /TCS/3/3/R2	Upgradation of Two lane to 4 lane with concentric widening

Fig. 1.1 Index Map





1.3 ENVIRONMENT IMPACT ASSESSMENTS IN THE PROJECTS

Environment Impact assessment has been carried out on the basis of recommendation of screening study carried out by M/S CES Pvt. Ltd. The Project component has been categorized as "Cat A". The Project involves widening to 2-lane carriageway with Hard and Earthen Shoulders and construction of five new additional two-lane bridges and concentric widening of four bridges. The project involves 32.248 Ha. of land acquisition. On the basis of recommendations/findings from the environment screening and scoping exercise, an EIA study was suggested for works involving land acquisition and impact on some roadside resources. In line with the said requirement an Environment Impact Assessment along with preparation of an Environment Management Plan has been carried out. This reports presents the corridor specific Environment Management Plan developed for Malerkotla- Dhuri- Sangrur road.

1.4 ENVIRONMENT MANAGEMENT PLAN

1.4.1 Scope

An Environment Management Plan has been developed on the basis of screening report of CES and further studies carried out by ICT Pvt. Ltd.

The Environmental Management Plan (EMP) consist of the set of mitigation, monitoring and institutional measures to be taken during the design, construction and operation stages of the project to eliminate adverse environmental impacts, to offset them, or to reduce them to acceptable levels. The plan also includes the actions, needed for the implementation of these measures.

The major components of the Environmental Management Plan are:

- Mitigation of potentially adverse impacts;
- Monitoring during project implementation and operations;
- Institutional Capacity Building and Training;
- Implementation Schedule and Environmental Cost Estimates;
- Integration of EMP with Project planning, design, construction and operation.
- Environment Enhancement Measures

1.4.2 Objectives of the EMP

The main aim of the Environmental Management Plan is to ensure that the various adverse impacts associated with the project are properly mitigated. The objectives of the EMP at various stages of the project planning and implementation are as follows.

Design Stage

- To have minimum impact on roadside trees, forests and ground cover;
- To keep land acquisition and building demolition at a minimum;
- To provide maximum safety to the highway user and road side communities as well as segregation of local and slow moving traffic in the congested areas, by preparing road designs to meet these needs;
- To develop a design that incorporates environmental safeguards and
- To define mitigative measures that effectively reduce all expected environmental degradation to an acceptable level.

Construction Stage

- To prevent and reduce the negative environmental impacts of the project by implementable, economically feasible mitigation measures, to be carried out by the Contractor.
- To ensure that the provisions of the EMP are strictly followed and implemented by strengthening implementation arrangements.

Operation Stage

- To prevent deterioration of environment components of air, water, soil, noise etc;
- To improve the safety of the highway users and road side communities

1.4.3 Meeting the EMP Objectives

The following are the key areas to make the Environment Management Plan effective into the ground.

a) *Environmental health, safety and social impacts*

To improve the environmental conditions, including areas such as environmental health, safety and social impacts, measures have been included as part of the EMP.

b) *Constant dialogue with the public and interested stakeholders*

The community consultation process was carried out right from the inception stage of the project. Continuous dialogue with local inhabitants and stakeholders including public agencies has been established on various environmental issues to obtain their feedback. Consultation would continue throughout the implementation stage of project.

c) *Training*

For the effective implementation of the EMP measures proposed, sustainable institutional arrangements have been proposed. To educate and train the CMU, the personnel of the Technical Assistance Consultants and the Contractor, an extensive training schedule has been worked out as part of the EMP. The training programme will be implemented as per the schedule proposed.

d) *Legal requirements*

The legal clearance and permits those are necessary or mandatory for the commencement of the project will be met. The conditions stipulated by the various statutory authorities such as the State Pollution Control Boards, State Forest Department, Ministry of Environmental and Forest (MoEF), etc. will be complied with.

1.5 CLEARANCE REQUIREMENTS FOR THE PROJECT

The various Clearances required for highway project and their applicability viz this project is given in **Table 1.3**.

Table 1.2: Check List For Statuary Clearances Required

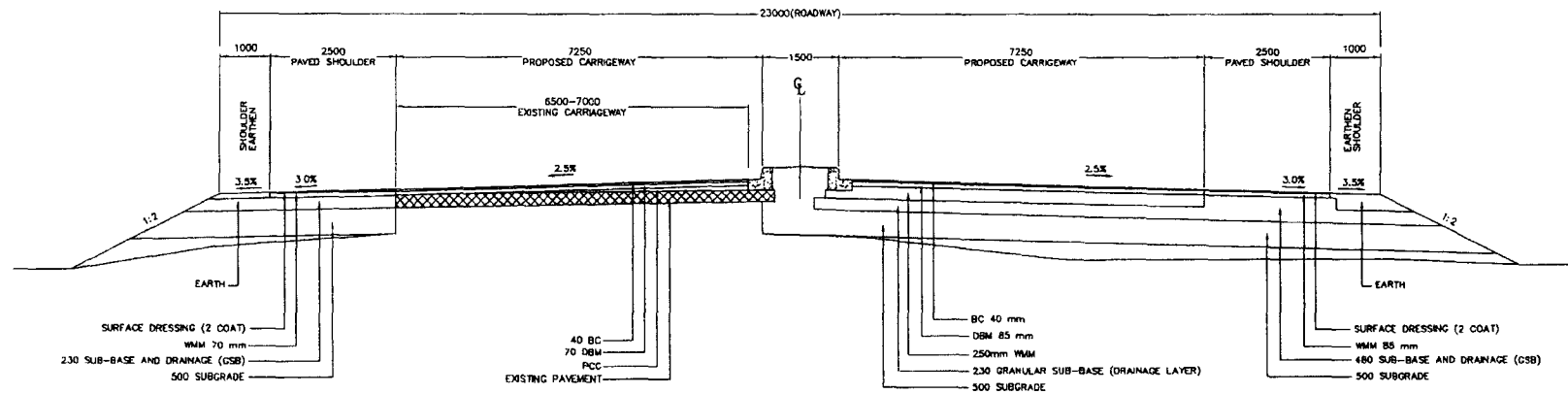
Sl. No.	Clearances	Acts	Approving Agency	Applicability to the Project	Time Required	Responsibility	
						Execution	Supervision
PROJECT PREPARATION STAGE							
1	No Objection Certificate	Water (Prevention and Control of Pollution) Act 1974, Air (Prevention and Control of Pollution) Act 1981	Punjab Pollution Control Board	✓	3 months	"EO PRBDB"	Project Director PRBDB
2	Environment Clearance	Environment Protection Act 1986	Ministry of Environment and Forest New Delhi	×	-		
3	Wild Life Clearance	Wild Life Act 1972	Hon'ble Supreme Court	×	-		
4	Diversion of forest land and Permission for felling of trees	Forest Conservation Act (1980)	Regional Office MoEF Chandigarh	✓	6 months	"EO PRBDB"	Project Director PRBDB
PROJECT IMPLEMENTATION STAGE							
5	Permission for Withdrawal of Ground Water	Environment Protection Act 1986	Central Ground Water Board	×	-	CONTRACTOR	CMU (PRBDB)
6	Permission for Withdrawl 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	To the Extent Possible Ground Water will be used, However where unavoidable after taking consent from CMU (PRBDB) Surface water may be used	2 months	CONTRACTOR	CMU (PRBDB)
7	NOC from Archaeological Survey of India	The Ancient Monument and Archaeological sites and Remains Act 1958.	Department of Archaeology Govt. of Punjab	×	-		

Introduction

Sl. No.	Clearances	Acts	Approving Agency	Applicability to the Project	Time Required	Responsibility	
						Execution	Supervision
8	Permission for Sand Mining from river bed	Punjab Mines and Minerals Concession Rules 1969	River Board Authorities/ Department of Mining Govt. of Punjab	✓	-	CONTRACTOR	CMU (PRBDB)
9	Permission for Opening of New Quarry	Punjab Mines and Minerals Concession Rules 1969	Department of Mining Govt. of Punjab / Punjab Pollution Control Board	✓	-	CONTRACTOR	CMU (PRBDB)
10	Hot mix plant, Crushers, Cement Batching Plant	Air (Prevention and Control of Pollution) Act 1981	Punjab Pollution Control Board	✓	3 months	CONTRACTOR	CMU (PRBDB)
11	Storage of Hazardous Chemicals	Hazardous Waste (Management and Handling) Rules 1989 and Manufacturing Storage and Import of Hazardous Chemicals Rules 1989	Punjab Pollution Control Board	✓	3 months	CONTRACTOR	CMU (PRBDB)
12	Disposal of Hazardous Waste	Hazardous Waste (Management and Handling) Rules 1989	Punjab Pollution Control Board	✓	2 months	CONTRACTOR	CMU (PRBDB)
13	Disposal of Construction Waste and liquid effluent from Labor camps	Water (Prevention and Control of Pollution) Act 1974	Punjab Pollution Control Board	✓	2 months	CONTRACTOR	CMU (PRBDB)
15	Pollution Under Control Certificate	Central Motor and Vehicle Act 1988	Department of Transport, Govt. of Punjab	✓	2 months	CONTRACTOR	CMU (PRBDB)
16	Employing Labour	Executing Agency of Building and other construction act, 1996	District Labour Commissioner	✓	1 week	CONTRACTOR	CMU (PRBDB)
17	Registration of Workers			✓	-	CONTRACTOR	CMU (PRBDB)

•••

Fig-1.2: Cross Section upgradations



APPLICABLE CHAINAGES :-

1. Km 47.096 TO Km. 47.451
2. Km 50.700 TO Km. 51.645
3. Km 54.625 TO Km. 54.977
4. Km 59.428 TO Km. 59.729
5. Km 74.098 TO Km. 74.375

NOTES:-

1. ALL DIMENSION ARE IN mm.

ACRONYMS:-

- BC : BITUMINOUS CONCRETE
- DBM : DENSE BITUMINOUS MACADAM
- PCC : PROFILE CORRECTIVE COURSE
- WMM : WET MIX MACADAM
- GSB : GRANULAR SUBBASE

Fig-1.3: Cross Section upgradations

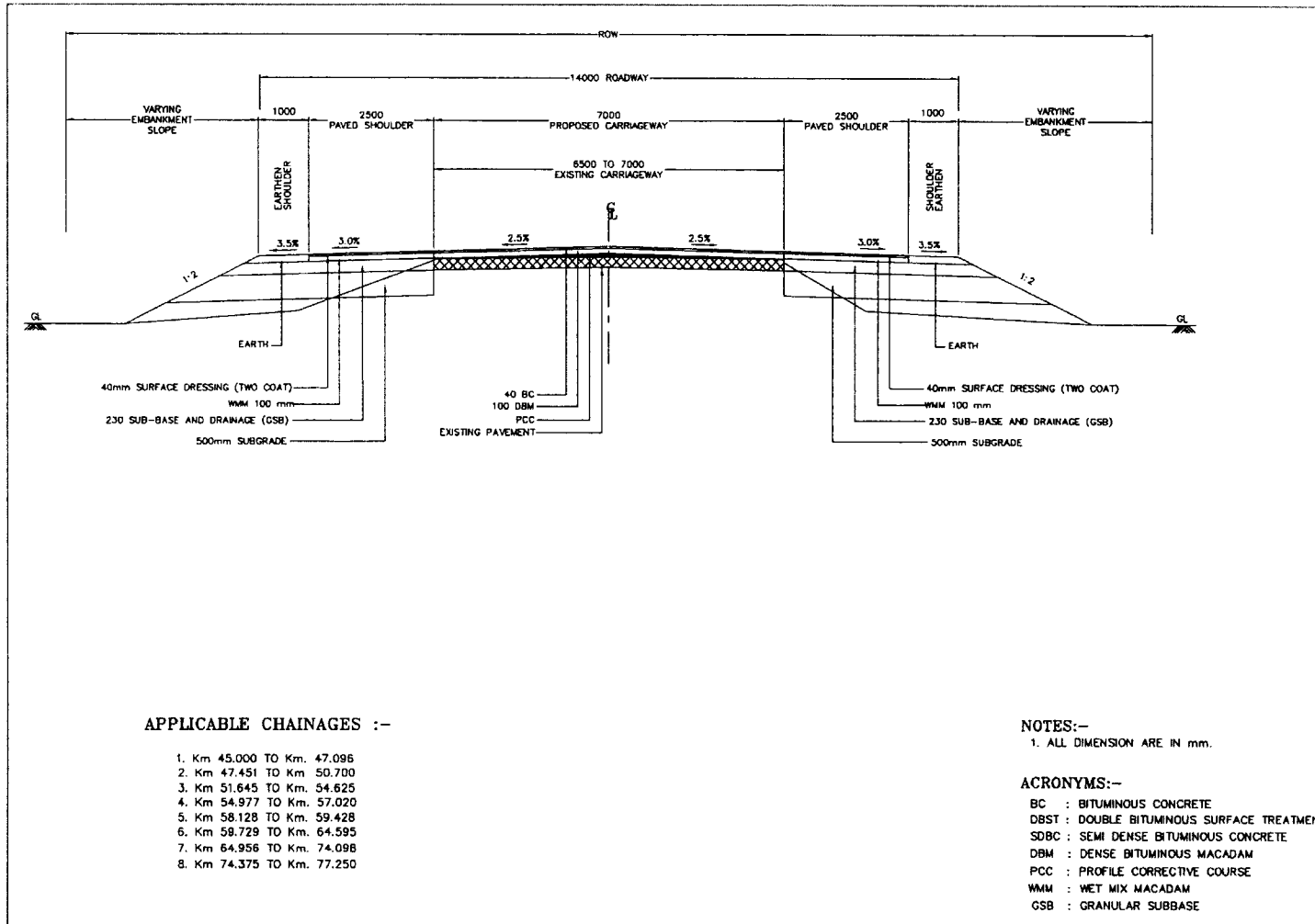
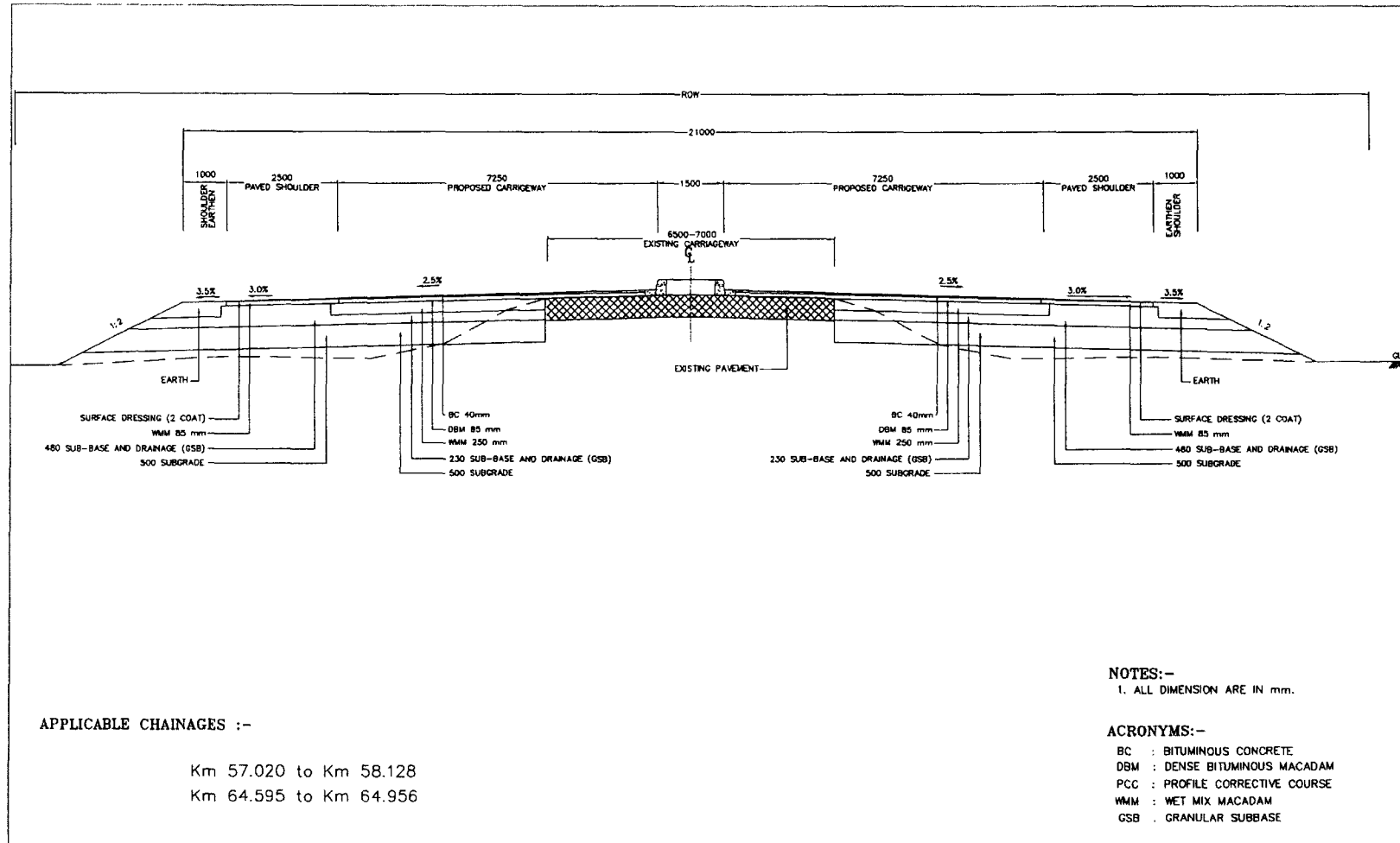


Fig-1.4: Cross Section upgradations





**Baseline and
Impacts Summary**



2. BASELINE AND IMPACT SURVEY

2.1 INTRODUCTION

The baseline and impacts summary is based on the screening report and further studies carried out by M/s ICT Pvt. Ltd. Corridor specific baseline and impacts summary on Physical, Biological and Socio Cultural environment is presented below. The chainagewise details of physical, biological and Socio Cultural environment is given in Annexure 2.1, 2.2 and 2.3 respectively. Table 2.2 summarizes the impacts on different parameters due to the project activities

2.2 PHYSICAL ENVIRONMENT¹

The topography of the area is slightly undulating and general slope is Southwest and altitude varies from 241 to 238m above MSL in Malerkotla-Dhuri and 229 to 235m above MSL in Dhuri-Sangrur. The soil type is Seriozens in Malerkotla-Dhuri and mainly Seriozens and partly loamy soils in Sangrur. The geology of the area is quaternary alluvial deposits. All parameters monitored are within permissible limits for agriculture use. (Refer Annexure 2.1 A for details).

The soil of the area may be impacted because of construction activities, movement of heavy vehicles and Borrow areas. Topography of the area will not be altered, as embankment height is not being raised.

2.2.1 Water Resources

7 irrigations canals and 2 drains are crossing the road (Refer Annexure 2.1 B for details). There are 10 hand pumps, 2 ponds along the road out of which one is used for fish breeding and other is used for disposal of waste water . (Refer Annexure 2.1 C for details). There are 35 deep tube wells along the road (Refer Annexure 2.1 D for details). The surface water and ground water quality was monitored along the road and all parameters monitored were found to be within. Permissible limits. (Refer Annexure 2.1 E for monitoring result and Fig. 2.1 for monitoring locations). The aquifer type is unconfined. The annual average rainfall along the road is 400-500mm. The depth of water table varies from 30.0 to 40.0 mbgl (Pre Monsoon) and (20.0 to 25.0 mbgl) (Post Monsoon).

**Major Issues along
Malerkotla-Dhuri-Sangrur Road**

- Surface water Pollution
- Loss of Hand Pumps
- Impact on Religious Properties and Schools
- Road Safety

During construction 6 hand pumps will need relocation (Refer Annexure 2.1 F for details) Water quality of two ponds, 7 irrigation canals and two drains may degrade and Surface water bodies may be subjected to siltation due to their close proximity to project road. Obstruction to flow may occur during construction due to appendages thrown in these bodies during construction. Problem of water logging, overtopping may increase during construction.

During operation problem of overtopping and water logging will not be there and aesthetics of surface water body will be enhanced.

2.2.2 Air Quality

The air quality was monitored at four locations and all parameters except SPM and RSPM were found to be within permissible limits (Refer Annexure 2.1 G for monitoring results) and Fig. 2.2 for monitoring location. The high level of SPM and RSPM may be due to presence of tractor trolley combination which is a slow moving combination and it was

¹ Annexure 2.1 for Chainage wise details of Physical Resources

observed during site visits that very often they have to go on berms to given way to fast moving vehicles. The emissions from tractor trolley is also very high

During construction air quality may deteriorate due to construction activities, fugitive emissions, whereas during operation stage air quality will improve due to smooth riding surface and uninterrupted flow of traffic.

2.2.3 Noise Level

The noise levels were monitored at four locations and were found be higher at three locations. The noise levels may be higher due to mixing of slow & fast moving traffic. (Refer Annexure 2.1 H for monitoring results and Fig. 2.2 for monitoring locations).

Noise levels may increase during construction due to construction activities and movement of Heavy vehicles and machineries.

During operation Noise Levels will come down considerably due to Smooth riding surface and uninterrupted flow of traffic.

2.3 NATURAL ENVIRONMENT²

Total 12,675 nos. of trees exists in ROW. Roadside plantation along the road has been declared as protected forests and attracts provision of forest conservation Act 1980. Approximately 73 hectare of protected forest exists on both side of the road. There are six stretches along the road where green tunnel exists (Refer Annexure 2.2 A for Details). Pre-dominant species along the road are Dek, Sisham, Sohtoot, Babool Eucalyptus and Neem. No rare and endangered fauna has been reported in the area.

Total 770 numbers of trees will be felled (Refer Annexure 2.2 B for details) in the process of up gradation of road. The numbers of trees are not substantial in numbers so, no major impact is envisaged. 29.54 hectare of roadside protected forestland will require diversion due to the project.

2.4 SOCIO CULTURE ENVIRONMENT³

The project corridor is passing through 9 Settlements (Refer Annexure 2.3 A for details). There are 13 Religious properties (Refer Annexure 2.3 B for details) 10 Educational Institution (Refer Annexure 2.3 C for details) and 9 Industries (Refer Annexure 2.3 D for details). along the road. The land use along the road is Pre-dominantly agriculture (56%), Built-up area 33%, Commercial area (10%) and Industrial area. (1%). The road is passing through many residential areas and road safety is not good along the road.

Around 32.248 Ha, of land will be required. During construction the environment along these settlements may degrade, Road safety may deteriorate and access to religious structures and educational institution may be disrupted. Additional stress on existing community because of establishment of labor camp may take place. No impact on Land use pattern is envisaged.

During operations Road safety will improve especially access to educational institutions.

2.5 IMPACT MATRIX

The impact of various activities has been given in **Table 2.1**.

² Annexure 2.2 for chainagewise details of Natural Environment

³ Annexure 2.3 for chainagewise details of Socio Culture Environment

Fig. 2.1 Water Quality Monitoring locations along the Project road

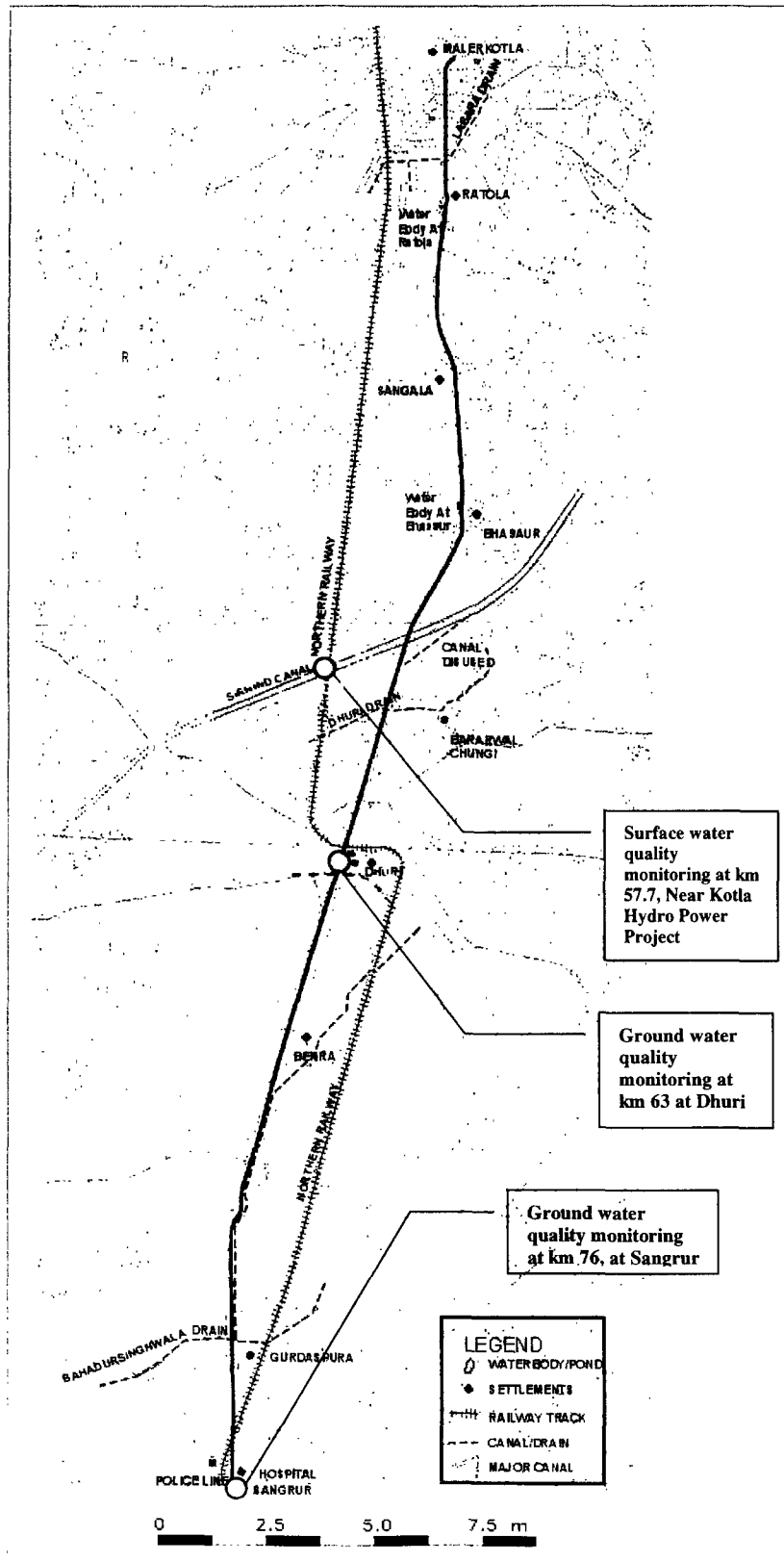




Fig-2.2: Location of Air and Noise Quality Monitoring

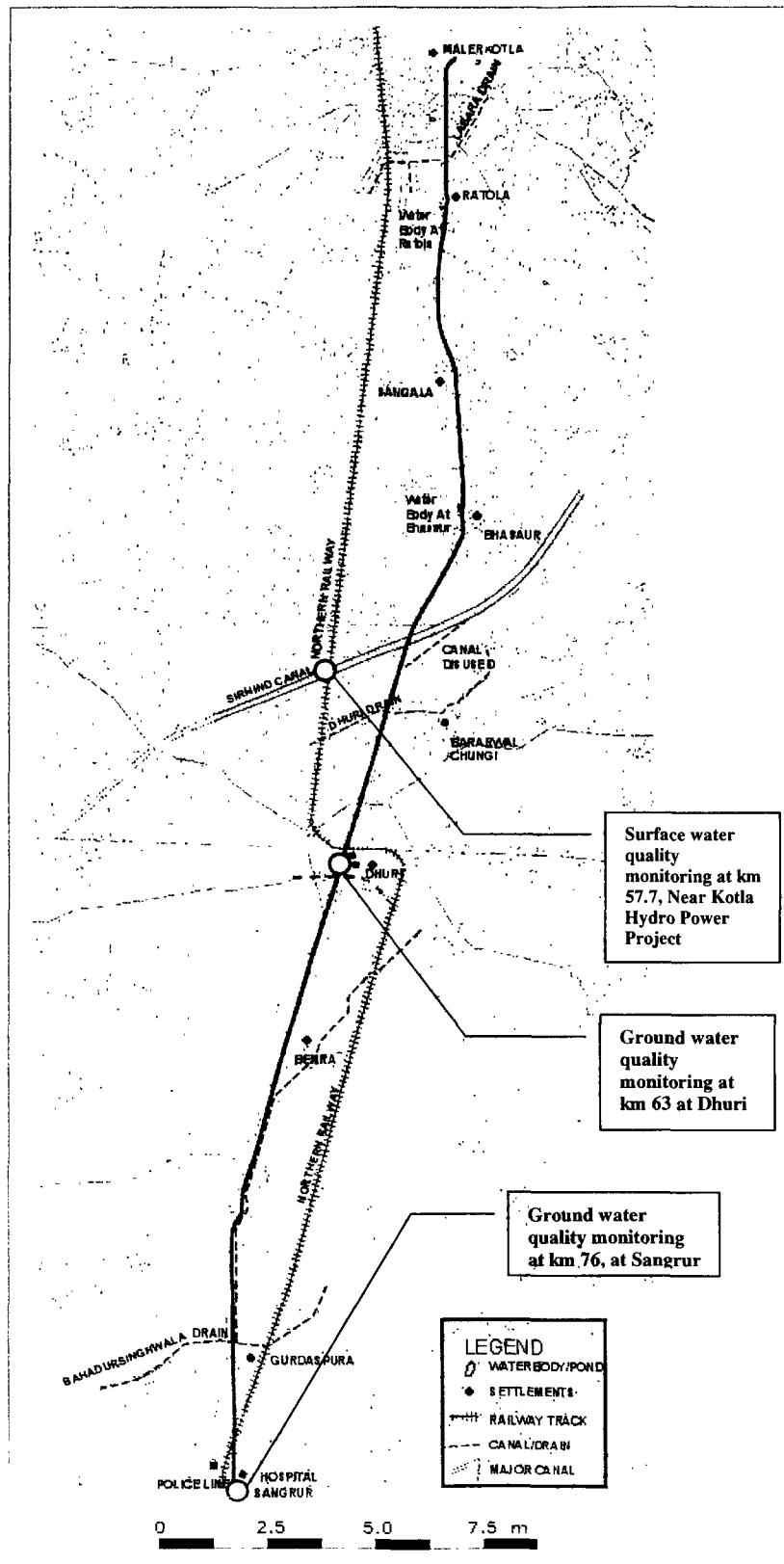




Table 2.1: Impacts Matrix

Sl. No.	Activity	Magnitude			Reversible	Irreversible	Nature		Positive	Negative	Direct	Indirect
		Low	Medium	High			Long Term	Short Term				
1	Land Acquisition	✓				✓	✓			✓	✓	✓
2	Relocation of Common Utilities and Common Property Resources	✓			✓			✓		✓	✓	
3	Relocation of Affected Properties	✓				✓		✓		✓	✓	
4	Construction Camps and Storage Areas		✓		✓			✓		✓	✓	
5	Disposal Locations		✓		✓			✓		✓	✓	
6	Borrow Areas		✓		✓			✓		✓	✓	
7	Quarries		✓		✓			✓		✓	✓	
8	Hot Mix / Cement Batching Plant		✓		✓			✓		✓	✓	
9	Temporary Arrangement of Land		✓		✓			✓		✓	✓	✓
10	Arrangement for Construction Water	✓			✓			✓		✓	✓	✓
11	Arrangement of Labor		✓					✓			✓	✓
12	Clearing of Site	✓			✓		✓			✓	✓	
13	Felling of Trees	✓			✓		✓			✓	✓	✓
14	Traffic Management During Construction		✓					✓			✓	
15	Labor Camp	✓			✓			✓		✓	✓	✓
16	Plantation		✓				✓		✓		✓	✓

Note: Categoration of Low Medium High has been done on recommendation of CES Screening Report

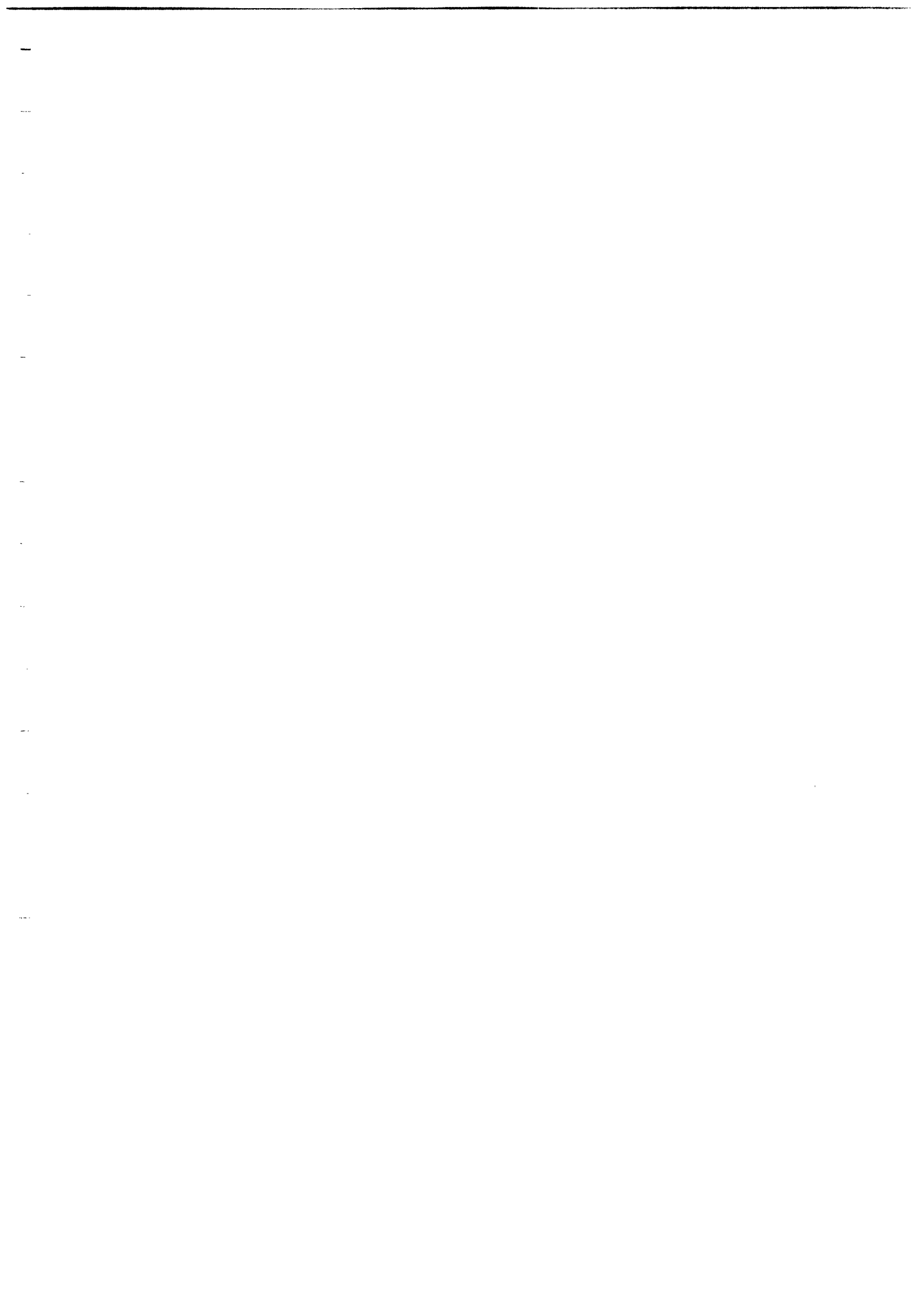


Table 2.2 Summary of Impact

S. No.	Parameter	Details
	Negative Impacts	
1	Hand Pumps Relocation (Nos.)	6
2	Diversion of land (ha.)	32.248
3	Borrow Earth (Cum)	187866.00
4	Quarry Material (Cum)	248105.00
5	Water (kL)	11733
6	Nos of trees to be felled (Nos)	1532
	Positive Impacts	
	Enhancement sites	
A	Cultural/Religious Properties	2
B	Surface water body	1
C	Educational Institute	1
D	Safe Access to educational institution	10
E	Enhancement of Bus bays	14
F	Village gates	2
H	Sitting Arrangement	4
I	Wall Noise Barrier	1
J	Four Lane section (m)	3699
	Mitigation Measures	
A	Silt fencing	
	i) Numbers	4
	ii) Metre	20
B	Debris reuse (Cum)	159000
C	Compensatory Afforestation (Ha)	29.54
D	Net Present Value (Rs)	2,71,76,800



S. No.	Parameter	Details
E	Traffic Calming Measures (Nos)	21
F	Drains (km)	60.15
G	Combined oil and Sedimentation chambers (Nos)	2
H	Oil interceptors at Vehicle parking Areas (Nos)	3
	Road safety Measures	
A	Major junction improvement (nos.)	4
B	Rotary Junction Improvements (nos.)	1
C	Intersections (nos.)	31
D	Bus Bays (nos.)	14
E	Pedestrian Crossing (locations)	6
F	Street lighting (locations)	3
G	Signage (nos.)	
	i) Intersection Signs	152
	ii) Sign on Side roads	170
	iii) School Signs	6
	iv) Place identification Sign	18
H	Traffic calming measures (locations)	15
I	Drain (length in Km)	78.14
J	Four lane sections (length in Km)	3.699
K	Crash Barriers / Gaurdrail (locations)	4
L	Crash Barriers / Gaurdrail (length in m)	1552



Environmental Management Plan

3



**Environmental Management Plan
(General)**

3



3. ENVIRONMENTAL MANAGEMENT PLAN

A description of the various management measures suggested during different stages of construction / rehabilitation of road and bridges is provided in **Table 3.1 and Table 3.2** respectively.

3.1 PRE-CONSTRUCTION STAGE

3.1.1 Pre-construction activities by CMU/Supervising Consultant

Prior to the contractor mobilization, the CMU will ensure that an encumbrance free Corridor of Impact is handed over to enable the start of construction. Clearance involves the following activities:

- Removal and felling of trees is very minimal
- Relocation of common property resources and community assets like telephone poles, electric poles and hand pumps will be impacted.
- Formal arrangements for maintenance of enhancement sites. This includes plantation of trees and barricades along the road.
- Modification (if any), of the contract documents by the Engineer of the Supervision Consultant.

3.1.2 Pre-construction activities by Contractor

- Pre-construction stage involves mobilisation of the contractor and the activities undertaken by the contractor pertaining to the planning of logistics and site preparation necessary for commencing construction activities. The activities include:
- Joint field verification of EMP by the Environment Specialist of the Supervision Consultant and Contractor.
- Identification and selection of material sources (quarry and borrow material, water, sand etc).
- Procurement of construction equipment / machinery such as crushers, hot mix plants, batching plants and other construction equipment and machinery.
- Selection, design and layout of construction areas, hot mix and batching plants, labour camps etc.
- Apply for and obtain all the necessary clearances from the agencies concerned.
- Planning traffic diversions and detours including arrangements for temporary land acquisition.

3.2 CONSTRUCTION STAGE

3.2.1 Construction activities by the Contractor

Construction stage is the most crucial stage in terms of activities that require careful management to avoid environmental impacts.

There are several other environmental issues that have been addressed as part of good engineering practices, the costs for which has been accounted for in the Engineering Costs. They include providing roadside drainage, provision of cross drainage structures etc.

3.2.2 Construction activities by the CMU/Supervising Consultants

The CMU/Supervising Consultant shall be involved in the smooth execution of the project and assisting the contractor during this phase. Their work shall include but not limited to:

- Monitoring and guiding the contractor on adopting good environmental and engineering practices.
- Arrangement of plantation through the Forest Department
- Arranging training to the contractor and other stakeholders according to the needs arising.
- Making changes in the design if need so arises.

3.3 OPERATION STAGE

The operational stage involves the following activities by CMU:

- Monitoring of environmental conditions through approved monitoring agency.
- Monitoring of operational performance of the various mitigation/enhancement measures carried out.

Table 3.1: Generic Environmental Management Plan

PRE-CONSTRUCTION STAGE					
Pre-construction activities by Contract Management Unit					
P.1	Land Acquisition	<p>The acquisition of land and private properties will be carried out in accordance with the RAP and entitlement framework for the project.</p> <p>It will be ensured that all R & R activities including implementation of Environment Management Plan are completed before the start of work.</p> <p>CMU has to ascertain that any additional environmental impacts resulting from acquisition of land are addressed and integrated into the EMP and other relevant documents.</p>	LA Act 1984 and its amendments, PRBDB	CMU, Revenue Dept., NGOs, Collaborating Agencies	Engineer
P.2	Preservation of Trees	<p>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.).</p> <p>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.</p> <p>Particular species declared as 'protected' by the State's Forest Dept. in the private land will be felled only after due clearance from the Forest Dept./ concerned agencies is obtained.</p> <p>In the event of design changes, additional assessments including the possibility to save trees shall be made.</p> <p>Stacking, transport and storage of the wood will be done as per the relevant norms.</p> <p>Systematic corridor level documentation for the trees cut and those saved will be maintained with 'EO PWD/ PRBDB.</p>	<p>Clause No. 201.2 MORT&H Specifications for Road and Bridge works Annexure 2.2 B</p>	CMU, Forest Department, Contractor	Engineer, EO PRBDB, EO SC.

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. The CMU will relocate these properties in consultation and written agreement with the agency/owner/community. Environmental considerations with suitable/required actions including health and hygiene aspects will be kept in mind while relocating all community utilities and resources.	RAP Annexure 2.1F	CMU, Concerned Agencies, Contractor	Engineer
P.4	Orientation of Implementing Agency and Contractors	The CMU 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 all staff of Supervision Consultants, field level implementation staff of CMU and Contractor, Environmental Experts of SCs and Contractors. The contractor will ensure that his staff including engineers, supervisors and operators attend the training sessions.		Contractor	Engineer, EO PRBDB, EO SC.
Pre-construction activities by the Contractor/Environmental Expert of Supervision Consultants (SC)					
P.5	Field Verification and Modification of the Contract Documents				
P.5.1	Joint Field Verification	The Environmental Expert of SC 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 SC	Engineer, EO CMU, EO PRBDB

P.5.2	Assessment of Impacts due to Changes/Revisions/Additions in the Project Work	The Environmental Expert of SC 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 SC	Engineer, EO PRBDB
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 SC 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 " EO PRBDB/ PWD through Supervision Consultant. 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.	Clause No 111.1 MoRT&H Air (P&CP) Act 1981	Contractor	Engineer, EO SC
P.5.4	Other Construction Vehicles, Equipment and Machinery	All vehicles, equipment and machinery to be procured for construction will conform 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 equipments 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 the edge of the equipment in free field, as specified in the Environment (Protection) Rules, 1986.		Contractor	Engineer, EO SC

		<p>The Contractor shall maintain a record of PUC for all vehicles and machinery used during the contract period, which shall be produced for EO SC and EO PRBDB/ PWD's verification whenever required.</p> <p>Mobile equipment shall be placed at least 100metres away from the nearest dwelling.</p>			
P.6	Identification and Selection of Material Sources				
P.6.1	Borrow Areas	<p>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.</p> <p>The Contractor will not start borrowing earth from select borrow area until the formal agreement is signed between landowner and contractor and a copy is submitted to the " EO PRBDB/ PWD through the Engineer.</p>	<p>Clause No. 111.2 & 305.2.2 MORT&H Specifications for Road and Bridge works</p> <p>Guideline-V Guidelines for Borrow Area Management).</p>	Contractor	Engineer, EO SC, EO PRBDB
		<p>Locations finalized by the contractor shall be reported to the Environmental Expert of SC and who will in turn report to CMU.</p> <p>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 it as per Borrow Area Rehabilitation Guidelines) and will use the existing village roads wherever available.</p> <p>In addition to testing for the quality of borrow materials by the SC, the environmental personnel of the SC will be required to inspect every borrow area location prior to approval</p> <p>Format for reporting will be as per the Reporting Format for Borrow Area and will include a reference map. (Refer Chapter- 5 Monitoring Measures)</p> <p>The SC will make sure that each such site is in line with IRC and other Project Guidelines.</p>			

P.6.2	Quarry	<p>Contractor will finalize the quarry for procurement of construction materials after assessment of the availability of sufficient materials, quality and other logistic arrangements.</p> <p>In case the contractor decides to use quarries other than recommended by DPR consultants, then it will be selected based on the suitability of the materials and as per established law.</p> <p>The contractor will procure necessary permission for procurement of materials from Mining Department, District Administration and State Pollution Control Board and shall submit a copy of the approval and the rehabilitation plan to the "EO PRBDB/PWD through Engineer.</p> <p>Contractor will also work out haul road network and report to Environmental Expert of SC and SC will inspect and in turn report to "EO PRBDB/PWD before approval.</p>	Clause No. 111.3 & MORT&H Specifications for Road and Bridge works	Contractor	Engineer, EO SC.
P.6.3	Arrangement for Construction Water	<p>The contractor will use ground water as a source of water for the construction and can set up the own bore well facility for construction work.</p> <p>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 SC.</p> <p>To avoid disruption/disturbance to other water users, the contractor will extract water from fixed locations and consult the Environmental Expert of SC before finalizing the locations.</p> <p>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 EO SC prior to the finalization of these locations</p> <p>The contractor will not be allowed to pump from any irrigation canal and surface water bodies used by community.</p> <p>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 SC and "EO PRBDB/ PWD " prior to initiation of any construction work.</p>	Clause No. 1010 MORT&H Specifications for Road and Bridge works EP Act 1986	Contractor	Engineer

P.7	Labor Requirements	The contractor preferably will use unskilled labor drawn from local communities to give the maximum benefit to the local community.	F Special Conditions of Contract Section-3 Volume-I Conditions of Contract, Bidding Document	Contractor	Engineer
P.8	Construction Camp Locations – Selection, Design and Lay-out	Siting of the construction camps will be as per the guidelines. Locations identified by the contractor will be reported as per format. Construction camps will not be proposed within 500 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.	Guidelines II Guidelines for Siting and Layout of Construction Camp	Contractor	Engineer, EO SC, EO 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 Environment Expert of Supervision Consultant. The Environmental Expert of SC 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	Engineer
P.10	Implementation Information Meetings	The contractor will organize at least 2 implementation information meetings in the vicinity of Project Site (minimum one in each section) for general public to consult and inform people about his plans covering overall construction schedule, safety, use of local resources (such as earth, water), traffic safety and management plans of debris disposal, drainage protection, canal training work during construction,		Contractor	Engineer, EO PRBDB, EO SC

		<p>pollution abatement and other plans, measures to minimize disruption, damage and in convenience to roadside users and people along the road. The first Implementation information meeting be conducted within four weeks of mobilization. The people should be informed about the date, time and venue atleast 7 days prior to meetings. Public shall be informed about the meeting through display of posters at prominent public places (panchayat offices, offices of Market committees, Notice board of religious places etc.) and distribution of pamphlets along roadside communities or in any manner deemed fit. The contractor will maintain a channel of communication with the communities through his designated Environment and Safety Officer to address any concern or grievances. Periodic meetings will also be conducted during the construction period to take feedback from communities or their representatives to ensure minimum disturbance.</p> <p>The mechanism and contents for disclosure shall be approved by "EO PRBDB" prior to the meetings.</p>			
CONSTRUCTION STAGE					
Activities to be Carried Out by the Contractor					
C.1	Site Clearance				
C.1.1	Clearing and Grubbing	<p>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.</p> <p>Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works will be removed with prior approval from the Environmental Expert of SC.</p> <p>The Contractor under any circumstances will not cut trees other than those identified for cutting and for which he has written instructions from the CMU. The CMU will issue these instructions only after receiving all stages of clearances from the Forest Department/ MoEF.</p>	<p>Clause No. 201 MORT&H Specifications for Road and Bridge works Annexure 2.2 B Guideline-III Guidelines for Site Clearance</p>	Contractor	Engineer, EO PRBDB, EO SC

		<p>Vegetation only with girth of over 30 cm will be considered as trees and shall be compensated, in the event of CMU's instruction to undertake tree cutting.</p> <ul style="list-style-type: none"> ➤ 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. 			
C.1.2	Disposal of debris from dismantling structures and road surface	<p>The contractor shall identify disposal sites. The identified locations will be reported to the Environmental Expert of SC. These locations will be checked on site and accordingly approved by Environmental Expert of SC prior to any disposal of waste materials.</p> <p>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 approved and directed by the Environmental Expert of SC.</p> <p>The pre-designed disposal locations will be a part of Comprehensive Solid Waste Management Plan to be prepared by Contractor in consultation and with approval of Environmental Expert of SC.</p> <p>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.</p>	<p>Clause No. 201.4 MORT&H Specifications for Road and Bridge works Guideline-IV Guidelines for Disposal Site Management</p>	Contractor	Engineer, EO PRBDB, EO SC
C.1.3	Other Construction Wastes Disposal	<p>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 SC. Location of disposal sites will be finalized prior to initiation of works on any particular section of the road..</p>	<p>Clause No. 301.3.2 MORT&H Specifications for Road and Bridge works</p>	Contractor	Engineer, EO PRBDB, EO SC

		<p>The Environmental Expert of SC will approve these disposal sites after conducting a joint inspection on the site with the Contractor.</p> <p>Contractor will ensure that any spoils of material unsuitable for 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 the Environment Expert SC).</p> <p>Non-bituminous wastes other than fly ash may be dumped in borrow pits (preferably located in barren lands) covered with a layer of the soil. No new disposal site shall be created as part of the project, except with prior approval of the Environmental Expert of SC.</p> <p>All waste materials will be completely disposed and the site will be fully cleaned and certified by Environmental Expert of SC before handing over.</p> <p>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.</p>			
C.1.4	Stripping, stocking and preservation of top soil	<p>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:</p> <p>(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.</p>	Clause No. 301.2.2 MORT&H Specifications for Road and Bridge works	Contractor	Engineer, EO PRBDB, EO SC

		<p>(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 gunny bags or vegetation.</p> <p>(c) It will be ensured by the contractor that the topsoil will not be unnecessarily trafficked either before stripping or when in stockpiles.</p> <p>Such stockpiled topsoil will be utilized for -</p> <ul style="list-style-type: none"> ➤ 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. <p>Residual topsoil, if there is any will be utilized for the plantation at median and side of the main carriageway.</p>			
C.1.5	Accessibility	<p>The contractor will provide safe and convenient passage for vehicles, pedestrians and livestock to and from roadsides and property accesses connecting the project road, providing temporary connecting road.</p> <p>The Contractor will take care that Schools and religious places are accessible to Public. The contractor will also ensure that the work on / at existing accesses will not be undertaken without providing adequate provisions and to the prior satisfaction of Environmental Expert of SC.</p> <p>The contractor will take care that the cross roads are constructed in such a sequence that construction work over the adjacent cross roads are taken up one after one so that traffic movement in any given area not get affected much.</p>	Annexure 2.3 B & C	Contractor	Engineer, EO SC

C.1.6	Planning for Traffic Diversions and Detours	<p>Temporary diversions will be constructed with the approval of the Resident Engineer and Environmental Expert of SC for which contractor will seek prior approval for such plans.</p> <p>Detailed Traffic Control Plans will be prepared and submitted to the Resident Engineer for approval, seven days prior to commencement of works on any section of road. The traffic control plans shall contain details diversions; traffic safety arrangement during construction; safety measures for night – time traffic and precautions for transportation of hazardous materials. Traffic control plans shall be prepared in line with requirements of IRC’s SP- 55 document and The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow.</p> <p>The contractor will also inform local community of changes to traffic routes, conditions and pedestrian access arrangements with assistance from SC and CMU. The temporary traffic detours will be kept free of dust by sprinkling of water three times a day and as required under specific conditions (depending on weather conditions, construction in the settlement areas and volume of traffic).</p>	<p>Clause No. 112 MORT&H Specifications for Road and Bridge works IRC; SP 55 Guideline-VII Guidelines for Traffic management during construction attached as</p>	Contractor	Engineer, EO PRBDB, EO SC
C.2 Procurement of Construction Material					
C.2.1	Earth from Borrow Areas for Construction	<p>No borrow area will be opened without permission of the Environmental Expert of SC. The location, shape and size of the designated borrow areas will be as approved by the Environmental Expert of SC and in accordance to the IRC recommended practice for borrow pits for road embankments (IRC 10: 1961). The borrowing operations will be carried out as specified in the guidelines for siting and operation of borrow areas.</p> <p>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 twice a day to control dust along such roads during their period of use.</p>	<p>Clause No. 305.2.2 MORT&H Specifications for Road and Bridge works Guideline-V Guidelines for Borrow areas management</p>	Contractor	Engineer, EO PRBDB, EO SC

		<p>During dry seasons (winter and summer) frequency of water sprinkling will be increased in the settlement areas and Environmental Expert of SC will decide the numbers of sprinkling depending on the local requirements.</p> <p>Contractor will rehabilitate the borrow areas as soon as borrowing is over from a particular borrow area in accordance with the Guidelines for Redevelopment of Borrow Areas or as suggested by Environmental Expert of SC.</p> <p>The final rehabilitation plans will be approved by the EO from the Supervision Consultants team.</p>			
C.2.2	Quarry Operations	<p>The contractor shall obtain materials from quarries only after the consent of the Department of Mining / PPCB / District Administration or will use existing approved sources of such materials. Copies of consent/ approval/ rehabilitation plan for opening a new quarry or use of an existing quarry source will be submitted to Environment Expert SC and the Resident Engineer.</p> <p>The contractor will develop a Comprehensive Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy to CMU and SC prior to opening of the quarry site.</p> <p>The quarry operations will be undertaken within the rules and regulations in force in the state.</p>	<p>Clause No. 111.3 MORT&H Specifications for Road and Bridge works Guidelines for Quarry Management</p>	Contractor	<p>Engineer, EO PRBDB, EO SC</p>
C.2.3	Transporting Construction Materials and Haul Road Management	<p>Contractor will maintain all roads (existing or built for the project), which are used for transporting construction materials, equipment and machineries as précised. All vehicles delivering fine materials to the site will be covered to avoid spillage of materials.</p> <p>All existing highways and roads used by vehicles of the contractor 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.</p> <p>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.</p>		Contractor	<p>Engineer, EO PRBDB, EO SC</p>

		The unloading of materials at construction sites/close to settlements will be restricted to daytime only.			
C.2.4	Construction Water	<p>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 'EO PRBDB' through the Engineer.</p> <p>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 'EO PRBDB' through the Engineer.</p> <p>prior to initiation of construction.</p> <p>The contractor will take all precaution to minimize the wastage of water in the construction process/ operation.</p>	Clause No. 1010 EP Act 1986 MORT&H Specifications for Road and Bridge works	Contractor	Engineer
C.3	Construction Work				
C.3.1	Disruption to Other Users of Water	<p>While working across or close to any perennial water bodies, contractor will not obstruct/ prevent the flow of water.</p> <p>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.</p> <p>The contractor will take prior approval of the River Authority or Irrigation Department or SC for any such activity. The CMU and the Engineer will ensure that contractor has served the notice to the downstream users of water well in advance.</p>	Annexure 2.1C	Contractor	Engineer, EO SC
C.3.2	Drainage	Contractor will ensure that no construction materials like earth, stone, ash or appendage is disposed off in a manner that blocks the flow of water of any water course and cross drainage channels. Contractor will take all-necessary measures to prevent any blockage to water flow. In	Clause No. 501.8.6 MORT&H Specifications for Road and Bridge	Contractor	Engineer, EO PRBDB, EO SC

		addition to the design requirements, the contractor will take all required measures as directed by the 'EO SC' and the 'Resident Engineer' to prevent temporary or permanent flooding of the site or any adjacent area.	works Annexure 3.2A		
C.3.3	Siltation of Water Bodies and Degradation of Water Quality	<p>The Contractor will not excavate beds of any stream/canals/ any other water body for borrowing earth for embankment construction.</p> <p>Contractor will construct silt fencing at the base of the embankment construction for the entire perimeter of any water body (including wells) adjacent to the RoW and around the stockpiles at the construction sites close to water bodies. The fencing will be provided prior to commencement of earthwork and continue till the stabilization of the embankment slopes, on the particular sub-section of the road. The contractor will also put up sedimentation cum grease traps at the outer mouth of the drains located in truck lay byes and bus bays which are ultimately entering into any surface water bodies / water channels with a fall exceeding 1.5 m. . At present there is no identified place for the provision of Sedimentation Cum Grease Trap, However the item has been kept in case need arises during construction.</p> <p>Contractor will ensure that construction materials containing fine particles are stored in an enclosure such that sediment-laden water does not drain into nearby watercourse.</p>	<p>Clause No. 501.8.6 MORT&H Specifications for Road and Bridge works Water (P & CP) Act 1981 Annexure 3.1</p>	Contractor	Engineer, EO PRBDB, EO SC
C.3.4	Slope Protection and Control of Soil Erosion	<p>The contractor will take slope protection measures as per design, or as directed by the Environmental Expert of SC to control soil erosion and sedimentation.</p> <p>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.</p> <p>Contractor will ensure the following aspects:</p>	<p>Clause No. 306 & 305.2.2 MORT&H Specifications for Road and Bridge works Guideline-IX Soil Erosion & Sedimentation</p>	Contractor	Engineer, EO PRBDB, EO SC

		<ul style="list-style-type: none"> ➤ During construction activities on road embankment, 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 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. 	Control)		
C.4	Pollution				
C.4.1	Water Pollution				
C. 4.1.1	Water Pollution from Construction Wastes	<p>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.</p> <p>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.</p>	Clause No. 501.8.6 MORT&H Specifications for Road and Bridge works Water (CP & CP) Act 1981	Contractor	Engineer, EO PRBDB, EO SC
C.4.1.2	Water Pollution from Fuel and Lubricants	<p>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.</p> <p>All location and layout plans of such sites will be submitted by the</p>	Clause No. 501.8.6 MORT&H Specifications for Road and Bridge works	Contractor	Engineer, EO PRBDB, EO SC

		<p>Contractor prior to their establishment and will be approved by the 'EO, PRBDB/ PWD'.</p> <p>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.</p> <p>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.</p> <p>Contractor will arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites (list to be submitted to SC and CMU) and approved by the Environmental Expert of SC. All spills and collected petroleum products will be disposed off in accordance with MoEF and state PCB guidelines.</p> <p>'EO SC and Resident Engineer' will certify that all arrangements comply with the guidelines of PCB/ MoEF or any other relevant laws.</p>	Water (CP & CP) Act 1981 Annexure 3.4		
C.4.1.3	Chemical Attack	<p>To limit the potential chemical attack the concrete foundation should contain minimum cement concrete of 330 kg/cc</p> <p>For Under water concrete 10% extra cement be used.</p> <p>Clear Concrete cover of minimum 75mm shall be provided to under water structures.</p>		Contractor	Engineer, EO PRBDB, EO SC
C.4.2	Air Pollution				
C.4.2.1	Dust Pollution	<p>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.</p>	Clause No. 111 & 501.8.6 MORT&H Specifications for Road and Bridge works	Contractor	Engineer, EO PRBDB, EO SC

		<p>All the plants will be sited at least 1 km in the downwind direction from the nearest human settlement.</p> <p>The contractor will provide necessary certificates to confirm that all crushers used in construction conform to relevant dust emission control legislation.</p> <p>The suspended particulate matter value at a distance of 40m from a unit located in a cluster should be less than 500 g/m³. The pollution monitoring is to be conducted as per the monitoring plan.</p> <p>Alternatively, only crushers licensed by the PSPCB shall be used. Required certificates and consents shall be submitted by the Contractor in such a case to the 'EO PRBDB' through the 'Engineer'.</p> <p>Dust screening vegetation will be planted on the edge of the RoW for all existing roadside crushers. Hot mix plant will be fitted with dust extraction units.</p>	Air (P & CP) Act 1974		
C.4.2.2	Emission from Construction Vehicles, Equipment and Machineries	<p>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.</p> <p>The Contractor will submit PUC certificates for all vehicles/equipment/machinery used for the project. Monitoring results will also be submitted to 'EO PRBDB' through the 'Engineer'.</p>	<p>Clause No. 501.8.6 MORT&H Specifications for Road and Bridge works Air (P & CP) Act 1974 Central Motor & Vehicle Act 1988</p>	Contractor	Engineer, EO PRBDB, EO SC
C.4.3	Noise Pollution				
C.4.3.1	Noise Pollution: Noise from Vehicles, Plants and Equipments	<p>The Contractor will confirm the following:</p> <ul style="list-style-type: none"> ➤ All plants and equipment used in construction (including CMU, I aggregate crushing plant) shall strictly conform to the MoEF/CPCB noise standards. 	<p>Clause No. 501.8.6 MORT&H Specifications for Road and Bridge</p>	Contractor	Engineer, EO PRBDB, EO SC

	<ul style="list-style-type: none"> ➤ 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 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 machinery shall be regular to keep noise levels at the minimum. ➤ At the construction sites within 150 m of the nearest habitation, noisy construction work such as crushing, concrete mixing, batching will be stopped during the night time between 9.00 pm to 6.00 am. <p>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.</p> <p>A noise barrier has been suggested at the end of Project Road For city hospital Sangrur by raising the height of existing Boundary wall .</p> <p>Monitoring shall be carried out at the construction sites as per the monitoring schedule and results will be submitted to 'EO PRBDB' through the 'Engineer'.</p>	<p>works EP Act 1986 Noise Rules 2002 Annexure 3.4</p>		
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C.5	Safety				
C.5.1	Personal Safety Measures for Labour	<p>Contractor will provide:</p> <ul style="list-style-type: none"> ➤ 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 and workers will be seated at sufficiently safe intervals ➤ 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. ➤ The contractor will comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress. <p>The contractor will comply with all the 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.</p> <p>The contractor will make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to.</p> <p>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.</p>	<p>The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act 1996 and cess Act of 1996 Factories Act 1948</p>	Contractor	<p>Engineer, EO PRBDB, EO SC</p>

		<p>The contractor will also ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint.</p> <p>Contractor will provide facemasks for use to the workers when paint is applied in the form of spray or a surface having lead paint dry is rubbed and scrapped.</p> <p>The Contractor will mark 'hard hat' and 'no smoking' and other '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 'SC' and 'EO PRBDB'.</p>			
C.5.2	Traffic and Safety	<p>The contractor will take all necessary measures for the safety of traffic during construction 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 'EO SC' and 'Resident Engineer' for the information and protection of traffic approaching or passing through the section of any existing cross roads.</p> <p>The contractor will ensure that all signs, barricades, pavement markings are provided as per the MOSRT&H specifications. Before taking up of construction on any section of the existing lanes of the highway, a Traffic Control Plan will be devised and implemented to the satisfaction of 'EO SC' and 'Resident Engineer'</p>	IRC: SP: 55 Guidelines VII Guidelines for Traffic Management during Construction	Contractor	Engineer, EO PRBDB, EO SC
C.5.3	Risk from Electrical Equipment(s)	<p>The Contractor will take all required precautions to prevent danger from electrical equipment and ensure that -</p> <ul style="list-style-type: none"> ➤ 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 will be provided to protect the public in construction zones. <p>All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and</p>	The Building and other construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996 Factories Act 1948	Contractor	Engineer, EO PRBDB, EO SC

		properly maintained as per IS provision and to the satisfaction of the 'Resident Engineer'.			
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. Construction Safety Plan prepared by the Contractor will identify necessary actions in the event of an emergency.	The Building and other construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996 Factories Act 1948	Contractor	Engineer, EO PRBDB, EO SC
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 every work zone ➤ availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital ➤ equipment and trained nursing staff at construction camp.	The Building and other construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996 Factories Act 1948	Contractor	Engineer, EO PRBDB, EO SC
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 and MoSRT&H specifications.	IRC:SP:55	Contractor	Engineer, EO PRBDB, EO SC
C.6	Flora and Fauna: Plantation/Preservation/ Conservation Measures				
C.6.1	Road side Plantation Strategy	The contractor will do the plantation at median and/or turbing at embankment slopes as per the tree plantation strategy prepared for the project. Minimum 80 percent survival rate of the saplings will be acceptable otherwise the contractor will replace dead plants at his own cost. The contractor will maintain the plantation till they handover the project site to PWD.	Forest Conservation Act 1980 Annexure 10	Contractor	Engineer, EO PRBDB, EO SC

		The Environmental Expert of SC will inspect regularly the survival rate of the plants and compliance of tree plantation guidelines.			
C.6.2	Flora and Chance found Fauna	<p>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.</p> <p>If any wild animal is found near the construction site at any point of time, the contractor will immediately upon discovery thereof acquaint the Environmental Expert of SC and carry out the SC's instructions for dealing with the same.</p> <p>The Environmental Expert of SC will report to the near by forest office (range office or divisional office) and will take appropriate steps/ measures, if required in consultation with the forest officials.</p>	Forest Conservation Act 1980 Wild Life Act 1972	Contractor	Engineer, EO PRBDB, EO SC
C.6.3	Chance Found Archaeological Property	<p>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.</p> <p>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 SC of such discovery and carry out the SC's instructions for dealing with the same, waiting which all work shall be stopped.</p> <p>The SC will seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence the work in the site.</p>	The Ancient Monument and Archaeological Site Remains Act 1958	Contractor	Engineer, EO PRBDB, EO SC

C.7 Labor Camp Management				
C.7.1	Accommodation	<p>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 labor camp.</p> <p>The location, layout and basic facility provision of each labor camp will be submitted to SC and 'EO PRBDB' prior to their construction.</p> <p>The construction will commence only upon the written approval of the Environmental Expert of SC.</p> <p>The contractor will maintain necessary living accommodation and ancillary facilities in functional and hygienic manner and as approved by the SC.</p>	<p>The Building and other construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996 Factories Act 1948</p> <p>Guidelines II Guidelines for Siting and Layout of construction camp</p>	<p>Contractor</p> <p>Engineer, EO PRBDB, EO SC</p>
C.7.2	Potable Water	<p>The Contractor will construct and maintain all labour accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing.</p> <p>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.</p> <p>The contractor will also guarantee the following:</p> <ol style="list-style-type: none"> Supply of sufficient quantity of potable water (as per IS) in every workplace/labor campsite at suitable and easily accessible places and regular maintenance of such facilities. If any water storage tank is provided that will be kept such that the bottom of the tank at least 1mt. from the surrounding ground level. 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. 	<p>The Building and other construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996 Factories Act 1948</p>	<p>Contractor</p> <p>Engineer, EO PRBDB, EO SC</p>

		<p>d) All such wells will be entirely covered and provided with a trap door, which will be dust proof and waterproof.</p> <p>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.</p> <p>Testing of water will be done as per parameters prescribed in IS 10500:1991.</p>			
C.7.3	Sanitation and Sewage System	<p>The contractor will ensure that -</p> <ul style="list-style-type: none"> ➤ 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 <p>all toilets in workplaces are with dry-earth system (receptacles) which are to be cleaned and kept in a strict sanitary condition.</p>		Contractor	Engineer, EO PRBDB, EO SC
C.7.4	Waste Disposal	<p>The contractor will provide 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 of SC.</p> <p>Unless otherwise arranged by local sanitary authority, arrangements for disposal of night soils (human excreta) suitably approved by the local medical health or municipal authorities or as directed by Environmental Expert of SC will have to be provided by the contractor.</p>	Guidelines II Guidelines for Siting and Layout of Labor Camp	Contractor	Engineer, EO PRBDB, EO SC

C.8	Environment Enhancement	<p>The 'EO SC' will contact the responsible people with the enhancement drawing of the site for which enhancement has been proposed and take their consent before the start of work if no deviation from existing drawing is desired.</p> <p>If some change is desired and acceptable to 'Engineer' revised enhancement drawings will be prepared and discussed with the responsible Authorities, Based on this revised drawings BOQ's will be prepared and work will be undertaken.</p> <p>Accesses to Different Schools along the road will be developed to the satisfaction of 'EO PRBDB'.</p>	Annexure 4.1 & 4.2	Contractor	Engineer, EO PRBDB, EO SC
C.9	Contractor's Demobilization	<p>Contractor will prepare site restoration plans, which will be approved by the Environmental Expert of SC. 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 SC.</p> <p>All disposal pits or trenches will be filled in and effectively sealed off. Residual topsoil, if any will be distributed in pre identified approved areas or in places suggested by the 'EO SC' areas in a layer of thickness of 75 mm-150 mm. 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 of SC. Environment Expert, SC and EO PRBDB/ PWD will certify in this regard.</p>	Guidelines VI Guidelines for Disposal Site management	Contractor	Engineer, EO PRBDB, EO SC
C.9.1	Clean-up Operations, Restoration and Rehabilitation				

Table 3.1 Environmental Management Plan

OPERATION STAGE					
Activities to be Carried Out by the CMU					
O.1	Monitoring Operation Performance	<p>The PWD/PRBDB will monitor the operational performance of the various mitigation/ enhancement measures carried out as a part of the project.</p> <p>The indicators selected for monitoring include the survival rate of trees; utility of enhancement provision, status of rehabilitation of borrow areas and disposal sites, utility of noise barriers;</p>		PWD	EOPRBDB
O.2	Maintenance of Drainage	<p>PWD/PRBDB will ensure that all drains (side drains, median drain and all cross drainages) are periodically cleared especially before monsoon season to facilitate the quick passage of rainwater and avoid flooding.</p> <p>PWD/PRBDB will ensure that all the sediment and oil and grease traps set up at the water bodies are cleared once in every three months.</p>	Annexure 3.2	PWD	EOPRBDB
O.3	Pollution Monitoring	<p>The periodic monitoring of the ambient air quality, noise level, water (both ground and surface water) quality, soil pollution/contamination in the selected locations as suggested in pollution monitoring plan (Refer Chapter 5 for Monitoring Locations) will be responsibility of PWD/PRBDB.</p> <p>PWD/PRBDB will either appoint PPCB or its approved pollution-monitoring agency for the purpose.</p>		PWD through Pollution Monitoring Agency	EO PRBDB
O.3.1	Atmospheric Pollution	<p>Ambient air concentrations of various pollutants shall be monitored as envisaged in the pollution-monitoring plan. (Refer Chapter 5).</p>	Air (P & CP) Act 1974	PWD through Pollution Monitoring Agency	EO PRBDB

O.3.2	Noise Pollution	Noise pollution will be monitored as per monitoring plan at sensitive locations. Noise control programs are to be enforced strictly. Monitoring the effectiveness of the pollution attenuation barriers Hospital Boundary wall will be taken up thrice in the operation period.	Noise Rules 2002	PWD through Pollution Monitoring Agency	EO PRBDB
O.3.3	Water Pollution	Water Quality will be monitored as per monitoring plan at identified locations. (Refer Chapter 5)	Water (P & CP) Act 1981	PWD through Pollution Monitoring Agency	EO PRBDB
O.4.	Soil Erosion and Monitoring of Borrow Areas	Visual monitoring and inspection of soil erosion at borrow areas, quarries (if closed and rehabilitated), embankment > 2m. and other places expected to be affected, will be carried out once in every three months as suggested in monitoring plan.		PWD	EO PRBDB
0.5	Road Safety	Road Safety will be monitored during operation especially at location where traffic-calming measures have been proposed.	Annexure 3.3	PWD	EO PRBDB



Environmental Management Plan (Bridges)

3

The specific management / mitigation measures required for bridge works are detailed in Part B. These measures must be read in conjunction with those already in covered in Part A.

The details of proposed works in bridges is given in Table 3.2 below:

Table-3.2: Details of Improvement Proposal of Bridges



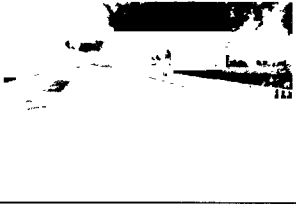
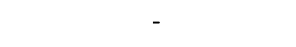
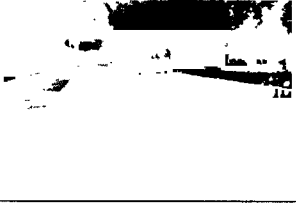




S. No	Location (km)	Name	Improvement Proposed	Photograph
1	47.270	Lasara Drain	Additional 2 lane bridge on left hand side	
2	51.445	-		
3	54.790	-		
4	57.090	-	Concentric widening to four lane bridge	
5	57.790	-		
6	57.850	Kotla Branch Canal Bridge		
7	59.570	Dhuri Drain	Additional 2 lane bridge on left hand side	
8	64.780	Sheron Rajwaha Distributary	Concentric widening to four lane bridge	
9	74.240	Barhokha Drain	Additional 2 lane bridge on left hand side	



Table 3.3: Environmental Management Plan (Bridges)

Sl. No.	Environmental Issue	Management Measures	Responsibility	
			Planning and Execution	Supervision /Monitoring
Pre-construction stage activities by the Contractor				
P.1	Permission from Irrigation department	Permission from Irrigation department shall be taken prior to start of construction work on bridges.	Contractor/ CMU	Engineer, EO, PRBDB and EO SC
P.2	Pollution Monitoring	Water Quality upstream and down stream of bridges will be tested prior to initiation of any work at the site of new construction of Bridges to establish baseline. (Refer Chapter 5 Monitoring Measures for details)	Contractor	Engineer, EO, PRBDB and EO SC
P.3	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 traffic detours, material storage, construction machinery & equipment, vehicle parking etc.. Contractor shall enter into a written agreements with land owners for all such sites and Environment Officer will be required to ensure that the rehabilitation/clearing up of the sites prior to handing over to the owners have been carried out as per written agreement.	Contractor	Engineer
Construction Stage Activities				
C.1	Dismantling of Structures/ Components and Debris Disposal	<p>The contractor shall identify disposal sites and will report the same to the Environment Officer. These locations will be checked on site and accordingly approved by Environment Officer prior to any disposal of waste materials.</p> <p>Contractor shall prepare Comprehensive Solid Waste Management Plan in consultation with Environment Officer and after approval of plan by Environmental Officer debris shall be disposed off accordingly.</p> <p>No dismantling work shall be carried out at night, or during storm or heavy rain. No dismantling be carried out without identification and approval of site by Environment Officer of TA consultant. Dismantled material will not be stored in canal bed, embankment slopes except material, which will be reused in Construction. All debris requiring disposal will be directly taken to the Pre identified disposal site and deposited as per approved Comprehensive Waste Disposal Locations.</p> <p>Debris generated shall be reused in the construction of temporary diversion of traffic, filling in embankment, slope protection work etc subject to the suitability of the materials and approval of the Engineer and Environment Officer.</p> <p>All arrangements for dismantling, clearing debris and its transportation will be considered incidental to the work and will be planned and implemented by the Contractor as approved and directed by the Environment Officer.</p>	Contractor	Engineer, EO, PRBDB and EO SC



Table 3.3: Environmental Management Plan (Bridges)

Sl. No.	Environmental Issue	Management Measures	Responsibility	
			Planning and Execution	Supervision/Monitoring
Pre-construction stage activities by the Contractor				
P.1	Permission from Irrigation department	Permission from Irrigation department shall be taken prior to start of construction work on bridges.	Contractor/ CMU	Engineer, EO, PRBDB and EO SC
P.2	Pollution Monitoring	Water Quality upstream and down stream of bridges will be tested prior to initiation of any work at the site of new construction of Bridges to establish baseline. (Refer Chapter 5 Monitoring Measures for details)	Contractor	Engineer, EO, PRBDB and EO SC
P.3	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 traffic detours, material storage, construction machinery & equipment, vehicle parking etc.. Contractor shall enter into a written agreements with land owners for all such sites and Environment Officer will be required to ensure that the rehabilitation/clearing up of the sites prior to handing over to the owners have been carried out as per written agreement.	Contractor	Engineer
Construction Stage Activities				
C.1	Dismantling of Structures/ Components and Debris Disposal	<p>The contractor shall identify disposal sites and will report the same to the Environment Officer. These locations will be checked on site and accordingly approved by Environment Officer prior to any disposal of waste materials.</p> <p>Contractor shall prepare Comprehensive Solid Waste Management Plan in consultation with Environment Officer and after approval of plan by Environmental Officer debris shall be disposed off accordingly.</p> <p>No dismantling work shall be carried out at night, or during storm or heavy rain. No dismantling be carried out without identification and approval of site by Environment Officer of TA consultant. Dismantled material will not be stored in canal bed, embankment slopes except material, which will be reused in Construction. All debris requiring disposal will be directly taken to the Pre identified disposal site and deposited as per approved Comprehensive Waste Disposal Locations.</p> <p>Debris generated shall be reused in the construction of temporary diversion of traffic, filling in embankment, slope protection work etc subject to the suitability of the materials and approval of the Engineer and Environment Officer.</p> <p>All arrangements for dismantling, clearing debris and its transportation will be considered incidental to the work and will be planned and implemented by the Contractor as approved and directed by the Environment Officer.</p>	Contractor	Engineer, EO, PRBDB and EO SC

Sl. No.	Environmental Issue	Management Measures	Responsibility	
			Planning and Execution	Supervision /Monitoring
C.2	Construction of temporary traffic diversions	<p>Construction of temporary traffic diversions shall be carried out in accordance with the plans prepared and approved during pre-construction stage.</p> <p>Temporary diversions will be constructed after receipt of approval from concerned authorities and under supervision of Environment Officer.</p> <p>Warning boards should be placed at least 500m and 200m from the construction sites on both sides along with battery operated lamp / retroreflected lamps.</p> <p>Flashlights be provided at least 200m before the construction site on either side giving warning to drivers before reaching construction sites.</p> <p>Signs, lights, barriers, cones, and other traffic control devices, as well as the riding surface of diversions shall be maintained in a satisfactory condition till such time they are required as directed by the engineer.</p> <p>Contractor shall keep the temporary traffic diversions free of dust by sprinkling of water three times a day and as required under specific conditions (depending on weather conditions, construction in the settlement areas and volume of traffic).</p> <p>Contractor shall prepare a Detailed Traffic Control Plans and shall submit it to the Environment Officer for approval, five days prior to commencement of works on any bridge. The traffic control plans shall contain details of temporary diversions, traffic safety arrangements i.e. lighting arrangement, signages, arrangement of flagmen etc. The Contractor will provide specific measures for safety of pedestrians and workers at night as a part of traffic control plans. The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow.</p> <p>The contractor will also inform local community of changes to traffic routes, conditions and pedestrian access arrangements with assistance from local bodies and PRBDB.</p>	Contractor	Engineer, EO, PRBDB and EO SC
C.3	Handling and storing of materials	<p>Contractor shall not store/dump the construction material in watercourse.</p> <p>Area for storage of material near the work site will be earmarked in consultation with Environmental officer of Technical Assistance Consultant/ CMU. This area shall not be at a distance of less than 100 meters from bank of the watercourse</p> <p>The access road should be free from water logging.</p> <p>Storage area should be leveled ground, stacking area should be planned and have racks, stands, sleepers, access traces etc and properly lighted, all materials consumables, including raw steel or fabricated materials shall be stored properly on platforms, skids or other supports IS: 7293 & IS: 7969</p>	Contractor	Engineer, EO, PRBDB and EO SC

Sl. No.	Environmental Issue	Management Measures	Responsibility	
			Planning and Execution	Supervision /Monitoring
		dealing with handling of materials and equipment for safe working should be followed Contractor shall prepare a plan for handling & storing of material at bridge construction site and shall submit it for approval from Environmental Officer/Engineer		
C.4	Water Training and Disruption to Other Users of Water	<p>Contractor will not obstruct the flow of water while constructing/ rehabilitating bridges. Contractor shall ensure that velocity in the constricted portion does not increase more than twice the lean season velocity. This will help turbidity control in downstream and minimum disruption to flora and fauna.</p> <p>Contractor shall carry out the excavation for foundation & construction of substructures during lean season to reduce turbidity levels and soil erosion, which may cause disruption to flora and fauna.</p> <p>Construction over and close to the non-perennial streams shall be undertaken in the dry season.</p> <p>Contractor shall construct river training and protection work i.e construction of guide bunds, guide walls, bank protection, flooring and approach embankment protection etc. as given in engineering design./drawing in such a fashion that will provide safety to the bridge structure and its approaches against damage by flood /flowing water and at the same time shall not pollute water.</p> <p>Contractor shall prevent the soil erosion by minimizing the amount of exposed soil, minimizing the time the soil is exposed, avoiding steep cutting of slope (steeper than 1:2), and constructing all slope protection measures whether incidental or payable, temporary or permanent in time.</p> <p>The contractor shall serve notice to the down stream users well in advance if construction work is expected to disrupt users of community water bodies or flow of surface water body is diverted. The Engineer/CMU will ensure that contractor has served the notice to the downstream users of water well in advance.</p> <p>The contractor will take prior approval of the Irrigation Department or CMU (PRBDB) for any such activity.</p>	Contractor	Engineer, EO, PRBDB and EO SC
C.5	Aquatic fauna	No worker should catch fish in the canals. Proper warnings and Instructions to worker will be given in this regard.	Contractor	Engineer, EO, PRBDB and EO SC
C.6	POLLUTION CONTROL			
C.6.1	Water Pollution			
C.6.1.1	Water Pollution from Construction Wastes	<p>Contractor will avoid construction works over/close to the canals during monsoon to minimize Impact on surface watercourses.</p> <p>The Contractor should not discharge wastewater, generated during construction, into streams, water</p>	Contractor	Engineer, EO, PRBDB and EO SC

Sl. No.	Environmental Issue	Management Measures	Responsibility	
			Planning and Execution	Supervision /Monitoring
		<p>bodies or the irrigation system without preliminary treatment and should conform to Punjab State Pollution Control Board.</p> <p>Cofferdams or formwork shall be such as to ensure still water conditions. All waste arising from the bridges construction activity is to be disposed off in the manner that is acceptable to the State Pollution Control Board and as per approved Comprehensive Waste Management Plan.</p> <p>Wastes must be collected, stored and reused in the construction / taken to approved disposal sites.</p> <p>The Environmental Officer will certify that all wastes generated on bridge site have been disposed off as per norms or in environment friendly manner.</p>		
C 6.1.2	Contamination of water from fuel and lubricants	<p>To avoid contamination from fuel and lubricants, the vehicle and equipments will be properly maintained and refueling / maintenance of vehicles will not be done near the bridge sites.</p> <p>Diesel Generator set will be placed on a cement concrete platform with oil and grease trap to control the oil ingress into soil/ water bodies.</p>	Contractor	Engineer, EO, PRBDB and EO SC
C 6.1.3	Drainage and run-off	<p>Contractor will ensure that no construction materials like earth; stone or any other obstructing construction material is disposed in watercourse and will take all necessary measures to prevent the blockage of water flow blocking the flow of water.</p> <p>In addition to the design requirements, the contractor will take all required measures as directed by the Environment Officer to prevent temporary or permanent flooding of the site or any adjacent area.</p>	Contractor	Engineer, EO, PRBDB and EO SC
C.6.1.4	Siltation of Water Bodies and Degradation of Water Quality	<p>The Contractor will not excavate beds of any stream/canals/ nallah for borrowing earth for embankment construction.</p> <p>Silt fencing will be provided at bridge locations where rehabilitation / New construction is proposed as per drawing to avoid siltation of water bodies (Refer Annexure 3.1 for locations and 3.4 for drawings of Oil cum Sedimentation Chambers, Oil and Grease Traps and Silt Fencing).</p>	Contractor	Engineer, EO, PRBDB and EO SC
C.6.2	AIR POLLUTION			
C.6.2.1	Dust Pollution	<p>The Contractor will follow good engineering practices during demolishing of bridges or part thereof and during Construction and rehabilitation of bridges.</p> <p>The contractor should provide Screen around the demolition sites as far as possible where feasible.</p> <p>The contractor will reduce dust nuisance from construction sites by sprinkling of water, encapsulation of dust source and by erection of screen/barriers.</p>	Contractor	Engineer, EO, PRBDB and EO SC

Sl. No.	Environmental Issue	Management Measures	Responsibility	
			Planning and Execution	Supervision / Monitoring
		<p>Vehicle delivering material will be covered. End boards in loaders will be provided to prevent spillage. Water will also be sprayed on temporary access roads and diversions.</p> <p>The air pollution monitoring will be carried out as per monitoring and reporting programme detailed in Environment Assessment and Management Plan.</p>		
C.6.3	NOISE POLLUTION			
C.6.3.1	Noise Pollution: Noise from Vehicles, Plants and Equipments	<p>The demolition of bridges / rehabilitation of bridges will be done using good engineering practices so that noise levels are kept at acceptable levels.</p> <p>If required screens will be erected around the construction sites.</p>	Contractor	Engineer, EO, PRBDB and EO SC
C.7	HEALTH AND SAFETY			
C.7.1	Tools Box Meetings	<p>Toolbox meeting will be held daily in order to brief workers about Safety, do's and don't during construction. Toolbox safety meetings are on-the-job meetings and will keep employees alert to work related accidents and illnesses. Toolbox meetings also helps alert employees to workplace hazards, and by preventing accidents, illnesses and on the job injuries. The meeting should involve groups of people who work together and face same sort of injury risks. The meetings should be so designed to raise employee's awareness following hazardous incidents, a recent injury or near miss. Toolbox meeting improve workplace safety and health, provide information and instructions, improve consultation and help identify hazards and deciding what action needs to be taken to reduce the risks.</p>	Contractor	Engineer, EO, PRBDB and EO SC
C.7.2	Safety Measures for Labour	<p>Contractor will provide:</p> <ul style="list-style-type: none"> ➤ Protective footwear, goggles and clothing to all workers employed on laying of wearing coat, preparing cement mortars for brick work, concreting, painting etc. ➤ Welder's protective eye-shields to workers who are engaged in welding works ➤ Earplugs to workers exposed to loud noise, and workers working with jack hammer, joint cutting machines, vibrators etc. ➤ Adequate safety measures for workers during handling of materials at site are taken up. ➤ The contractor will comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress. ➤ At every workplace, good and sufficient water supply will be maintained to avoid waterborne/water-related/ water-based diseases to ensure the health and hygiene of workers. ➤ Safety helmets and rubber gloves for workers 	Contractor	Engineer, EO, PRBDB and EO SC

Sl. No.	Environmental Issue	Management Measures	Responsibility	
			Planning and Execution	Supervision /Monitoring
		<p>➤ Contractor at his own expenses shall put up necessary shoring, shuttering and planking or cut slopes to a safer angle or both with due regard to the safety of personnel and workers and to the satisfaction of the Engineer</p> <p>The contractor will comply with all the 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.</p> <p>The contractor will make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to.</p> <p>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.</p> <p>The contractor will also ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint.</p> <p>Contractor will provide facemasks for use to the workers when paint is applied in the form of spray or a surface having lead paint dry is rubbed and scrapped.</p> <p>The Contractor will mark 'hard hat' and 'no smoking' and other '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 SC</p> <p>Contractor shall install a warning device in the area to be used to warn the workers in case of mishap/emergency.</p> <p>Contractor shall provide Safety helmets conforming to IS 2925 to all the workmen engaged in dismantling work.</p> <p>The shed and tool boxes should be located away from work site.</p> <p>Goggles preferably made up of celluloids and gas masks shall be worn at the time of dismantling, especially where tools like jack hammers are deployed to protect eyes from injuries from flying pieces, dirt, dust etc.</p> <p>The workers shall wear leather or rubber gloves during demolition of RCC work. Screens made up of GI sheets shall be placed wherever necessary to prevent the flying pieces from injuring the workers</p> <p>Water should be sprayed to reduce the dust while removing concrete wearing course with jackhammer.</p> <p>No work shall be taken up under the span when dismantling work is in progress.</p> <p>Contact numbers of Police, Fire Brigade, Ambulance, Police Station, Engineer, EO TA Consultant and PRBDB should be displayed at every bridge Site.</p>		

Sl. No.	Environmental Issue	Management Measures	Responsibility	
			Planning and Execution	Supervision /Monitoring
C.7.3	Handling of Hazardous Materials/Chemicals	<p>Any skin contacts with epoxy materials; solvents and epoxy strippers should be avoided. Epoxy resin can cause irritation of skin particularly epoxy hardeners (B component) may cause a rash on skin in sensitive persons if incorrectly handled. The resin and hardener should not be allowed to come into direct contact with skin. The most effective protection is achieved by wearing polythene gloves, rubber gloves, with a cloth liner, and protective clothing.</p> <p>The official toxicity classification on container labels may be looked for before starting work.</p> <p>Barrier creams are recommended but are not substitutes for protective clothing. Eyes shall be protected where splashing could occur while spraying. Good ventilation shall be ensured and inhalation of vapours avoided. If materials are sprayed, a respirator shall be used. If skin contact occurs, it shall be immediately washed with a cleaner, followed by soap and water. Should eye contact occur, it shall be flushed immediately with plenty of water for 15 minutes and a doctor called for</p> <p>If contact occurs with the clothing, it shall be immediately changed to prevent further skin contact, and if the contact occurs with component A or B, the clothing shall be thrown away. Hardened epoxy is not harmful but will break the clothing.</p> <p>All emptied used buckets; rags and containers shall be removed from site. These shall be stored in waste disposal bags and suitable disposed</p> <p>The contractor will prepare a hazardous waste management and disposal plan and will submit a copy of it to Environmental officer (PRBDB) for review and supervision.</p>	Contractor	Engineer, EO, PRBDB and EO SC
C.7.4	Traffic Management and Safety	<p>The Contractor will ensure that temporary bridges constructed for diversion of traffic are as per norms and safe and approved by Environment Officer.</p> <p>Speed limits will be set for movement of traffic on temporary bridges.</p> <p>The contractor will take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags, lights, warning boards and flagmen as proposed in the Traffic Control Plan/Drawings and as required by the Environment officer for the information and protection of traffic approaching or passing the bridge under construction or through the temporary diversion.</p> <p>The contractor will ensure that all signs, barricades, markings are provided as per the MoRTH specifications. Before taking up of construction on any bridge site, a Traffic Control Plan will be devised and implemented to the satisfaction of the Environmental Expert. The contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricading, including signs, markings lights and flagmen ect. For the information and protection of</p>	Contractor	Engineer, EO, PRBDB and EO SC

Sl. No.	Environmental Issue	Management Measures	Responsibility	
			Planning and Execution	Supervision /Monitoring
		traffic.		
C.7.5	First Aid	A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules at every Bridge Construction site.	Contractor	Engineer, EO, PRBDB and EO SC
C.7.6	Safety Measures	Contractor will submit Accident Safety and Hazardous Chemical Spill Management Plan and will get it approved by the "EO PRBDB". The plan should also have details of detours in case of emergency.	Contractor	Engineer, EO, PRBDB and EO SC
C.7.7	Informatory Signs and Hoardings	The contractor will provide, erect and maintain informatory/safety signs, hoardings written in English and local language, wherever required or as suggested by the Environment Officer for safety of road users, communities living near the bridge site.	Contractor	Engineer, EO, PRBDB and EO SC
C.8	Clean-up Operations, Restoration and Rehabilitation	<p>Contractor will prepare site restoration plans, which will be approved by the Environment Officer. The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. All spaces excavated and not occupied by the foundation or other permanent works shall be refilled with earth upto surface of surrounding ground.</p> <p>The contractor will clear all temporary structures; dispose all surplus material laying in waterway or around bridge site as per Comprehensive Waste Management Plan and as approved by Environment Officer.</p> <p>The bridge construction site will be left clean and tidy, at the contractor's expense, to the satisfaction to the Environment Officer.</p>	Contractor	Engineer, EO, PRBDB and EO SC

Environment Enhancement Measures

4



4. ENVIRONMENT ENHANCEMENT MEASURES

Road construction project brings lot of concerns for the local communities. Their concerns apprehension and suspicious can only get dispelled through creation of an atmosphere of mutual trust and transparency. Intensive public consultation helps a lot in building rapport between Project Authorities and Stake Holders environment enhancement takes this process of a step further apart from improving environment and gives the road-side communities a sense of belongingness.

4.1 OBJECTIVE

The objective of Environment Enhancement is;

- To improve visual qualities of highway by providing aesthetically pleasing landscape features
- To integrate the road corridor with surrounding views and landforms.
- To improve the environment setting along the road
- To improve the condition of neglected Archaeological / Communities sites
- To integrate local communities with the project by development community properties along the road.
- Provide facilities to Highway user.

4.2 METHODOLOGY

Procedure followed for Environment Enhancement Measures in includes the following in chronological order;

- Selection of Sites
- Discussion with concerned authorities of proposed sites
- Development of concept and preparation of conceptual drawings
- Discussion and finalization of drawing with PRBDB
- Discussion with Authorities of concern site
- Revision of drawings
- Integration of cost with project cost estimate

Selection of Sites

The sites for environment enhancement measures were selected on the basis of defined criteria for different type of properties, which are detailed out in preceding sections

Discussion with concerned authorities of proposed sites

The discussion was done with authorities of selected sites to know their views, requirements and willingness to undertake enhancement.

Development of Design concept and Preparation of drawings

On the basis of discussions, objective of environment enhancement, requirements of community design concepts were developed for enhancement of sites. Based on these design concepts conceptual drawings were prepared.

Discussion with PRBDB Authorities

The conceptual drawings along with other inputs used like selection criteria, Design concepts, discussion with communities / site authorities were discussed with PRBDB officials for their approval.

Discussion With Community/ Authorities of Proposed Sites

The conceptual drawings approved by PRBDB was showed to the community/ Authorities and explained in detail rationale behind it. The doubts if any were clarified; Suggestions if any were taken and incorporated. If found feasible signature of authority of proposed site was taken on Drawings as token of acceptance.

Revision of Concept drawings and preparation of working drawings

The conceptual drawings were revised based on the observations if any and then working drawings were prepared.

Integration of Cost into Project Cost Estimates

The Bills of Quantities and Cost estimates were prepared and put under Head “Environment” Bill No. 12 of Cost Estimates.

In this project surface water bodies, Religious structures, Educational Institutions, Villages gates, Access to schools from road have been selected for enhancement. The corridor-wise details of enhancement sites are given in **Table 4.1** below. Location and proposed works for different sites is given in Annexure 4.1 & conceptual drawing in Annexure-4.2.

Table 4.1: Summary of Environment Site Proposed

Sl. No.	Type o Property	Nos.
1	Religious Structure	2
2	Surface water body	1
3	Educational Institution	1
4	Safe Assess to School	10
5	Enhancement of Bus bays	14
6	Village Gates	2

4.3 ENHANCEMENT FOR SURFACE WATER BODIES

There are two surface water bodies along the project road. These bodies can be categorized into following;

- **Wastewater ponds:** These are surface water bodies along the road where village communities discharge their wastewater. These comprise about 99% of surface water body.
- **Fish Ponds:** This is a Pvt. Owned pond and used for fishing.

Criteria for Selection

- Proximity to Road
- Improvement of road side Aesthetics
- Comfort to road users
- Community property

Design Concept

Waste Water Ponds

The wastewater ponds are not only major generators of foul smell but they also act as an eyesore for the highway users. Low height colorful plantation along these ponds have

been provided to visually block these areas thereby enhancing the overall aesthetics of the transport corridor.

4.4 ENHANCEMENT FOR CULTURAL PROPERTIES

Criteria for Selection

- Proximity of the property to Project Road
- Public demand and use of the property
- Properties belonging to Marginal Groups
- Poor Condition of the Structure
- Willingness of the property owners to proposed enhancements

Design Concept

A boundary wall has been provided for demarcating the site. The site has further been enhanced by beautifully landscaping it. The space available in front of the buildings has been planned for parking. A continuous row of Plantation has been incorporated all along the boundary of the site. Tree surrounds have been provided with horizontal platforms to Junctions as informal seating area for the visitors.

4.5 ENHANCEMENT FOR EDUCATIONAL INSTITUTIONS AND COMMUNITY PROPERTIES

Criteria for Selection

- Proximity to Project Road
- Public demand and use
- Willing of Authorities to enhancement measures
- Road Safety
- Institutions belonging to Government

Design Concept

Special safety provisions have been taken into account while planning for such sensitive areas. Boundary walls demarcating the site extents of these properties have also been incorporated separating it from other areas, thereby providing proper ambience for education of children. The site is dominated by soft landscape and character has been retained. Further informal seating under existing trees have also been planned for to continue with the concept of open air schools. The sites have also been furnished with prayer platforms with continuous rows of trees around it.

4.6 ENHANCEMENT FOR COMMUNITY PROPERTIES

Criteria for Selection

- Proximity to road
- Extent of use by the community
- Improving roadside aesthetics
- Comfort to road users

Design Concept

The inputs given by local communities during informal discussions and Public Consultations have been incorporated into the design. Boundary walls demarcating the site extents of these properties have also been provided. The sites have also been beautifully landscaped to enhance the visual quality of the place and to make these aesthetically significant and architecturally identifiable.

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Monitoring Measures

5



5. MONITORING MEASURES

5.1 ENVIRONMENTAL MONITORING PLAN

The monitoring programme is devised to ensure that the envisaged purpose of the project is achieved and results in the desired benefit to the target population. To ensure the effective implementation of the EMP, it is essential that an effective monitoring programme be designed and carried out. Broad objectives of the monitoring programme are:

- To evaluate the performance of mitigation measures proposed in the EMP
- To suggest improvements in the management plans, if required
- To satisfy the statutory and community obligations

The monitoring programme contains monitoring plan for all performance indicators, reporting formats and necessary budgetary provisions. Monitoring plan for performance indicators and reporting system is presented in the following sections.

5.1.1 Performance Indicators

Physical, biological and environmental management components identified as of particular significance in affecting the environment at critical locations have been suggested as Performance Indicators (PIs). The Performance Indicators shall be evaluated under three heads as:

- Environmental condition indicators to determine efficacy of environmental management measures in control of air, noise, water and soil pollution;
- Environmental management indicators to determine compliance with the suggested environmental management measures
- Operational performance indicators have also been devised to determine efficacy and utility of the mitigation/enhancement designs proposed

The Performance Indicators and monitoring plans prepared for *Project Implementation* are presented in **Table 5.1**.

Table 5.1: Performance Indicators and Monitoring Plans for Project Implementation

S. No	Indicator	Stage	Responsibility
A	Environmental Condition Indicators and Monitoring Plan		
1	Air Quality	Pre Construction	CMU through approved monitoring agency
		Construction	Contractor/CMU through approved monitoring agency
		Operation	PWD through approved monitoring agency
2	Noise Levels	Pre Construction	CMU through approved monitoring agency
		Construction	Contractor/CMU through approved monitoring agency
		Operation	PWD through approved monitoring agency

S. No	Indicator	Stage	Responsibility
3	Water Quality	Pre Construction	CMU through approved monitoring agency
		Construction	Contractor/CMU through approved monitoring agency.
		Operation	PWD through approved monitoring agency
4	Soil Quality	Construction	Contractor through approved monitoring agency.
		Operation	PWD through approved monitoring agency
B	Environmental Management Indicators and Monitoring Plan		
1	Construction Camps	Pre-construction	Contractor
2	Borrow Areas	Pre-construction	Contractor
3	Tree Cutting	Pre-construction	Forest Department to CMU
4	Tree Plantation	Construction	Forest Department
C	Management & Operational Performance Indicators		
1	Survival Rate of Trees	Operation	Forest Department/ PWD
2	Status Regarding Rehabilitation of Borrow Areas	Operation	The PWD/PRBDB will be responsible for a period of two years.
3	Soil Erosion	Operation	The PWD/PRBDB will be responsible for a period of two years.

5.1.2 Monitoring Parameters And Standards

The Environmental monitoring of the parameters involved and the threshold limits specified are discussed below:

Ambient Air Quality Monitoring (AAQM)

The air quality parameters viz: Sulphur Dioxide (SO₂), Oxides of Nitrogen (NO_x), Carbon Monoxide (CO), Hydro-Carbons (HC), Suspended Particulate Matter (SPM), and Respirable Particulate Matter (RPM) shall be regularly monitored at identified locations from the start of the construction activity. The air quality parameters shall be monitored in accordance with the National Ambient Air Quality Standards as given in **Annexure 5.1**. The duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan **Table 5.2**, Specific details in **Table 5.3** and Desired Monitoring and Reporting Process and Responsibilities details in **Table 5.4**.

Noise Quality Monitoring

The noise levels shall be monitored at already designated locations in accordance with the Ambient Noise Quality standards given in **Annexure 5.2**. The duration and the noise pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan **Table 5.2** Specific details in **Table 5.3** and Desired Monitoring and Reporting Process and Responsibilities details in **Table 5.4**.

Water Quality Monitoring

Water quality parameters such as pH, BOD, COD, DO coliform count, total suspended solids, total dissolved solids, Iron, etc. shall be monitored at all identified locations during the construction stage as per standards prescribed by Central Pollution Control Board and Indian Standard Drinking water specifications IS 10500, 1991, presented in **Annexure 5.3** respectively. The duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan **Table 5.2**, Specific Monitoring details in **Table 5.3** and Desired Monitoring and Reporting Process and Responsibilities details in **Table 5.4**.

5.1.3 Monitoring Plans for Environment Condition

For each of the environmental components, the monitoring plan specifies the parameters to be monitored; location of the monitoring sites; frequency and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising responsibilities. The monitoring plan for the various environmental condition indicators of the project in construction and operation stages is presented in **Table 5.2**.

Monitoring plan does not include the requirement of arising out of Regulation Provision such as obtaining NOC/ consent for plant site operation.

Table 5.2: Environmental Monitoring Plan

Env. Component	Project Stage	Monitoring						Institutional Responsibility	
		Parameters	Special Guidance	Standards	Location	Frequency	Duration	Implementation	Supervision
Air Quality	Pre Construction Stage	SPM, RSPM, SO ₂ , NO _x , CO, HC	High volume Sampler to be located 40 m from the earthworks site downwind direction. Use method specified by CPCB for analysis	Air (Prevention and Control of Pollution) Act 1981	Refer Table 5.3	Once before Start of Work	Continuous 24 hours/or for 1 full working day	CMU through approved monitoring agency	“EO PRBDB”
	Construction Stage	SPM, RSPM, SO ₂ , NO _x , CO, HC	High volume sampler to be located 50 m from the plant in the downwind direction. Use method specified by CPCB for analysis	Air (Prevention and Control of Pollution) Act 1981	Refer Table 5.3	Thrice a year (April, October, January) during construction period,	Continuous 24 hours/or for 1 full working day	CMU through approved monitoring agency	“EO PRBDB”
	Operation Stage	SPM, RSPM, SO ₂ , NO _x , CO, HC	High volume Sampler to be located 40 m from the earthworks site downwind direction. Use method specified by CPCB for analysis	Air (Prevention and Control of Pollution) Act 1981	Refer Table 5.3	Thrice a year (April, October, January) during operation period for a period of two years,	Continuous 24 hours/or for 1 full working day	PWD through approved monitoring agency	“EO PRBDB”
Water Quality	Pre Construction Stage	pH, TSS, TDS, Turbidity, Hardness, Coliform, BOD, COD, Oil & Grease	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Water quality standard by CPCB	Refer Table 5.3	Once before Start of Work	Grab Sample	CMU through Approved Monitoring Agency	“EO PRBDB”
	Construction Stage	pH, TSS, TDS, Turbidity, Hardness, Coliform, BOD, COD, Oil & Grease	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Water quality standard by CPCB	Refer Table 5.3	Thrice a year (April, October, January) during construction period,	Grab Sample	CMU through Approved Monitoring Agency	“EO PRBDB”

Env. Component	Project Stage	Monitoring						Institutional Responsibility	
		Parameters	Special Guidance	Standards	Location	Frequency	Duration	Implementation	Supervision
	Operation Stage	pH, TSS, TDS, Turbidity, Hardness, Coliform, BOD, COD, Oil & Grease	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Water quality standard by CPCB	Refer Table 5.3	Thrice a year (April, October, January) during first two years of operation,	Grab Sample	PWD through Approved Monitoring Agency	"EO PRBDB"
		Cleaning of drains/openings of culvert	Flooding locations to be identified and choked drains, water bodies under going siltation and subject to debris disposal should be monitored under cleaning operations	Cleaning shall be such that there is no obstruction to the flow of water and to the Satisfaction of PRBDB	Refer Annexure 3.1	Twice in pre-monsoon and post-monsoon seasons.		CMU	"EO PRBDB"
Noise Levels	Pre Construction Stage	L day equivalent L night equivalent	Free field at 1 m from the equipment whose noise levels are being determined.	Noise standards by CPCB	Refer Table 5.3	Once Before the Start of Work	Reading to be taken at 15 seconds interval for 15 minutes every hour and then averaged	CMU through approved monitoring agency	"EO PRBDB"
	Construction Stage	L _d equivalent	Free field at 1 m from the equipment whose noise levels are being determined.	Noise standards by CPCB	Refer Table 5.3	Thrice a year (April, October, January) during construction period	Reading to be taken at 15 seconds interval for 15 minutes every hour and then averaged	CMU through approved monitoring agency	"EO PRBDB"
	Operation Stage	Noise levels on dB (A) scale	Equivalent Noise levels using an integrated noise level meter kept at a distance of 15 m from edge of Pavement within settlements	Noise standards by CPCB	Refer Table 5.3	Thrice a year (April, October, January) during Operation period.	Readings to be taken at 15 seconds interval for 15 minutes every hour and then averaged.	PWD through Approved Monitoring Agency	"EO PRBDB"

Monitoring Measures

Env. Component	Project Stage	Monitoring						Institutional Responsibility	
		Parameters	Special Guidance	Standards	Location	Frequency	Duration	Implementation	Supervision
Soil Erosion	Construction Stage	Loose soil in High Embankment		Visual Examination	High Embankments near river Beas in Kapurthala-Tarn Taran Road	Pre-monsoon and post-monsoon seasons during construction period.		CMU	"EO PRBDB"
	Operation Stage	Loose soil in High Embankment		Visual Examination	High Embankments near river Beas in Kapurthala-Tarn Taran Road	Pre-monsoon and post-monsoon seasons for a period of two years during operation.		PWD	"EO PRBDB"
Soil Quality	Pre construction	pH, Organic Carbon, Alkanity, P ₂ O ₅ , Conductivity		CPCB Standards	Refer Table 5.3	Before the Start of work	Grab Sample	CMU through Approved Monitoring Agencies	"EO PRBDB"
	Construction stage	pH, Organic Carbon, Alkanity, P ₂ O ₅ , Conductivity		CPCB Standards	Refer Table 5.3	Once in a year	Grab Sample	CMU through Approved Monitoring Agencies	"EO PRBDB"
	Operation Stage	pH, Organic Carbon, Alkanity, P ₂ O ₅ , Conductivity		CPCB Standards	Refer Table 5.3	Once in a year	Grab Sample	PWD through Approved Monitoring Agency	"EO PRBDB"
Construction Sites and Construction Camps	Construction Stage	Monitoring of: Storage Area Drainage Arrangements Sanitation in Construction Camps	The parameters mentioned are further elaborated in the reporting format C1. These are to be checked for adequacy.	To the satisfaction of the PRBDB and the standards given in the reporting form.	At storage area and construction camps	Quarterly during Construction Period		CMU	"EO PRBDB"

Env. Component	Project Stage	Monitoring						Institutional Responsibility	
		Parameters	Special Guidance	Standards	Location	Frequency	Duration	Implementation	Supervision
Borrow Areas	Construction Stage	Operations as per Guidelines of Operation			Borrow area in operation	Once in a month	Visual examination	CMU	"EO PRBDB"
	Operation Stage	Rehabilitation as per plan	Visual examination		Closed Borrow areas	Once in every three month	Visual examination	PWD	"EO PRBDB"
Tree Plantation	Operation Stage	Survival Rate			Areas where Plantation was done	Quarterly	Count	Forest Department	"EO PRBDB"

Table 5.3: Monitoring Locations

Environmental Parameter	S. No	Chainage (km)	Location	Remark
MALERKOTLA – DHURI – SANGRUR ROAD				
Air Quality	Location of Hot Mix Plant			
	1	45.000	Start of Project Road	Residential
	2	57.700	Kotla Hydro Power Babanpur	Hydro Power Plant
	3	77.200	Sangrur Hospital	Residential cum Commercial
Water Quality	Labour Camp Site (Drinking Water)			
	Construction Site (Drinking Water)			
	1	45.000	Malaerkotla	Ground Water (Hand Pump)
	2	57.700	Up Stream and Down Stream of Bridge (Kotla Hydro Power Project Babanpur)	Surface Water
	3	63.000	Dhuri	Ground Water (Hand Pump)
	4	76.000	Sangrur	Ground Water (Hand Pump)
Noise Quality	Construction Yards			
	1	57.700	At Kotla Hydro Power Project Babanpur	Residential cum Commercial
	2	76.000	Near Springale Public School Sangrur City	Residential cum Commercial
	3	77.200	At the wall of Govt. Hospital Sangrur	Silence Zone
Soil Quality	Location of Hot Mix Plant			
	1	59.600	Birdwal	Agricultural
	2	61.000	Village Dhura	Agricultural
	3	67.000	Benra	Agricultural

5.2 REPORTING SYSTEM

Reporting system provides the necessary feedback for project management to ensure quality of the works and that the program is on schedule. 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. Reporting system for the suggested monitoring program operates at two levels as:

- Reporting for environmental condition indicators and environmental management indicators
- Reporting for operational performance indicators at the CMU level.

Table 5.4: Desired Monitoring and Reporting Process and Responsibilities

Format No.	Item	Stage	Contractor	Supervision Consultant		CMU, PRBDB		Reporting from PRBDB to World Bank
			Implementation and Reporting to Supervision Consultant	Supervision	Reporting to CMU, PRBDB	Oversee Field Compliance Monitoring	Reporting to EO, PRBDB	
P1	Identification for disposal locations	Pre -construction	One Time	One Time	One Time	One Time	One Time	One Time
P2	Setting up of Construction Camp	Pre- construction	One Time	One Time	One Time	One Time	One Time	One Time
P3	Establishment of Borrow areas	Pre- construction	Monthly	Monthly	Quarterly	Quarterly	Quarterly	Quarterly
P4	Establishment of HMP/ BMP	Before start of construction	One Time	One Time	One Time	One Time	One Time	One Time
P5	Road Safety and Traffic Management	Pre- construction	Monthly	Monthly	Monthly	Monthly	Quarterly	Quarterly
P6	Arrangement for Temporary Land	Pre- Construction	Monthly	Monthly	Monthly	Quarterly	Quarterly	Quarterly
P7	Pollution Monitoring	Pre- Construction	Quarterly	During Monitoring	Immediately on receipt of results	Quarterly	Quarterly	Quarterly
P8	Tree cutting/Stump Removal	During construction period	Monthly	Monthly	Monthly	Quarterly	Quarterly	Quarterly
P9	Identification of Source of water for Construction	Pre- construction	One Time	One Time	One Time	One Time	One Time	One Time
C1	Details of earth work	During Construction period	Monthly	Monthly	Monthly	Quarterly	Quarterly	Quarterly
C2	Details of Hot Mix Plant	During Construction period	Monthly	Monthly	Monthly	Quarterly	Quarterly	Quarterly
C3	Details of landfill locations/	During Construction period	Monthly	Monthly	Monthly	Quarterly	Quarterly	Quarterly
C4	Details of Machinery in Operations	During Construction period	Monthly	Monthly	Monthly	Quarterly	Quarterly	Quarterly
C5	Redevelopment of borrow areas	During construction period	Monthly	Monthly	Monthly	Quarterly	Half Yearly	Quarterly
C6	Safety Check List	During construction period	Monthly	Monthly	Monthly	Quarterly	Half Yearly	Quarterly
C7	Accident Report	During construction period	After Accident	After Accident	Immediately on receipt of report	Quarterly	Half Yearly	Quarterly
C8	Pollution Monitoring	During construction period	Quarterly	During Monitoring	Quarterly	Quarterly	Quarterly	Quarterly

Monitoring Measures

Format No.	Item	Stage	Contractor	Supervision Consultant		CMU, PRBDB		Reporting from PRBDB to World Bank
			Implementation and Reporting to Supervision Consultant	Supervision	Reporting to CMU, PRBDB	Oversee Field Compliance Monitoring	Reporting to EO, PRBDB	
C9	Enhancement Measures	During Construction	Monthly	Monthly	Monthly	Quarterly	Quarterly	Quarterly
C10	Restoration of Construction Sites	Immediate after Construction	One Time	One Time	One Time	One Time	One Time	Quarterly
O1	Pollution Monitoring	During Operation	-	-	-	Quarterly	Quarterly	Quarterly
O4	Monitoring of culvert opening and longitudinal drains	During Operation	-	-	-	Twice a year Pre and Post monsoon	Twice a year Pre and Post monsoon	-
FORMS TO BE FILLED BY CMU/SC								
CMU1	Form for keeping records of Consent obtained by contractor (To be filled by Supervision Consultant)	Construction	Quarterly		Quarterly	Quarterly	Half Yearly	-
CMU2	Checklist for Environment Inspection	-	-	-	-	-	-	-
CMU3	Summary Sheet (To be filled by CMU)	Construction	-	-	-	Quarterly	Half Yearly	-

The reporting formats are presented in the end of the EMP Document

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Implementation Arrangement



6. IMPLEMENTATION ARRANGEMENT

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.

PRBDB is headed by the Chief Engineer who will be responsible for the successful implementation of the Project. The Chief Engineer will be assisted by the Project Director, Contract Management Unit, Project Management Information System, Environmental and Social Expert at the head office. The Executive Engineers and supporting staff as Employers representatives nominated for the project will be responsible for the implementation of the Projects under his division. The PRBDB is a small and efficient management organisation and is supported by a large number of competent highway professionals that can be drawn from the Public Works Department. The Environmental Expert of PRBDB will look after the environmental issues during the project preparation, implementation and operation with the assistance of the Environmental Specialist of the Project Design and Supervision Consultant. The structure is shown in more detail in Volume V section 9 and is summarised in **Figure 6.1**.

The Environmental monitoring during the design and construction phase will be carried out by an Independent Environmental Reviewer who has been appointed for this project. During the operation stage monitoring will be carried out by PRBDB with the help of the environmental monitoring agencies approved by the State or Central Pollution Control Board.

6.1 INTEGRATION OF EMP WITH THE PROJECT

The environmental mitigation measures for the protection of the environment impacted by the project activities are presented in Table 3.1. Detailed environmental monitoring plans for air, noise, soil and water quality is presented in Table 5.3. Tentative reporting formats for the reporting of the environmental aspects of the Contract are also presented in the EMP in, these reports must be reviewed by CSC and discussed with Contractor and PRBDB within 2 months of mobilization of the Contractor or before commencement of the works.

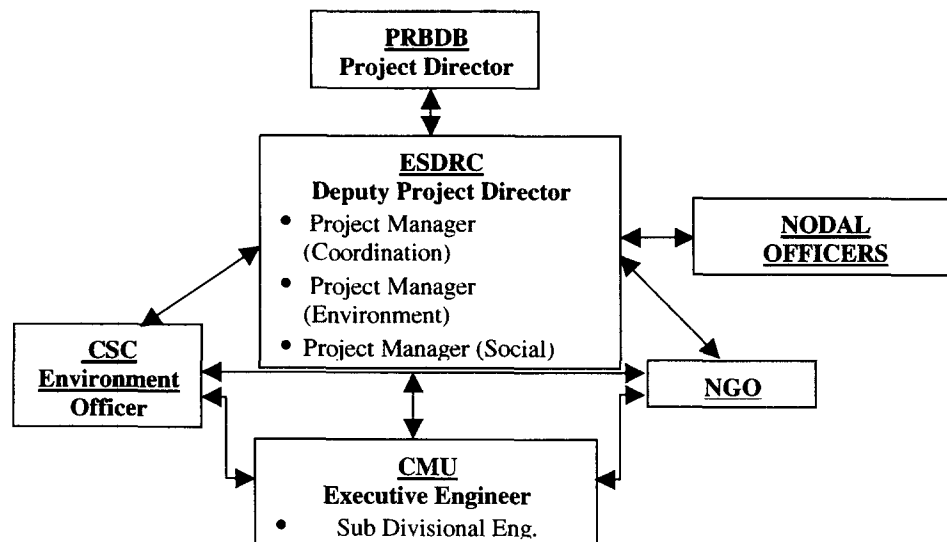


Figure 6.1: Institutional / Implementation Arrangements

The environmental measures suggested as part of contract broadly fall into the following categories:

- Specific Items shown in the volume of drawings, specifications and in the BOQ and summarised in this EMP.
- Management measures that are stand-alone items and can be implemented by the Contractor (as provision of oil interceptors, regulatory monitoring of environmental components etc)
- Management measures that are to be taken up by the Contractor as part of permanent works in accordance with good engineering practices
- Enhancement measures including measures not directly related to the road construction (enhancement of cultural properties, common property resources such as wastewater ponds etc).

The environmental management measures have been incorporated into the permanent and temporary work items. Separate provisions have been made in the BOQ for the items which can be quantified separately. Other items that are specified but not priced separately in the BOQ are to be included in the Contractors rates.

6.2 TRAINING

The basic objective of giving training to different Stakeholder is to enhance their capabilities for implementation of Environment Management and Monitoring Plan. It is recommended that training be given at least 4 times both offsite and on site

- Before Start of Construction Work
- During Construction
 - During Construction
 - During Construction at site
 - Before de-mobilization of Contractor
- After construction before start of Monitoring

The training modules have been developed.



Table 6.1: Training Module

Sl. No.	Training Recipients	Mode of Training	Environmental Aspects to be covered in training modules	Training Conducting Agency
SESSION-I				
Module-I	Staff of PRBDB (Nodal Level) involved in the project, staff of SC Consultant, PWD engineers involved in construction, contractor, and collaborating Government agencies	Lecture Sessions, Workshops & Presentation	Environmental overview and Environmental Regulations & Acts	SC
Module-II	Staff of PRBDB (Nodal Level) involved in the project, staff of SC Consultant, PWD engineers involved in construction, contractor, and collaborating Government agencies	Lecture Sessions, Workshops & Presentation	Environmental Impact Assessment: Highway Projects & Environmental Issues	SC
Module-III	Staff of PRBDB (Nodal Level) involved in the project, staff of SC Consultant, PWD engineers involved in construction, contractor, and collaborating Government agencies	Lecture Sessions, Workshops & Presentation	Environmental Management Plan for Highway Projects with Special emphasis on Contract Clauses Viz a Viz EMP	SC
SESSION -II				
Module-IV	Staff of PRBDB (Nodal Level) involved in the project, staff of SC Consultant, PWD engineers involved in construction, contractor, and collaborating Government agencies.	Lectures; Group Discussions	Environmental Issues in the Project	SC
Module-V	Staff of PRBDB (Nodal Level) involved in the project, staff of SC Consultant, PWD engineers involved in construction, contractor, and collaborating Government agencies	Lectures; Demonstration sessions; Group Discussions	Environmentally Sound Construction Management & Environmentally, Sustainably operations of Highways	SC
Module-VI	Staff of PRBDB (Nodal Level) involved in the project, staff of SC Consultant, PWD engineers involved in construction, contractor, and collaborating Government agencies	Lectures; Group Discussions	Monitoring and Reporting Formats	SC

Sl. No.	Training Recipients	Mode of Training	Environmental Aspects to be covered in training modules	Training Conducting Agency
Module for Training during Construction				
Module-I	Staff of PRBDB (Nodal Level) involved in the project, staff of Supervision Consultant, PWD engineers involved in construction, contractor, and collaborating Government agencies	Lecture Sessions, Workshops & Presentation	Implementation of Environment Management Plan, Environmental Friendly Construction Methodology and Workers Safety during Construction	SC
Module-II	Staff of PRBDB (Nodal Level) involved in the project, staff of Supervision Consultant, PWD engineers involved in construction, contractor, and collaborating Government agencies	Lecture Sessions, Workshops & Presentation	Monitoring and Reporting System	SC
Module for Training during Construction at Site				
Module-I	Staff of Supervision Consultant, PWD engineers involved in construction, All Staff of contractor involved in construction	Lecture Sessions, Workshops & Presentation	Environmental Friendly Construction Methodology and Workers Safety during Construction	SC
Module for Training before Contractor Demobilization				
Module-I	Staff of TA Consultant, PWD engineers involved in construction, Contractor	Lecture Sessions, Workshops & Presentation	Restoration of Site	SC
Module-II	Staff of TA Consultant, PWD engineers involved in construction, Contractor	Lecture Sessions, Workshops & Presentation	Reporting Formats for Restoration	SC
After Construction before Start of Monitoring				
Module-I	PWD / PRBDB engineers involved in monitoring	Lecture Sessions, Workshops & Presentation	Environment Monitoring	SC
Module-II	PWD / PRBDB engineers involved in monitoring	Lecture Sessions, Workshops & Presentation	Reporting Formats	SC

Cost Estimate

7 _____



7. COST ESTIMATE

A detailed cost estimate has been prepared based on the mitigative and monitoring measures suggested in Environment Management Plan. To the extent possible mitigative measures have been made a Bill of Quantity item, the bill number 12 of BOQ explicitly contains environment items, but many of the works are incidental as detailed out in Environment Management Plan, which also includes following:

1. Borrow Area Rehabilitation
2. Management of labor camps as detailed in Environment Management Plan
3. Debris disposal generated during construction
4. Maintenance of Haul Roads
5. Quarry re-development plan
6. Traffic Management Plan during Construction
7. Site Restoration.

7.1 Environmental Budget

Summary of Environment Budget is given **Table 7.1** and specific budget details are given **Table 7.2** and Training Budget in **Table 7.3**. One vehicle is required for Environment Officer of PRBDB cost of which is included Environment Budget of Up gradation Package.

Table 7.1: Summary of Environment Budget

ITEMS	COST (Rs.)
Forest clearance	32494000.00
Mitigation	311186.00
Monitoring	676500.00
Enhancement	897260.00
Total	34378946.00
Contingency	1718947.30
Total	36097893.30
Say	36098000.00
Training	690000.00

Table 7.2: Environmental Budget of Malerkotla – Sangrur Road

Sl. No.	Component	Stage	Item	Unit	Unit Cost (Rs.)	Quantity	Total cost (Rs.)
(A) Forest Clearance							
1		Pre-Construction	Compensatory Afforestation	Ha	90000.00	59.08	5317200.00
2			Net Present Value	Ha	920000.00	29.54	27176800.00
(A) Forest Clearance							32494000.00
(B) MITIGATION							
3	Flora	Construction	Combined oil & Sedimentation chambers	No.	43200.00	2	86400.00
4			Silt Fencing	metre	1225.00	80	98000.00
5			Oil Interceptors at Vehicle parking areas	No.	2602.00	3	7806.00
6			Median Plantation	km	30000.00	3.966	118980.00
(B) Mitigation cost							311186.00
(C) MONITORING							
8		Pre Construction	Monitoring at Hot mix plant and batching plant sites for establishing baseline before establishment of plants	No. of Samples	5000.00	At 2 Locations once before start of construction	10000.00
9		Construction	Monitoring along the road	No. of Samples	5000.00	At 3 locations, thrice in a year for a period of 1.5 years (Total 3x5=15 Samples)	75000.00
10			Monitoring at Hot mix plant and batch plant	No. of Samples	5000.00	At 2 locations thrice in a year for 1.5 years (Total 2x5 =10 Sample)	50000.00
11		Operation	Monitoring along the road at locations where monitoring was done during constructions	No. of Samples	5000.00	At 3 locations, thrice in a year for a period of two years (Total 3x3x2 = 18 samples)	90000.00
12		Water Quality	Pre construction	Monitoring along the road where base line is to be established	No. of Samples	4000.00	At 2 Locations once before start of construction
13	Construction		Drinking water quality monitoring at labour camps/ works site	No. of Samples	4000.00	At 2 location, Thrice in a year for 1.5years (Total 2x5=10 samples)	40000.00

Sl. No.	Component	Stage	Item	Unit	Unit Cost (Rs.)	Quantity	Total cost (Rs.)
14			Monitoring along the road	No. of Samples	4000.00	At 6 location, Thrice in a year for 1.5 years (Total 6 x5=30 Samples)	120000.00
15		Operation	Monitoring along the road at locations where monitoring was done during constructions	No. of Samples	4000.00	At 3 locations thrice in a year for two years (Total 3x3x2 = 18 samples)	72000.00
16	Noise Quality	Pre construction	Monitoring at the Hot mix plant and Batch plant	No. of Samples	1500.00	At 2 location before the start of construction	3000.00
18		Construction	Monitoring along the road	No. of Samples	1500.00	At 3 location, Thrice in a year for 1.5 years (Total 3x5 =15 Samples)	22500.00
19			Monitoring at the Hot mix plant and Batch plant	No. of Samples	1500.00	At 2 location, Thrice in a year for 1.5 years (Total 2x5 =10 Samples)	15000.00
20		Operation	Monitoring along the road at locations where monitoring was done during constructions	No. of Samples	1500.00	At 3 locations, Thrice in a year for 2 years (Total 3x3x2 =18 Samples)	27000.00
21	Soil Quality	Pre construction	Monitoring along the road	No of Samples	3000.00	Once at three location for establishing baseline (Total 1 x 3 = 3 Samples)	9000.00
22			Monitoring at hot mix plant and batching plant	No of Samples	3000.00	Once at two location for establishing baseline (Total 1 x 2 = 2 Samples)	6000.00
23		Construction	Monitoring along the road	No of Samples	3000.00	At 3 location, Thrice in a year for 1.5 years (Total 3 x5 =15 Samples)	45000.00
24			Monitoring along hot mix plant and batch plant	No of Samples	3000.00	At 2 locations, thrice in a year for 1.5 years (Total 2x5 = 10 samples)	30000.00
25		Operation	Monitoring along the Road	No. of Samples	3000.00	At 3 locations thrice in a year for 2 years (Total 3x3x2=18 (samples)	54000.00
(C)- Monitoring Costs							676500.00
(D) ENHANCEMENT							
26	Enhancement Sites (1)	Construction	Enhancement of Gurudwara	No.	174660.00	1	174660.00
27	Enhancement Sites (2)	Construction	Enhancement of Temple	No.	130800.00	1	130800.00

Cost Estimate

Sl. No.	Component	Stage	Item	Unit	Unit Cost (Rs.)	Quantity	Total cost (Rs.)
28	Enhancement Sites (3)	Construction	Enhancement of Govt. High School	No.	298800.00	1	298800.00
29	Enhancement Sites (4)	Construction	Safe Access to educational institutes Accesses	L.S.			200000.00
31	Enhancement Sites (6)	Construction	Bus bays	No	5000.00	14	70000.00
32	Enhancement Sites (7)	Construction	Waste Water Ponds	No	10000.00	1	10000.00
	Enhancement Sites (8)	Construction	Village Gate	No	6500	2	13000
(D)- Enhancement							897260.00

SUMMARY OF COST	
(A) Forest Clearance	32494000.00
(B) Mitigation cost	311186.00
(C)- Monitoring Costs	676500.00
(D)- Enhancement	897260.00
Total	34378946.00
Contingency @ 5%	1718947.30
Total Cost	36097893.30
Say	36098000.00
Rs Three Crores Sixty Lacs Ninty Eight Thousand only.	

Table 7.3 Training Budget

S. No	Component	Item	Unit Cost (Rs.)	Qty	Total Cost (Rs.)
1	Training	Training at HO, PRBDB	1,50,000.00	1	1,50,000.00
2		Training Before Construction at CMU	1,50,000.00	1	1,50,000.00
3		Training during construction at CMU	1,40,000.00	1	1,40,000.00
4		Training Before Demobilization of site at CMU	1,40,000.00	1	1,40,000.00
5		Training during operation stage at CMU	1,10,000.00	1	1,10,000.00
Total (Rs.)					6,90,000.00
Rupees Six Lacs Ninety Thousand only.					

Guidelines



GENERIC GUIDELINES FOR ENVIRONMENT FRIENDLY CONSTRUCTION METHODOLOGY

The contractor shall be deemed to have acquainted himself with the requirements of all the current statutes, ordinances, by-laws, rules and regulations or their instruments having the force of law including without limitation those relating to protection of the environment, health and safety, importation of labour, demolition of houses, protection of environment and procurement, transportation, storage and use of explosives, etc.

1. Protection of Environment

- The contractor will take all necessary measures and precautions and ensure that the execution of the works and all associated operations on site or offsite are carried out in conformity with statutory and regulatory environmental requirements including those prescribed in EMP.
- The contractor will take all measures and precautions to avoid any nuisance or disturbance to inhabitants arising from the execution of works.
- All liquid waste products arising on the sites will be collected and disposed of at a location on or off the sites and in a manner that will not cause either nuisance or pollution.
- The contractor will at all times ensure that all existing water courses and drains within and adjacent to the site are kept safe and free from any contamination.
- The contractor will submit details of his temporary drainage work system (including all surface channels, sediment traps, washing basins and discharge pits) to the Project Implementation Unit / Supervising Engineer for approval prior to commencing work on its construction.
- The contractor will arrange all the equipment in good condition to minimize dust, gaseous or other air-borne emissions and carry out the works in such a manner as to minimize adverse impact on air.
- Any vehicle with an open load-carrying area used for transporting potentially dust-producing material will have properly fitted side and tailboards. Materials having the potential to produce dust will not be loaded to a level higher than the side and tail boards and will be covered with a clean tarpaulin in good condition.
- The contractor will take all necessary measures to ensure that the operation of all mechanical equipment and condition processes on and off the site will not cause any unnecessary or excessive noise, taking into account applicable environmental requirements.
- The contractor will take necessary measures to maintain all plant and equipment in good condition.
- Where the execution of the works requires temporary closure of road to traffic, the contractor will provide and maintain temporary traffic diversions subject to the approval of the CMU.
- Where the execution of the works requires single-lane operation on public road the contractor will provide and maintain all necessary barriers, warning signs and traffic control signals to the satisfaction of the CMU/SE.
- Wherever traffic diversions, warning signs, traffic control signals, barriers and the like are required, the contractor will install them to the satisfaction of CMU/SE prior to commencing the work, in that area.

- Contractor will install asphalt plants and other machineries away from the populated areas as per laid down regulations.
- Permit for felling of trees will be obtained from the forest department before the execution of any work.
- Trees and plants going to be uprooted will be duly compensated and maintained up to 3 years.
- Mist sprays should be provided at appropriate places for preventing dust pollution during handling and stockpiling of stones and loose earth.
- Over Burden (OB) waste dumps shall be sprayed with water, as they are the major source of air borne particulate matter.
- OB waste dumps shall be reclaimed / afforested to bind the loose soil and to prevent soil erosion. The frequency of sprinkling should be fixed as per the seasonal requirement and in consultation with engineer.
- Regular water spraying on haulage roads during transportation of construction material by water sprinklers. The frequency of sprinkling should be fixed as per the seasonal requirements in consultation with engineer.
- Transfer point for transporting construction material shall be provided with appropriate hoods/ chutes to prevent dust emissions.
- Dumping of construction material should be from an optimum height (preferably not too high), so as to reduce the dust blow.
- Innovative approaches of using improvised machinery designs, with in-built mechanism to reduce sound emission.
- Procurement of drill loaders, dumpers and other equipment with noise proof system in operator's cabin.
- Confining the equipment with heavy noise emissions in soundproof cabins, so that noise is not transmitted to other areas.
- Regular and proper maintenance of noise generating machinery including the transport vehicles to maintain noise levels.
- Provisions should be made for noise absorbing pads at foundations of vibrating equipments to reduce noise emissions.

2. Quarry Operations

The Contractor shall obtain materials from quarries only after the consent of the Forest Department or other concerned authorities and in consultation with the supervision Engineer. The quarry operations shall be undertaken within the purview of the rules and regulations in force.

3. Prevention of Water Courses from Soil Erosion and Sedimentation Siltation

The Contractor shall apply following mitigation measures to prevent sedimentation and pollution of watercourses.

- To prevent increased siltation, if need be existing bridges maybe widened downstream side of the water body;
- Cement and coal ash should be stacked together, fenced by bricks or earth wall, and kept away from water, to prevent leachate formation and contamination of surface and ground water;

- If need be, slope of the embankments leading to water bodies should be modified and rechannelised to prevent entry of contaminants into the water body;
- During construction silt fencing (consists of geo-textile with extremely small size supported by wire-mesh mounted on a panel made up of angle frame) could be used along the road at all canals and rivers to prevent sediments from the construction site to enter into the watercourses.

4. **Pollution from Hot-Mix Plants and Batching Plants**

Bituminous hot-mix plants and concrete batching plants shall be located sufficiently away from habitation, agricultural operations. The Contractor shall take every precaution to reduce the levels of noise, vibration, dust and emissions from his plants and shall be fully responsible for any claims for damages caused to the owners of property, fields and residents in the vicinity.

5. **Arrangement for Traffic During Construction**

The Contractor shall at all times carry out work on the road in a manner creating least interference to the flow of traffic with the satisfactory execution. For all works involving improvements to the existing state highway, the Contractor shall, in accordance with the directives of the SE, provide and maintain, during execution of the work, a passage for traffic either along a part of the existing carriageway under improvement, or along a temporary diversion constructed close to the state highway. The Contractor shall take prior approval of the SE regarding traffic arrangements during construction.

6. **Traffic Safety and Control**

- Where subject to the approval of the Engineer the execution of the works requires temporary closure of road to traffic use, the Contractor shall provide and maintain temporary traffic diversions. The diversion shall generally consist of 200 mm thickness of gravel 4.5 meters wide laid directly upon natural ground and where any additional earthworks are required for this purpose that will be provided under the appropriate payment items.
- Where the execution of the works requires single-lane operation on public road, the Contractor shall provide and maintain all necessary barriers, warning signs and traffic control signals to the approval of the Engineer.
- With the exception of temporary traffic arrangements or diversions required within the first 4 weeks of the Contract, the Contractor shall submit details of his proposals to the Engineer for approval not less than 4 weeks prior to the temporary arrangement or diversion being required. Details of temporary arrangements or diversions for approval as soon as possible after the date of the Letter of Acceptance.
- The color, configuration, size and location of all traffic signs shall be in accordance with the code of practice for road sign. In the absence of any detail or for any missing details, the signs shall be provided as directed by the Supervising Engineer (SE).
- The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, marking, flags, lights and flagmen as may be required by the Engineer for the information and protection of traffic approaching or passing through the section of the road under improvement. Before taking up any construction, an agreed phased programme for the diversion of traffic or closer of traffic on the road shall be drawn up in consultation with the SE.
- At the points where traffic is to deviate from its normal path (whether on temporary diversion or part width of the carriageway) the lane width path for traffic shall be

clearly marked with the aid of pavement markings, painted drums or a similar device to the directions of the SE. At night, the passage shall be delineated with lanterns or other suitable light source.

- One-way traffic operation shall be established whenever the traffic is to be passed over part of the carriageway inadequate for two-lane traffic. This shall be done with the help of temporary traffic signals or flagmen kept positioned on opposite sides during all hours. For regulation of traffic, the flagmen shall be equipped with red and green flags and lanterns / lights.
- On both sides, suitable regulatory / warnings signs as approved by the SE shall be installed for the guidance of road users. On each approach, at least two signs shall be put up, one close to the point where transition of carriageway begins and the other 120 m away. The signs shall be of design and of reflectory type, if so directed by the SE.
- Upon completion of the works for which the temporary traffic arrangements or diversions have been made, the Contractor shall remove all temporary installations and signs and reinstate all affected roads and other structures or installations to the conditions that existed before the work started, as directed by the Engineer.

7. Health and Safety

The contractor shall take all measures and precautions necessary to ensure the health, safety and welfare of all persons entitled to be on the site. Such precautions shall include those that, in the opinion of the Engineer, are reasonable to prevent unauthorized entry upon the site and to protect members of the public from any activities under the control of the contractor. The contractor's responsibilities shall include but not be limited to:

- The provision and maintenance of the Contractor's Equipment in a safe working condition and the adoption of methods of work that are safe and without risks to the health of any person entitled to be on the site.
- The execution of suitable arrangements for ensuring safety and absence of risks to health in connection with the use, handling, storage, transport and disposal of articles and substances,
- The provision of lighting, including standby facilities in the event of failure, that, in the opinion of the Engineer, is adequate to ensure the safe execution of any works that are to be carried out at night.
- The provision of protective clothing and safety equipment, with such personnel and equipment and such information, instruction, training and supervision as are necessary to ensure the health and safety at work of all persons employed on or entering on the site in connection with the works, including the Engineer's supervisory staff, all in accordance with the laws.
- Near towns, villages and all frequented places, trenches and foundation pits shall be securely fenced provided with proper caution signs and marked with lights at night to avoid accidents. Contractor shall take adequate protective measures to see that the excavation operations do not affect or damage adjoining structures.
- The contractor shall not use or generate any materials in the works, which are hazardous to the health of persons, animals or vegetation. Where it is necessary to use some substances, which can cause injury to the health of workers, the Contractor shall provide protective clothing or appliances to his workers.

- The contractor will take all measures necessary to safeguard the health; safety and welfare of all persons entitled to be on site and will ensure that works are carried out in a safe and efficient manner.
- The contractor will provide, and ensure the utilization of appropriate safety equipment for all workmen and staff employed directly or indirectly by the contractor. Such safety equipment will include but not be limited to the safety helmets, goggles and other eye protectors, hearing protectors, safety harnesses, safety equipment for working over water, rescue equipment, fire extinguishers and first-aid equipment. The personnel working at vulnerable locations at site will wear safety helmets and strong footwear.
- The contractor will provide an adequate number of latrines and other sanitary arrangements at areas of the site where work is in progress and ensure that they are regularly cleaned and maintained in a hygienic condition.

8. First Aid

- The provision and maintenance of suitably equipped and staffed first aid stations throughout the extent of the works to the satisfaction of the Engineer. The contractor shall allow in his prices and be responsible for the costs of all such site welfare arrangements and requirements.
- Injuries might occur during the construction period. It is therefore pertinent to provide first aid facilities for all the construction workers. At construction camps and at all workplaces first aid equipment and nursing staff must be provided. Since many of the workplaces may be far away from regular hospitals, an indoor health unit having one bed facility every 250 workers needs to be provided.
- Adequate transport facilities for moving the injured persons to the nearest hospital must also be provided in ready to move condition.
- The first-aid units apart from an adequate supply of sterilized dressing material should contain other necessary appliances as per the factory rules.

9. Maintenance

- All buildings, rooms and equipment and the grounds surrounding them shall be maintained in a clean and operable condition and be protected from rubbish accumulation.
- Each structure made available for occupancy shall be of sound construction, shall assure adequate protection against weather, and shall include essential facilities to permit maintenance in a clean and operable condition. Comfort and safety of occupants shall be provided for by adequate heating, lighting, ventilation or insulation when necessary to reduce excessive heat.
- Each structure made available for occupancy shall comply with the requirements of the Uniform Building Code. This shall not apply to tent camps.

10. Maintenance of Diversions and Traffic Control Devices

Signs, lights, barriers and other traffic control devices, as well as the riding surface of diversion shall be maintained in a satisfactory condition till such time they are required as directed by the SE. The temporary traveled way shall be kept free of dust by frequent applications of water, if necessary.



GUIDELINES FOR SITING & LAYOUT OF CONSTRUCTION CAMP

A SITING

The contractor based on the following guidelines shall identify the location of the construction site. The construction site shall be located:

- The construction camps will be located at least 500 m away from habitations at identified sites. The living accommodation and ancillary facilities for labour shall be erected and maintained to standards and scales approved by the resident engineer.
- On non agricultural lands, as far as possible
- Not within 1000m of either side of locations (Wild life Sanctuary/Ecologically sensitive areas)
- All sites used for camps must be adequately drained.
- The camps must be located such that the drainage from and through the camps will not endanger any domestic or public water supply.
- All sites must be graded, ditched and rendered free from depressions such that water may get stagnant and become a nuisance.

B LAYOUT

A conceptual layout of a typical construction site has been presented in Figure 3.1. The Contractor during the progress of work will provide, erect and maintain necessary (temporary) living accommodation and ancillary facilities for labour to standards and scales approved by the engineer. All temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing. Safe drinking water should be provided to the dwellers of the construction camps. Adequate washing and bathing places shall be provided, and kept in clean and drained condition. Construction camps are to be sited away from vulnerable people and adequate health care is to be provided for the work force.

Sanitation Facilities: Construction camps shall be provided sanitary latrines and urinals. Sewerage drains should be provided for the flow of used water outside the camp. Drains and ditches should be treated with bleaching powder on a regular basis. The sewage system for the camp must be properly designed, built and operated so that no health hazard occurs and no pollution to the air, ground or adjacent watercourses takes place. Compliance with the relevant legislation must be strictly adhered to. Garbage bins must be provided in the camp and regularly emptied and the garbage disposed off in a hygienic manner

Shelter at Workplace: At every workplace, there shall be provided free of cost, four suitable shelters, two for meals and two others for rest, separately for use of men and women labourers. 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 0.5m² 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. The contractor shall conform generally to sanitary requirements of local medical, health and municipal authorities and at all times adopt such precautions as may be necessary to prevent soil pollution of the site.

First aid facilities: At every workplace, a readily available first-aid unit including an adequate supply of sterilized dressing materials and appliances will be provided. Workplaces remote and far away from regular hospitals will have indoor health units with one bed for every 250 workers. Suitable transport will be provided to facilitate taking injured and ill persons to the nearest hospital. At every workplace an ambulance room containing the prescribed equipment and nursing staff will be provided.

Health Care Facilities: Health problems of the workers should be taken care of by providing basic health care facilities through health centres temporarily set up for the construction camp. The health centre should have at least a doctor, nurses, duty staff, medicines and minimum medical facilities to tackle first-aid requirements or minor accidental cases, linkage with nearest higher order hospital to refer patients of major illnesses or critical cases.

The health centre should have MCW (Mother and Child Welfare) units for treating mothers and children in the camp. Apart from this, the health centre should provide with regular vaccinations required for children.

Day Crèche Facilities: At every construction site, provision of a day crèche shall be worked out so as to enable women to leave behind their children. At construction sites where 20 or more women are ordinarily employed, there shall be provided at least a hut for use of children under the age of 6 years belonging to such women. Huts shall not be constructed to a standard lower than that of thatched roof, mud walls and floor with wooden planks spread over mud floor and covered with matting. Huts shall be provided with suitable and sufficient openings for light and ventilation. There shall be adequate provision of sweepers to keep the places clean. There shall be two maidservants (or aayas) in the satisfaction of local medical, health, municipal or cantonment authorities. Where the number of women workers is more than 25 but less than 50, the contractor shall provide with at least one hut and one maidservant to look after the children of women workers. Size of crèches shall vary according to the number of women workers employed.

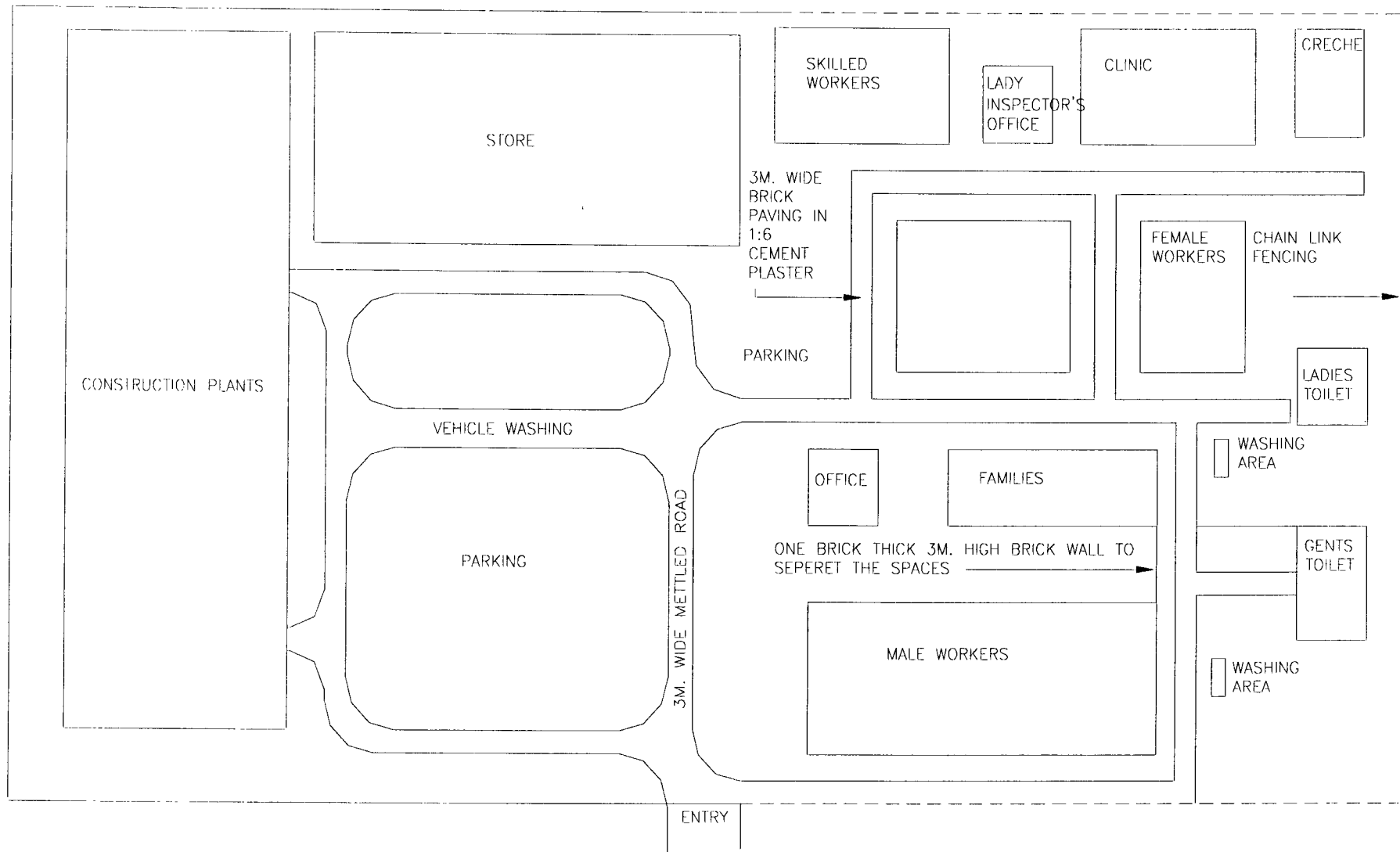


Figure-2.1: Typical Layout of Construction Camp



GUIDELINES FOR SITE CLEARANCE

1. VEGETATION CLEARANCE

Vegetation clearance shall comprise uprooting of vegetation, grass, brushwood, shrubs, stumps, trees and saplings of girth upto 30 cm. measured at a height of one meter above the ground level. Where only clearance of grass is involved it shall be measured and paid for separately. The procedure/ steps involved for uprooting, skating and felling trees are described below.

1.1 Uprooting of Vegetation

- The roots of trees and saplings shall be removed to a depth of 60 cm. Below ground level or 30 cm. below formation level or 15 cm below sub grade level, whichever is lower.
- All holes or hollows formed due to removal of roots shall be filled up with earth rammed and leveled.
- Trees, shrubs, poles, fences, signs, monuments, pipe lines, cables etc. within or adjacent to the area, which are not required to be disturbed during vegetation clearance shall be properly protected by the contractor at his own cost.

Staking and Disposal

- All useful materials obtained from clearing and grubbing operation shall be staked in the manner as directed by the Engineer.
- Trunks and branches of trees shall be cleared of limbs and tops stacked properly at the places indicated by the Engineer- in – charge. These materials shall be the property of the Government.
- All unserviceable materials are disposed off in such a manner that there is no livelihood of getting mixed up with the materials meant for construction.

Felling Trees

- Marking of trees: Trees, above 30 cm. Girth (measured at a height of one meter above ground level) to be cut, shall be approved by the Engineer-in-charge and then marked at the site.
- Felling of trees: Felling of trees shall include taking out roots up to 60 cm. below ground level or 30 cm. below formation level or 15 cm. below sub-grade level, whichever is lower.
- Filling: All excavations below general ground level arising out of removal of trees, stumps etc. shall be filled with suitable material in 20 cm. layers and compacted thoroughly so that the surface at these points conform to the surrounding area.
- Sizing: The trunks and branches of trees shall be cleared of limbs and tops and cut into suitable pieces as directed by the Engineer-in-charge.
- Staking: The serviceable materials shall be staked in the manner as directed by the Environmental specialist of Supervision Consultants/Engineer-in-charge.
- Disposal: The material, which cannot be used or auctioned shall be removed from the area and disposed off as per the directions of the Engineer-in-charge. Unsuitable waste materials should not get mixed with construction material during disposal.



GUIDELINES FOR DISPOSAL SITE MANAGEMENT

The locations of Disposal sites have to be selected such that:

- No residential areas are located downwind side of these locations,
- Disposal sites are located at least 1000 m away from sensitive locations like Settlements, Water body notified forest areas, Sanctuaries or any other sensitive Locations.
- Disposal sites do not contaminate any water sources, rivers etc for this site should be located away from waterbody, Disposal site should be lined properly to prevent infiltration of water.
- Public perception about the location of debris disposal site has to be obtained before finalizing the location.
- Permission from the Villager/local community is to be obtained for the Disposal site selected
- The Plan must be approved by Environment Engineer of TA Consultant and Executive Engineer of Contract Management Unit.

Precautions to be adopted during disposal of debris / waste material

The contractor shall take the following precautions while disposing off the waste material

- During the site clearance and disposal of debris, the contractor will take full care to ensure that public or private properties are not damaged/affected, there is no dwellings below the dumpsite and that the traffic is not interrupted.
- Contractor will dispose off debris only to the identified places or at other places only with prior permission of Engineer-in-Charge of works.
- In the event of any spoil or debris from the sites being deposited on any adjacent land, the contractor will immediately remove all such spoil debris and restore the affected area to its original state to the satisfaction of the Engineer-in-Charge of works.
- The contractor will at all times ensure that the entire existing canal and drains within and adjacent to the site are kept safe and free from any debris.
- Contractor will utilize effective water sprays during the delivery and handling of materials when dust is likely to be created and to dampen stored materials during dry and windy weather.
- Materials having the potential to produce dust will not be loaded to a level higher than the side and tail boards and will be covered with a tarpaulin in good condition.
- Any diversion required for traffic during disposal of debris shall be provided with traffic control signals and barriers after the discussion with local people and with the permission of Engineer-in-Charge of works.
- During the debris disposal, contractor will take care of surrounding features and avoid any damage to it.

While disposing debris / waste material, the contractor will take into account the wind direction and location of settlements to ensure against any dust problems.

Guidelines for Rehabilitation of Disposal Sites

The dumpsites filled only upto the ground level could be rehabilitated as per guidelines below and to be decided by the engineer and the supervision consultant

- The dumpsites have to be suitably rehabilitated by planting local species of shrubs and other plants. Local species of trees has also to be planted so that the landscape is coherent and is in harmony with its various components.

- In cases where a dumpsite is near to the local village community settlements, it could be converted into a play field by spreading the dump material evenly on the ground. Such playground could be made coherent with the landscape by planting trees all along the periphery of the playground.
- Some of the dumpsites could be used either for plantation or for growing agricultural produce such as ginger, turmeric or oranges etc.
- Care should always be taken to maintain the hydrological flow in the area.

GUILDE LINES FOR BORROW AREAS MANAGEMENT

Borrow areas will be finalized either form the list of locations recommended by DPR consultants or new areas identified by contractor. The finalization of locations identified DPR consultant depends upon the formal agreement between landowners and contractor. Agreement is not reached between the contractor and landowners for the identified borrow areas sites. In such cases arrangement for locating the source of supply of material for embankment and sub-grade as well as compliance to environment requirements in respect of excavation and borrow areas as stipulated from time to time by the Ministry of Environment and Forests, Government of India, and local bodies, as applicable shall be the sole responsibility of the contractor.

The contractor in addition to the established practices, rules and regulation will also consider following criteria before finalizing the locations.

- The borrow area should not be located in agriculture field unless unavoidable i.e. barren land is not available.
- The borrow pits should not be located along the roads.
- The loss of productive and agriculture soil should be minimum.
- The loss of vegetation is almost nil or minimum.
- Sufficient quality of soil is available.
- The Contractor will ensure that suitable earth is available.

The Contractor shall obtain representative samples from each of the identified borrow areas and have these tested at the site laboratory following a testing programme approved by the Engineer. It shall be ensured that the sub-grade material when compacted to the density requirements as in Table-1 shall yield the design CBR value of the sub-grade.

Table-1: Compaction Requirements for Embankment and Sub-grade

Sl No.	Type of Work/Material	Relative compaction as percentage of max. laboratory dry density as per IS:2720 (Part 8)
1	Sub-grade and earthen shoulders	Not less than 97
2	Embankment	Not less than 95
3	Expensive Clays	
	a) Sub-grade and 500mm portion just below the sub-grade	Not allowed
	b) Remaining portion of embankment	Not less than 90

The Contractor shall at least 7 working days before commencement of compaction submit be following to the Engineer for approval.

- The values of maximum dry density and optimum moisture content obtained in accordance with IS: 2720 (Part-7) or (Part-8), as the case may be, appropriate for each of the fill materials he intends to use.
- A graph of density plotted against moisture content from which, each of the values in (i) above of maximum dry density and optimum moisture content were determined.
- The Dry density-moisture content – CBR relationships for light, intermediate and heavy compactive efforts (light corresponding to IS: 2720 (Part-7), heavy corresponding to IS: 2720 (Part-8) and intermediate in-between the two) for each of the fill material he intends to use in the sub-grade.

After identification of borrow areas based on guidelines. Contractor will fill reporting format Annexure-III) and submit the same for approval to the “Engineer”.

After receiving the approval contractor will begin operations keeping in mind following;

- Haulage of material to embankments or other areas of fill shall proceed only when sufficient spreading and compaction plants is operating at the place of deposition.
- No excavated acceptable material other than surplus to requirements of the Contract shall be removed from the site. Should be contractor be permitted to remove acceptable material from the site to suit his operational procedure, then he shall make good any consequent deficit of material arising therefrom.
- Where the excavation reveals a combination of acceptable and un-acceptable materials, the Contractor shall, unless otherwise agreed by the Engineer, carry out the excavation in such a manner that the acceptable materials are excavated separately for use in the permanent works without contamination by the un-acceptable materials. The acceptable material shall be stockpiled separately.
- The Contractor shall ensure that he does not adversely affect the stability of excavation or fills by the methods of stockpiling materials, use of plants or siting of temporary buildings or structures.

Borrow Areas located in Agricultural Lands

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrowing of earth will be carried out up to a depth of 1.5m from the existing ground level.
- Borrowing of earth will not be done continuously through out the stretch.
- Ridges of not less than 8m widths will be left at intervals not exceeding 300m.
- Small drains will be cut through the ridges, if necessary, to facilitate drainage.
- The slope of the edges will be maintained not steeper than 1:4 (vertical: Horizontal).

Borrow Areas located in Agricultural land where un-avoidable

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- The depth of borrow pits will not be more than 30 cm after stripping the 15 cm topsoil aside.

Borrow Areas located in Elevated Lands

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- At location where private owners desire their fields to be leveled, the borrowing shall be done to a depth of not more than 1.5m or up to the level of surrounding fields

Borrow Areas near River side

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).

- Borrow area near to any surface water body will be at least at a distance of 15m from the toe of the bank or high flood level, whichever is maximum.

Borrow Areas near Settlements

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrow pit location will be located at least 0.75 km from villages and settlements. If unavoidable, the pit will not be dug for more than 30 cm and drains will be cut to facilitate drainage.
- Borrow pits located in such location will be re-developed immediately after borrowing is completed. If spoils are dumped, that will be covered with a layers of stockpiled topsoil in accordance with compliance requirements with respect MOEF/PPCB guidelines.

Borrow Pits along the Road

- The preservation of topsoil will be carried out in stockpile.
- A 15 cm topsoil will be stripped off from the borrow pit and this will be stored in stockpiles in a designated area for height not exceeding 2m and side slopes not steeper than 1:2 (Vertical: Horizontal).
- Borrow pits along the road shall be discouraged.
- It permitted by the Engineer; these shall not be dug continuously.
- Ridges of not less than 8m widths should be left at intervals not exceeding 300m.
- Small drains shall be cut through the ridges of facilitate drainage.
- The depth of the pits shall be so regulated that there bottom does not cut an imaginary line having a slope of 1 vertical to 4 horizontal projected from the edge of the final section of bank, the maximum depth of any case being limited to 1.5m.
- Also, no pit shall be dug within the offset width from the toe of the embankment required as per the consideration of stability with a minimum width of 10m.

Re-development Borrow Areas

The objective of the rehabilitation programme is to return the borrow pit sites to a safe and secure area, which the general public should be able to safely enter and enjoy. Securing borrow pits in a stable condition is fundamental requirement of the rehabilitation process. This could be achieved by filling the borrow pit floor to approximately the access road level.

Re-development plan will be prepared by the Contractor before the start of work inline with the owners will require and to the satisfaction of owner.

The Borrow Areas will be rehabilitated as per following;

- Borrow pits will be backfilled with rejected construction wastes and will be given a vegetative cover. If this is not possible, then excavation sloped will be smoothed and depression will be filled in such a way that it looks more or less like the original round surface.
- Borrow areas might be used for aquaculture in case landowner wants such development. In that case, such borrow area will be photographed after their post use restoration and Environment Expert of Supervision Consultant will certify the post use redevelopment.

The Contractor will keep record of photographs of various stages i.e., before using materials from the location (pre-project), for the period borrowing activities (construction Phase) and after rehabilitation (post development), to ascertain the pre and post borrowing status of the area.



GUIDELINES FOR QUARRY MANAGEMENT

The Contractor will finalize the locations from the list given by DPR Consultant's for procuring materials. The Contractor shall establish a new quarry only with the prior consent of the CMU only in cases when: (i) Lead from existing quarries is uneconomical and (ii) Alternative material sources are not available. The Contractor shall prepare a Redevelopment Plan for the quarry site and get it approved by the CMU.

The construction schedule and operations plans to be submitted to the CMU prior to commencement of work shall contain a detailed work plan for procuring materials that includes procurement, transportation and storage of quarry materials.

Operation & redevelopment plan (if a new quarry is opened).....

- Photograph of the quarry site prior to commencement
- The quarry boundaries as well as location of the materials deposits, working equipments, stockpiling, access roads and final shape of the pit.
- Drainage and erosion control measures at site.
- Safety Measures during quarry operation.
- Design for redevelopment of exhaust site.

Option-A: Revegetating the quarry to merge with surrounding landscape: This is done by conserving and reapplying the topsoil for the vegetative growth.

Option-B: Developing exhausted quarries as water bodies: The pit shall be reshaped and developed into pond, for harvesting rainwater. This option shall only be considered where the location of quarry is at the lowest point, i.e. surrounding areas/natural drainage slopes towards it.

Construction Stage

Development of site: To minimize the adverse impact during excavation of material following measures are need to be undertaken:

- i) Adequate drainage system shall be provided to prevent the flooding of the excavated area
- ii) At the stockpiling locations, the Contractor shall construct sediment barriers to prevent the erosion of excavated material due to runoff
- iii) Construction of offices, laboratory, workshop and rest places shall be done in the up-wind of the plant to minimize the adverse impact due to dust and noise.
- iv) The access road to the plant shall be constructed taking into consideration location of units and also slope of the ground to regulate the vehicle movement within the plant.
- v) Incase of storage of blasting material, all precautions shall be taken as per The Explosive Rules, 1983.

Quarry operations including safety:

- i) Overburden shall be removed and disposed inline with Guidelines of Disposal Management giving in Annexure-4
- ii) During excavation, slopes shall be flatter than 20 degrees to prevent their sliding. Incases where quarry strata are good and where chances of sliding are less this restriction can be ignored.
- iii) Incase of blasting, procedure and safety measures shall be taken as per The Explosive Rules, 1983

- iv) The contractor shall ensure that all workers related safety measures shall be done as per guidelines for Workers and Safety attached as Annexure-8
- v) The Contractor shall ensure maintenance of crushers regularly as per manufacturer's recommendation.

Topsoil will be excavated and preserved during transportation of the material measures shall be taken to minimize the generation of dust and prevent accidents.

The CMU and the Technical Examiner shall review the quarry site for the management measures during quarry operation, including the compliance to pollution norms.

Post Construction Stage

The Contractor shall restore all haul roads constructed for transporting the material from the quarries to construction site to their original state.

The CMU and the Technical Examiner shall be entrusted the responsibility of reviewing the quarry site for the progress of implementation of Redevelopment Plan. These shall include the following two cases;

- Redevelopment of quarries opened by the Contractor for the project
- Redevelopment of existing quarries operated by other agencies

In the first case, the Contractor shall be responsible for the Redevelopment Plan prior to completion after five years, during the defect liability period. The CMU shall be responsible for reviewing this case of redevelopment prior to the issuing the defect liability certificate.

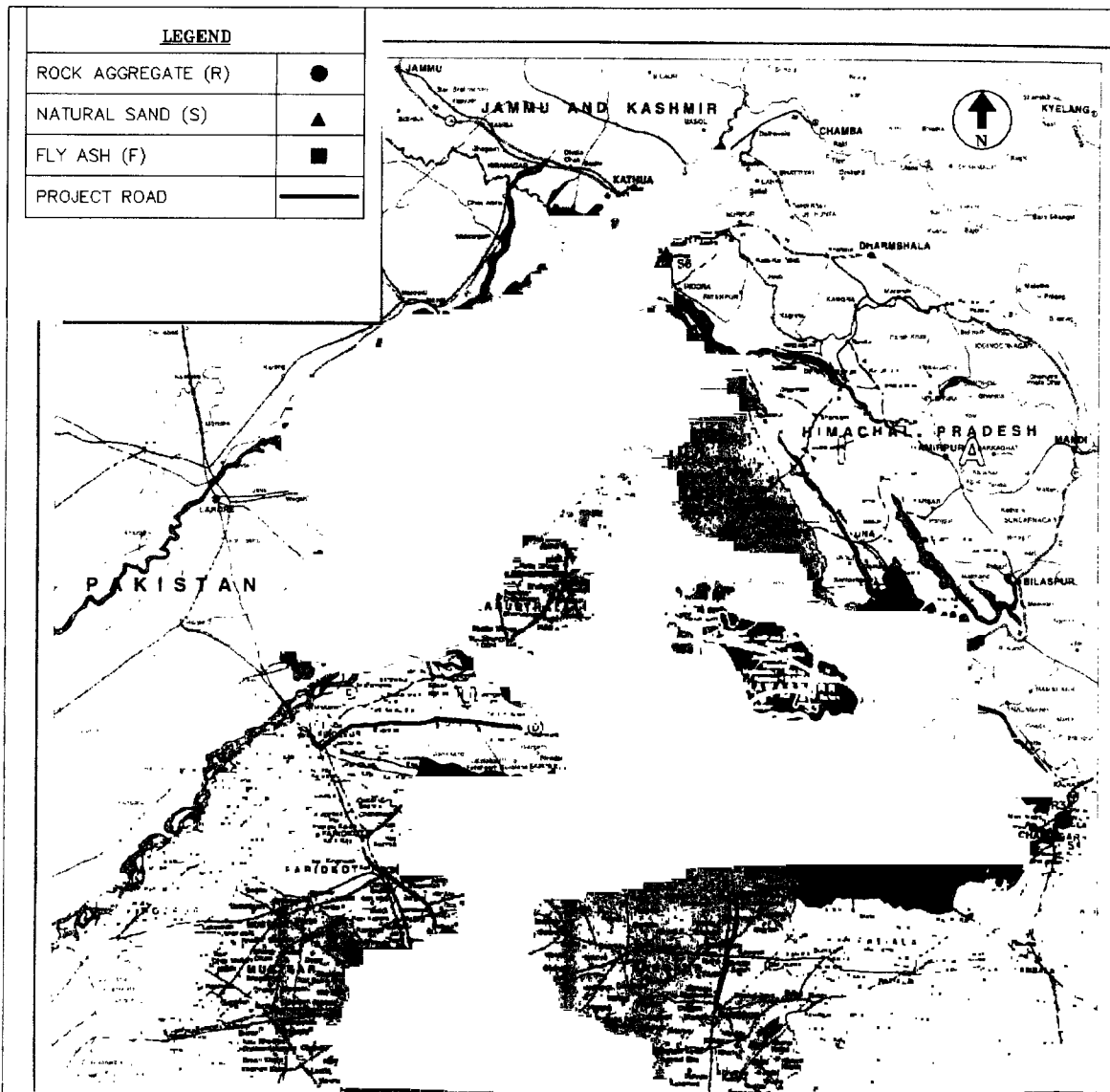
In the second case, the redevelopment of exhaust quarry shall be the responsibility of the agency providing the permit to ensure the implementation of Redevelopment Plan.

IDENTIFIED QUARRY

1. Pathankot
2. Mubarakpur, 5km from Zirakpur towards Panchkula
3. Ghanauli, 60 km away from Rohan, Ropar Town

Table: Description of Inspected Sources of River Bed Materials and Rock

Source ID	Source of Materials	Applicable roads
R1: Chakki Kad in Pathankot area	Satpal Stone Crusher, Gagi Crusher, Hariharan Stone Crusher all in Pathankot area, approx. 130 km from Tarn Taran & 170 km from Zira via Gurudaspur.	Kapurthala-Tarn Taran & Ferozpur-Dharamkot
R2: In the vicinity of Ghanauli town in Ropar	Tripti stone crusher near Ropar, 60 km from Rahon, 2 x 600 MT / day capacity	Rahon-Aur-Nagar
R3: Mubarakpur village in Panchkula, Haryana	River boulder from Ghaggar River crushed at Zarakpur near Mubarakpur village (Panchkula dist.) 10-15 km from Sohana, 100 km from Sangrur. About 35 Nos. of crushers presently operating at this site each 500 MT/day capacity. Samples taken from Saptrishi Stone crusher and Kirti Stone crusher	Chandigarh-Sirhind, Malerkotla-Sangrur





GUIDELINES FOR TRAFFIC MANAGEMENT DURING CONSTRUCTION

The roads are being rehabilitated. The work of rehabilitation and improvement will be undertaken in four stages.

Stage – 1

The traffic will continue to pass through the existing carriageway and the work will be carried out in the shoulders of one side. In 1.5 m width gravelling will be done for depth of 200 mm. This will be carried out in the continuous length not exceeding 500 m.

Stage - 2

Traffic will be diverted to half the carriageway and the graveled shoulders.

Construction work of laying of overlay and improvement of adjacent shoulders will be carried out in the other half.

Stage - 3

Traffic will pass through the already improved half carriageway and shoulders.

Construction work of overlay and improvement of shoulders upto the level of overlay level will be carried out.

Stage – 4 (Not shown in drawing)

Normal situation after construction. Carriageway is fully constructed and traffic will be passed on the improved carriageway.

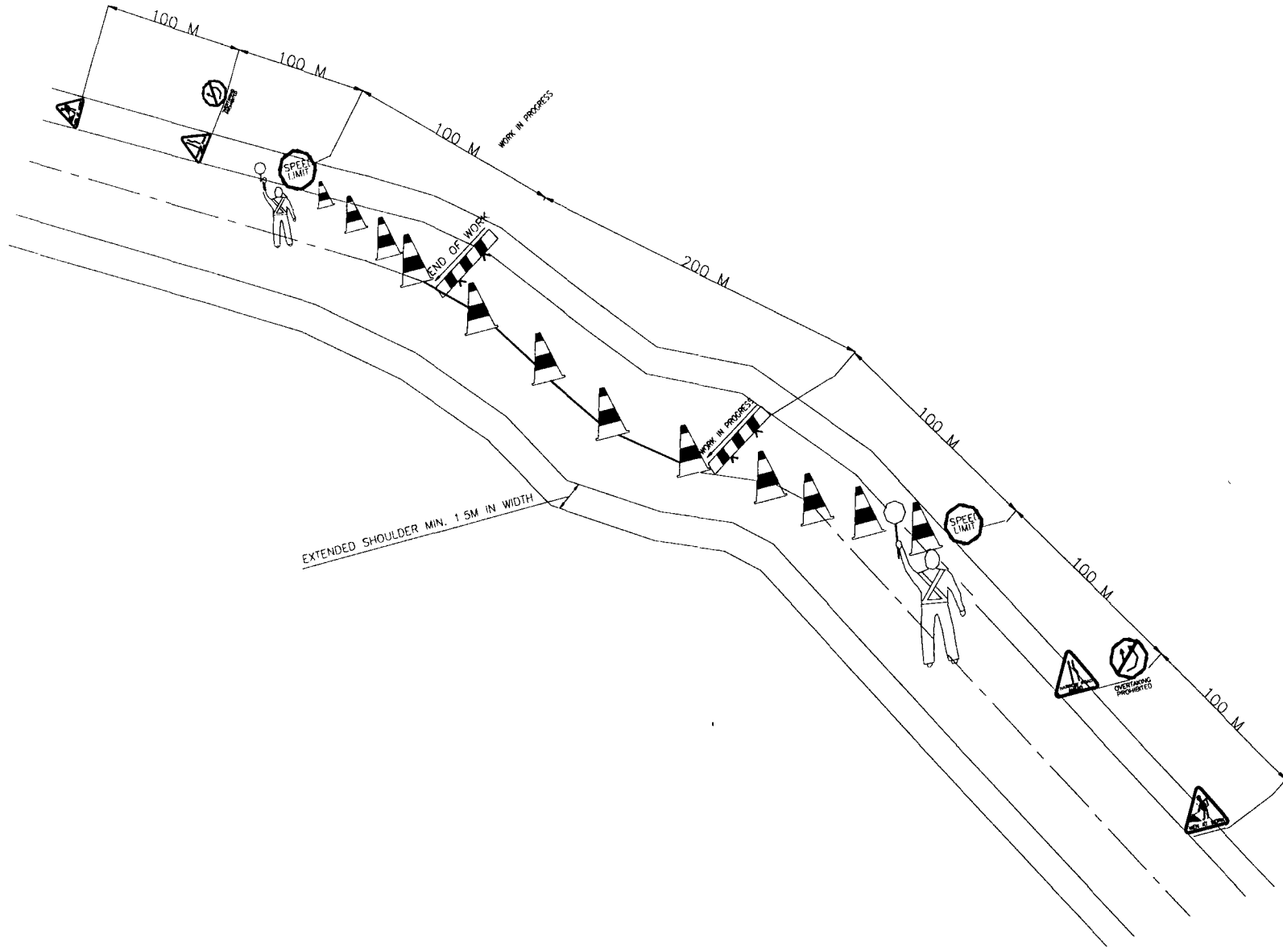
Construction Zones

The following dimensions are suggested:

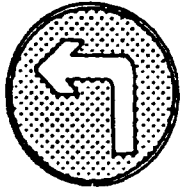
Advance working zone	300 m
Approved transition zone	100 m
Working zone	500 m
Terminal transition zone	100 m

Drawings of stages of traffic management during construction and road construction zones are placed in drawing folder.

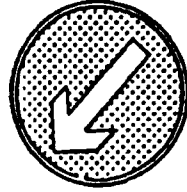
All the signages, delineators and Baricades and lateral buffer zones will be put by the contractor.



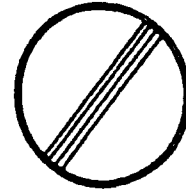
Diversion of traffic on half of the road width (say left)



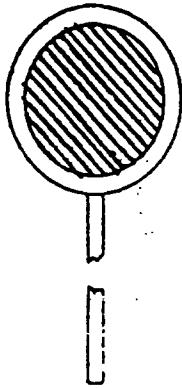
Turn left
(the direction of the arrow may be reversed for 'turn right')



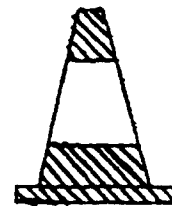
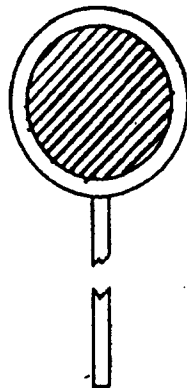
Keep left
(The arrow may be pointed downward to the right for 'keep right')



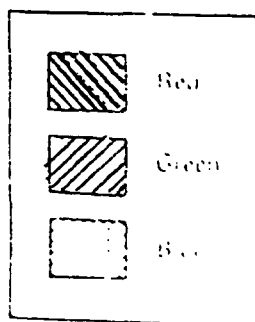
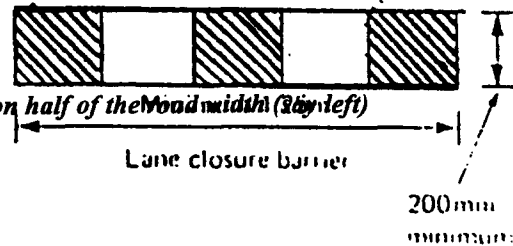
Road clear



Reversible stop/go



Traffic cone



Notes

- 1 All signs should be reflectorised
- 2 Minimum height of circular and triangular signs should be 1 metre (1.25 metres as preferred)

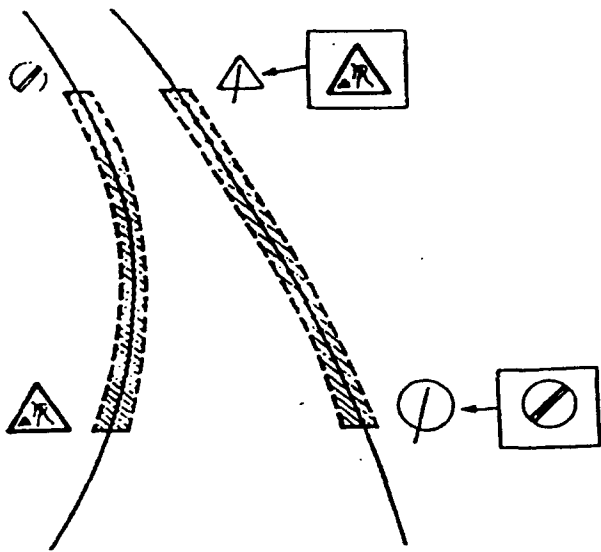


Figure: 3

Sign layout for edge working (drawn for driving on the left)

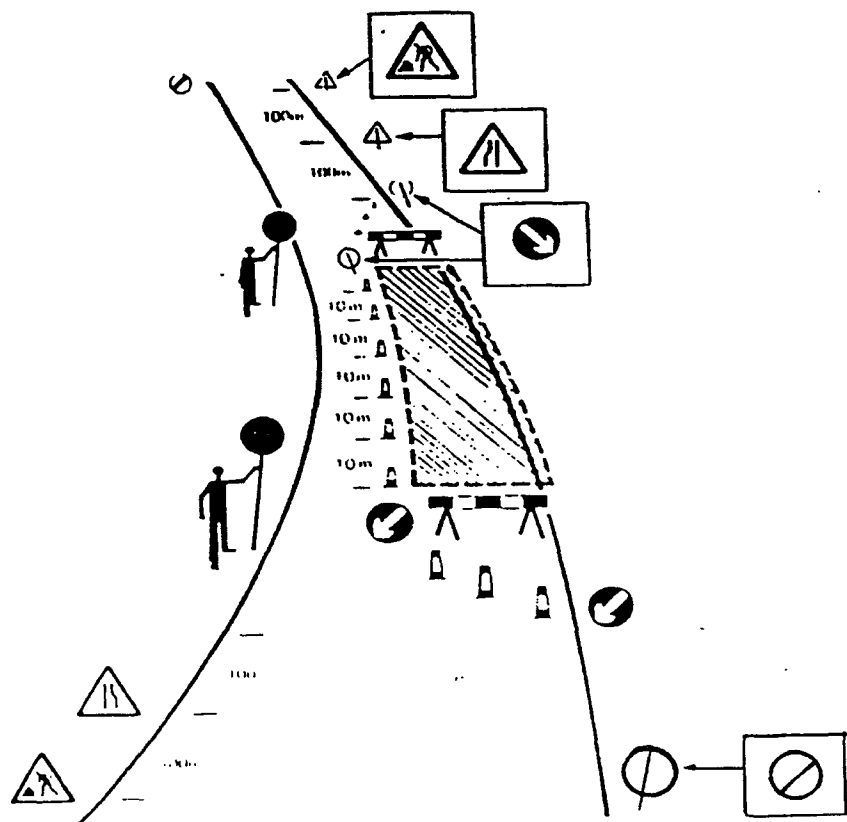


Figure: 4

Sign layout for lane closure (drawn for driving on left)

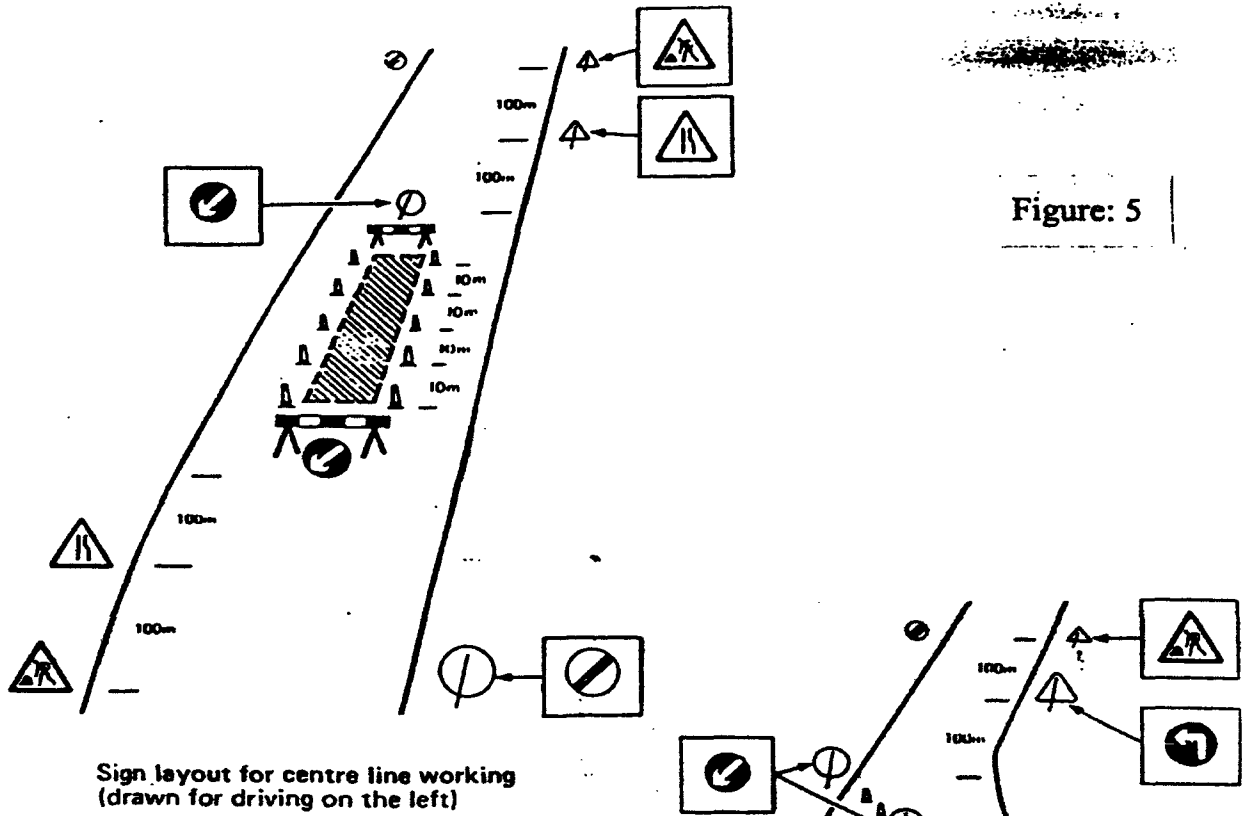
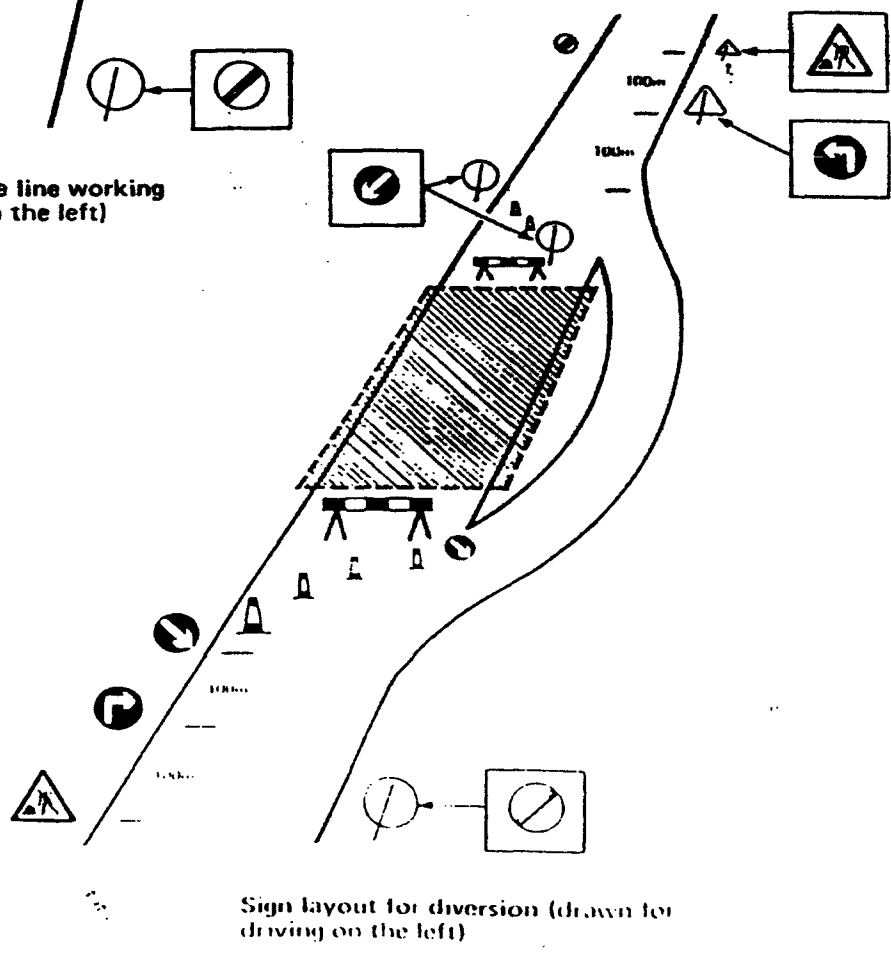


Figure: 5

Figure: 6



GUIDELINES FOR WORKERS SAFETY IN COMMON OPERATION AND DURING CONSTRUCTIONS

House Keeping Practices

1. Maintain washrooms and canteens clean
2. Keep all walkways clear and unobstructed at all times
3. Ensure that spillages of oil and greasy
4. Stack raw materials and finished products clear of walkways or inside roads
5. Do not leave tools on the floor or in any location where they can be easily dislodged
6. Keep windows and light fitting clean
7. Maintain the workplace floors dry and in a non-slippery condition
8. Provide and maintain proper drainage system to prevent water ponding
9. Use metal bins for oily and greasy rags and store all flammable materials in appropriate bins, racks or cabinets. Ensure that the metal bins for storing oily and grease rags should be covered with lids.
10. Ensure that protruding nails in boards or walls are moved or bent over so that they do not constitute a hazard to people
11. Make sure that hazardous/dangerous chemicals are kept in the goods stores with the appropriate labeling, display of the material-safety-data-sheet (MSDS) and other precautionary measures
12. Display 'no smoking' signs in areas with high fire risks, e.g. paint stores, wood working area and others

Safe layout in the construction plant, camp and quarry areas

1. Arrange border to perimeter fencing
2. Ensure good visibility and safe access at site entrances
3. Provide adequate warning signs at the entrance and exit where necessary
4. Provide adequate space/area for loading and unloading, storage of materials, plant and machinery
5. Display emergency procedure and statutory notices at conspicuous location
6. Consider welfare facilities required
7. Provide areas for dumping garbage and other waste materials, and also arrange for their regular clearance.
8. Arrange storage, transport and use of fuel, other flammable materials and explosives in line with the license requirements to be obtained from appropriate authorities
9. Plan emergency assembly points, fire escape routes and locate fire-fighting equipment
10. Provide access roads and plant movement areas within the site.
11. Ensure the availability of first aid facilities and display notices at the various works to show the location of these facilities
12. Provide proper drainage and sewage & drainage facilities

Tree Felling

Use hard hats during tree felling

Ensure tools such as the axes are in good condition

Determine proper foot and body position when using the axe. Do not cut above your head

Wear appropriate foot protection

Carry a first aid kit to the site

Determine possible hazards in the area, e.g. electrical or telephone or other utility lines

Prior to felling, determine the safest direction for the fall

Determine the proper hinge size before directing the tree fall.

Noise Hazards and its control

1. Note that indications of noise levels are:
 - You have to shout to be heard;
 - Your hearing is dulled just after work;
 - You get head noises or ringing in the ears after work;
 - You have difficulty hearing people while others are talking
2. Use sound level meters to measure. If the sound level exceeds 85 dB(A), then preventive measures should be taken
3. Make personnel aware of noisy areas by using suitable warning signs and insisting that ear protectors should necessarily be worn.
4. Reduce noise at source by improved maintenance, replacing noisy machines, screening with noise absorbing material, making changes to the process/equipment, controlling machine speeds, ensuring that two noise-generating machines are not running at the same time, using cutting oils and hydraulic breakers.
5. Appoint a competent person to carryout a detailed noise assessment of the site, designate ear protection zone, and give instructions on the necessary precautionary measures to be observed by site personnel, including the use of suitable type of ear protections.
6. Wear and maintain ear muffs and ear plugs as required
7. In construction or repair work, noise should be kept to a low-level bearing in mind the disturbance to local residents.

Road Works

1. The use of signage is most important to caution the road users of possible unsafe conditions due to the road works.
2. Use the appropriate signage devices as required by the site conditions/situation. The devices include regulatory signs, delineators, barricades, cones, pavement markings, lanterns and traffic control lights.
3. In using signs, make sure that they are (i) simple, easy-to-understand and convey only one message, (ii) luminescent and with reflective properties, and)iii) broad, prominent and of appropriate size.

4. In using barricades, make sure that you keep traffic away from work areas and you guide the drivers to keep along a safe, alternative path.
5. Ensure that proper personal protective equipment (PPE) is provided to all the workers.
6. Cover existing road signs and install new ones at appropriate locations taking into account the distances that would be required and reaction times.
7. Plan layout and traffic management so that hazard are not created.
8. Deploy flagmen, who control traffic at the work areas. The flag should be 600mm x 600mm fastened to a 1m length staff.
9. Flagmen should wear reflective safety vests along with hard hats
10. If required, use wireless devices for flagmen to co-ordinate from either ends of the road, where works are being carried out.

Electrical hazards in construction areas

1. Treat all wires as live wires
2. Never touch dangling wires, but report them to your manager
3. Unless you are a qualified electrician, do not attempt electrical repairs
4. Never use electrical equipment if you hands are wet or you are standing in water
5. If electrical equipment is sparking or smoking, turn the power off and report the condition to your supervisor
6. Never use electrical wires that have physical damage
7. Never allow equipment or traffic to run over electrical wires.

Use and Storage of Gas/LPG

1. Store filled gas/LPG cylinder in the open area, i.e. outside of the building
2. Transport, store, use and secure cylinders in upright position
3. Ensure proper ventilation at the ground level in locations where gas/LPG is in use
4. Avoid physical damage to the cylinders
5. Never weld or cut on or near the cylinders
6. Store empty cylinders secured and upright
7. Make sure that the cylinder is closed immediately after use
8. Investigate immediately if there is the smell of LPG or gas
9. Never use destenched gas/LPG on site.
10. Make sure that there is no other unrelated fire in the vicinity of the cylinder

Operation of Excavators

1. Ensure that excavators are operated by authorized persons who have been adequately trained.
2. Prevent unauthorized movement or use of the excavators
3. Check regularly and maintain the machine thoroughly

4. Ensure that all relevant information, including those related to instruction, training, supervision and safe system of work are provided to the operators.
5. Ensure that the operation and maintenance manuals, manufacturer's specifications, inspection and maintenance log books are provided for the use of the mechanics, service engineers or other safety personnel during periodic maintenance, inspection and examination.
6. During tipping or running alongside the trenches, excavators must be provided with stop blocks.
7. Excavators must be rested on firm ground during operation
8. Avoid operating the machine too close to an overhang, deep ditch or hole and be alert to potential carving edges, falling rocks and slides, rough terrain and obstacles.
9. Locate and identify underground services by checking with all utility companies before excavations.
10. Ensure that all excavations are supervised by experienced and competent persons.
11. When reversing or in case the operator's view is restricted, adequate supervision and signaling should be provided.
12. Ensure that the type and capacity of the excavator are properly chosen for the intended purposes and site conditions. Never use a machine for any purposes other than it is designed for.
13. Check and report for excessive wear and any breakage of the bucket, blade, edge, tooth and other working tools of the excavator.
14. Check that all linkages/hinges are properly lubricated and ensure that the linkage pins are secured. Never use improper linkage pins.
15. Never dismount or mount a moving machine
16. Work only with adequate ventilation and lighting
17. Ensure that the protective front screen of the driving cabin is fixed in position during excavations to avoid eye injury to the operator.
18. Ensure switch-off of the unattended vehicle.

Operation of trucks and dumpers

1. Ensure that only trained, authorized and licensed drivers operate the vehicles
2. Enlist the help of another worker before reversing the vehicle
3. Switch-off the engine of an unattended vehicle
4. Lower the tipping bodies when the machine is unattended, but if it is necessary to leave them in the raised position they should be blocked to prevent their fall.
5. Wear safety boots or shoes to avoid injuries during loading and unloading.
6. Carryout periodic servicing to the manufacturer's requirements. All records of maintenance and repairs should be in writing or kept on site.
7. Keep the vehicle tidy and the cabin free from tools and material, which might obstruct the controls.
8. Keep to speed limits.

9. No passenger should be carried on a dumper except the driver
10. Never drive the vehicle across a slope
11. Provide stop blocks when the vehicle is tipping into or running alongside excavations
12. Do not overload the vehicle.
13. Carry only well secured loads
14. Park only on level ground, in neutral with the parking brake applied
15. Never mount or dismount from a moving vehicle

Gas Welding

1. Use the following personal protective equipment during welding
 - Face or hand shield fitted with filters
 - Goggles, particularly when chipping slag
 - Gloves long enough to protect wrists and forearms against heats, sparks, molten metal and radiation
 - High-top boots to prevent sparks from entering footwear.
2. Screen of the work area with sturdy opaque or translucent materials because glare can cause eye injury.
3. Key for opening the acetylene cylinder valve must be on the valve stem while the cylinder is in use so that the cylinder valve may be immediately shut-off in an emergency.
4. Ventilate the workplace using air blowers and exhaust fans to remove poisonous fumes and gases that are given off during welding
5. Take precautions against flying sparks and hot slag where welding is being done near flammable materials and check the area before leaving.
6. Do not weld material degreased with solvents until completely dry.
7. Do not use gas cylinders for supporting work or as rollers
8. Do not use oil grease on oxygen cylinder fittings
9. Do not use cylinders with damaged valves.
10. Do not use too much force if valves are stuck.
11. Replace valve caps after use
12. Search for leaks in equipment by using a solution of soapy water.
13. Shut the cylinder valve if acetylene from a cylinder catches fire at the valve or regulator due to leakage at a connection.
14. Treat all gas cylinders as "full" unless you are sure otherwise.
15. Never attempt to transfer acetylene from one cylinder to another or attempt to refill an acetylene cylinder.
16. Place portable fire extinguishers near the welding area
17. Secure all cylinders against accidental displacement.

18. Always lift gas cylinders. Do not slide them along the ground or drop them from trucks.
19. Keep gas cylinders in vertical position both in storage and when in use
20. Keep the work place dry, secure, free from combustible materials and obstruction.
21. Store the acetylene and oxygen cylinders separately, and in a proper store.
22. Keep the gas cylinders from source of heat, flammable materials, corrosive chemicals and fumes.

Manual Handling and Lifting

1. Use mechanical equipment in lace of manual handling as far as possible.
2. Assess the manpower required to handle or life the load safety and arrange the manpower accordingly.
3. In handling hazardous materials, the workers shall be informed of the hazards and safety precautions.
4. All relevant persons shall be trained in the proper methods of lifting and carrying.
5. Where team work is required, select the persons whose ages and physical builds are compatible for teaming up. Coordinate the actions of the team members by giving necessary instructions.
6. Always lighten or suitably shape the load for manual handling as far as possible Keep a look out for splinters, sharp edges, loose banding and nails.
7. Clear path or obstruction and tripping hazards.
8. Stack and secure goods safety on trucks, otherwise they fall off and injure passers-by.
9. Use personal protective equipment such as gloves, safety shoes, etc.
10. Adopt the following procedure when you lift a load:
11. Stand close to the object. Have a firm footing with feet spread on either side of the road.
12. Bend the knees and keep your back as straight as you can
13. Grasp object firmly. Be sure grip will not slip
14. Breath in and throw the shoulder back wards.
15. Straighten the legs, continuing to keep the back as straight as you can.
16. Hold object firmly close to the body
17. Always lift smoothly. Avoid jerky motions. Turn with feet instead of twisting the back.

Handling chemicals and hazardous substances

1. Always substitute hazardous chemicals with harmless or less hazardous ones wherever possible.
2. Enclose the process using chemicals or provide other engineering controls such as local exhaust ventilation, a fume cupboard or a safety cabinet.
3. Exercise great care in the storage and use of chemicals because they may be explosive, poisonous, corrosive or combustible.
4. Separate different chemicals physically

5. Store chemicals classified as dangerous goods in a properly constructed and approved goods store. Keep proper records of all chemicals and hazardous substances delivered, stored and used on site.
6. Consider unknown substances and liquids as dangerous until proven otherwise.
7. All containers should be clearly labeled to indicate contents. Never use a wrongly labeled container for chemicals.
8. Prohibit smoking in the vicinity of dangerous chemicals
9. Ensure that you are wearing the correct personal protective equipment before you handle chemicals
10. Maintain the Material Safety Data Sheet of all chemicals for reference on safety precautions to be taken and the use of suitable PPE.
11. When opening containers, hold a rag over the cap or lid, as some volatile liquids tend to spurt up when released.
12. Wash before you eat and do not eat at the work place.
13. If the skin is splashed with a chemical, rinse it immediately with plenty of clean water. Eye should be flushed thoroughly with water followed by immediate medical attention.
14. Eye fountain, emergency shower and breathing apparatus should be available in the vicinity of the workplace.
15. Safety instructions for handling emergency situations should be displayed prominently at both the storage and use locations.

First Aid

1. Provide first aid boxes at every site
2. Ensure that training on the use of the first aid box is provided to a handful of staff working in the site.
3. Display the list of persons who are trained on providing first aid.
4. Ensure that every first aid box is marked plainly "First Aid" in English and local language.
5. The responsible person or first aider should replenish the contents of the first aid box as necessary.

Personal protective Equipment

General

1. Consider the provision of personal protective equipment only after all measures for removing or controlling safety hazards have been provided reasonably impractical.
2. Ensure that sufficient personal protective equipment are provided and that they are readily available for every person who may need to use them.
3. The management should ensure that all persons make full and proper use of the personal protective equipment provided.
4. Provide instruction and training in the proper use and care of any specific protective equipment where necessary
5. Do not willfully misuse, interfere with or ill-treat any protective clothing and equipment provided.

6. Ensure that the personal protective equipment are in good condition. Report immediately any damage to the management for replacement. Always keep the personal protective equipment as clean as possible.

Eye protection

7. Issue eye protection equipment where there is a foreseeable risk of eye injury
8. Ensure an adequate supply of goggles/shields is available.
9. Keep the goggles clean and make sure they are good fit.
10. Do not watch welding operations unless your eyes are protected from the damaging effect of flash.

Head Protection

11. No person shall enter a construction site unless he is wearing a suitable safety helmet
12. Wear a safety helmet:
 - When there is the risk of being hit by falling objects
 - While on or near a construction site
 - During adverse weather conditions
 - When in any area designated as a “hard hat” area.
13. Provide identification labels to all helmets in some way to prevent random exchange among wearers, with one helmet exclusive to each person.
14. Inspect helmets for cracks or sign of impact or rough treatment before each usage. Destroy, remove and replace all worn, defective or damaged helmets.

Hearing Protection

15. Provide ear plugs or ear muffs as required. Use re-usable ear plugs when the reduction required (15-25 dBA) is not excessive. Use ear muffs where a large attenuation of upto 40 dBA is demanded.
16. Do not use dry cotton wool for hearing protection because it cannot provide any.
17. Provide disposable ear plugs for infrequent visitors and ensure that they are never re-used.
18. Provide re-usable ear plugs for those who need to work continuously for a long period in a high noise area.
19. Use ear muffs with replaceable ear cushions because they deteriorate with age or may be damaged in use.
20. Avoid wearing spectacles with ear muffs.
21. Use soap and water or the recommended solvent for cleaning ear muffs.
22. Provide ear muffs for those who may need to get in and out of a high noise area frequently.

Respiratory Protective Equipment

23. Wear suitable respirable for protection when there is a potential for small particles entering the lungs, e.g. emptying of cement bags.
24. Ensure that the exhalators can provide adequate protection.

25. Provide training to all persons using the respirators for their correct fitting, use, limitations and symptoms of exposure.
26. Clean and inspect all respirators before and after use.
27. Store respirators properly when not in use.

Safety Footwear

28. Wear suitable footwear for work
29. Use safety footwear on site or in other dangerous areas
30. Wear suitable safety shoes or ankle boots when working anywhere where there is high risk of foot injuries from slippery or uneven ground, sharp objects, falling objects, etc.
31. All safety footwear, including safety shoes, ankle boots and rubber boots, should be fitted with steel toecaps.
32. Avoid wearing flip flops, high heeled shoes, slippers, light sport shoes in situations where there is a risk of foot injury.
33. Keep shoe lace knots tight.

Hand Protection

34. Wear suitable gloves for selected activities such as welding & cutting and manual handling of materials & equipment.
35. Do not wear gloves where there is a risk of them becoming entangled in moving parts of machinery
36. Wash hands properly with disinfectant soap and clean water before drinking, eating or smoking. Wash hands immediately after each operation on site when the situation warrants.

Fire Prevention, Fighting and Equipment

Before fire breaks out

1. Store flammable material in proper areas having adequate fire protection systems.
2. Display sufficient warning signs.
3. Train selected personnel to use these fire extinguishers
4. Inspect fire extinguishers regularly and replace as necessary
5. Fire escape route should be kept clear at all times and clearly indicated.
6. Know the escape route and assembly point.
7. Display escape route maps prominently on each floor
8. Carryout fire drill regularly. Designate fire officers
9. Install fire alarm wherever required and test regularly.
10. Provide sufficient exit signs at prominent locations for directing people to the escape staircases and routes.

When fire breaks out.

11. Alert all persons

12. Put off the fire with appropriate fire extinguishers only when you are sure that you are safe to do so.
13. Escape if you are in danger through the fire escape route to assembly point
14. Fire officers to carryout head count at the assembly point.

Incident and accident investigations

1. Carryout the investigation as quickly as possible.
2. Conduct interviews with as many witnesses as necessary
3. Do not rely on any one sole source of evidence
4. Use the following tools:

Checklists for obtaining basic and typical information for accidents

- Notebook
 - Tape records
 - Camera
 - Measuring tape
 - Special equipment for the parituclar investigation
5. Obtain answers to the following questions:
 - When did the accident occur?
 - Where did it occur?
 - Who was injured and what was damaged?
 - What caused the accident?
 - Why did it occur?
 - How could it have been prevented?
 - How can a recurrence be prevented?
 6. Prepare a short but sufficient investigation report that contains the following:
 - A summary of what had happened
 - A summary of events prior to the accident
 - Information gathered during the investigation
 - Details of witnesses
 - Information on injury or loss sustained
 - Conclusions and possible causes of the accident
 - Recommendations to prevent recurrence
 - Supporting materials (photos, diagrams, etc.)

GUIDELINES FOR WORKERS SAFETY DURING CONSTRUCTION

Sl No.	Stage and Nature of Construction Hazard	Safety measures expected to be taken by the Contractors and Site Engineers
1	Excavation in soft loose & slushy soil above 2.00 m depth sliding of earth or collapsing of sides.	The Excavation beyond 1.5 m to 2.00 m to be done in steps of minimum 500 mm offsets as shown in Clause 2.18.2(b) and also planking and strutting should be done as in Clause 2.19.1.
2	Excavation in slippery area (water logged) – The labour may fall or machinery on site may slip.	Try to dewater the area and spread minimum 150 mm thick sand layer to avoid slipping
3	Excavation in Rock where chiselling is involved – The fall of hammer may injure the hand, small rock pieces may injure the eyes and legs.	For hammer work, only experienced and skilled labour should be employed. Chisel should not be allowed to be held by hand, while hammering but chisel holding clamp should be provided. The labour should be provided with goggles and leg cover to protect eyes and legs, from injuries due to small rock pieces.
4.	Excavation in Rock where blasting is involved - Careless handling may lead to injury to main worker or a passer by.	The work of blasting should be entrusted to only experienced persons. Provide sufficient length of fuse to give ample margin of time from the time of lighting to the time of explosion. A danger zone at least 180m diameter is to be flagged off 10 minutes before actual firing. All workmen should be sent away from danger zone except the firing man, who should be provided with a whistle.
5	Excavation for drain across road or manhole adjacent to a road – chances of a passer by falling into the excavated portion	The area should be well barricaded & a red lamp provided at night. A watchman should be deputed to prevent any movement of persons, or vehicles.
6	During Excavation or some times even while concreting – Snake bites or Scorpion stings –	In places where the movement of snakes are more the contractor should provide the labour with gum boots, gloves etc. and also make snake antidotes available on site. A particular care that has to be taken on such site is to always keep a vehicle available on site to rush the patient to a doctor. This applies to snake stinged patients as well.
7	Centring (form-work) and scaffolding –Form-work collapse while concreting or just before concreting especially when wooden ballies are used.	Many a times ballies joined together give way due to weak joint. Hence the use of joined ballies should be restricted. Only 2 joined ballies out of 8 ballies should be allowed. In case of double staging for a Slab at a height, utmost care should be taken to see that the top balli rests on the bottom balli. A particular care that should be taken during each concreting operating of slabs and beams is that, one carpenter and two helpers with spare ballies, nails etc. should be deputed below the slab/beam that is being concreted to watch any disturbance in the supports of the form-work below during concreting and in case of any doubt the concreting should be stopped immediately and the form work strengthened. Never allow bricks below a balli to make up the required height. This is most dangerous.
8	Form-work for beams and slabs: The bottom of beam collapses and many a times brings down the slab as well, injuring the labour and supervision staff.	This case is noticed when slender ballies are used without bracing. In fact, no concreting should be allowed without bracing at 300 mm above ground, and at mid way, in normal beams & slabs. The bracings should be for the support of beams as well as slabs.
9	Form-work for sides of a slab–The labour just rests his foot on the plank and looses balance and falls resulting a fatal accident.	This is noticed when the carpenter fixes the side shuttering of a slab with a plank just tied by binding wire to the steel reinforcements and by wooden pieces nailed in wall and plank. This is so weak a portion that with little pressure the plank gives way. Hence side shuttering should be done with a direct balli support from ground or floor, and the practice of tying planks with binding wire to the steel reinforcement should be totally avoided. A temporary railing along the periphery of slab will guard the life of labour and supervision staff.

Sl No.	Stage and Nature of Construction Hazard	Safety measures expected to be taken by the Contractors and Site Engineers
10	Form-work for beams and slabs—Opening the form-work—Accident due to fall of materials during removing the forms.	In fact, this is a most dangerous work. One should be very careful while form-work is removed. Only trained carpenters should be deputed for the work. A safe resting place outside the area of slab as a temporary measure should be constructed from where the Slab can be removed safely. Removal of form-work during night should not be permitted under any circumstances.
11	Scaffolding—Fall of work-man, Supervision Staff, Standing on Chalis not tied properly or tied only at one end. (Chalis mainly made of Bamboos).	This is a very common negligence on the part of labour who do scaffolding work. The Chalis on which they work either span over it's complete length or is tied loosely and many a times at one end only. Hence, care must be taken that the Chali do not span over the full length but some middle support should be provided and also the same is tied properly on both ends.
12	Ladders—Balli or bamboo ladders – The horizontal member breaks and the person falls. Some times the top face just rests on wall and the whole ladder tilts causing an accident.	The ladders should be strong enough to bear the weight of a labour with materials on head. As far as possible a hand rail should be provided at one end. The horizontal member should be preferably fixed with bolt & nuts or strong nails. When the ladder is placed across a wall the top portion should be tied firmly to a strong support so that the ladder does not move laterally.
13	Column Reinforcements—Column reinforcements mainly in independent footings collapses – Injury to persons working nearby.	The tendency of bar-benders is to tie the vertical steel with coir rope or 8 mm steel rods as ties on all four sides of the column reinforcement. This method of supporting the column reinforcements results in a weak support. Hence, the column reinforcements should be supported by strong ballies on all four sides of reinforcements and as far as possible a combined platform should be constructed out of ballies over which the reinforcements can be supported.
14	Concreting chajjas – When chajjas are concreted with out care and on opening the form-work the chajja would collapse, causing injury to labour on top or bottom of chajja.	While concreting chajjas care must be taken that the labour do not stand on the reinforcement and disturb the position. Separate scaffolding must be tied over which the labour can stand and work without disturbing the reinforcements. The main reason is in chajja the steel is placed on top face but if the labour stands on the steel, it will bend and come to bottom face and hence the chajja will fall when form-work is removed, thus, causing injury to labour working on top, or bottom.
15	Dismantling—Dismantled materials may fall on passer by or the person engaged in dismantling work may fall due to slipping. The dismantled materials may fall on persons working below.	When work of demolition is to be taken up the area should be closed for all outsiders. No one should be allowed up to 50 m. from the place of demolition. The workers engaged in demolition should be asked to wear safety belts. Helmets must be worn by all the workers engaged in dismantling work. The place should be strictly guarded at night with red lights at prominent places, and watchman should be posted.
16	Electric-Connections/Cables etc. –High tension/L.T. Electric wire passing near the slab structure- while bending, lifting or tying reinforcements the bar benders may sustain the Electric Shock, causing fatal injury.	The work in such places, should not be allowed to the workers themselves, but in such position the work must be executed under the strict supervision of a responsible Foreman or a Supervisor.
17	Electric Connections/Cables etc. –Cables below ground may get punctured during excavation & thus electrocute the labour working. Similarly when concreting is in progress the punctured cable may prone to be fatal to the labour.	Before taking up the work all available drawings should be studied, local enquiry to be made to know the position of cables and work in such area should be got executed under strict supervision of an experienced Foreman or a Supervisor.
18	Electric Connections/Cables etc. –Temporary Electric lines near damp walls, near joinery stretched on a considerable length – There is every chance that the wire may get cut due to usage and may develop short circuits/leakages	The Electric wires should be maintained by an electrician who should regularly check up the insulation of wires especially placed near steel items & damp areas. The temporary wiring should be supported properly. As far as possible a good quality wire should be used which

Sl No.	Stage and Nature of Construction Hazard	Safety measures expected to be taken by the Contractors and Site Engineers
	etc. and may electrocute the person touching the wire accidentally.	may not get damaged easily.
19	Electric and gas welding work – Drilling, polishing work – Done by temporary cables used on a number of works – Due to the fact that the wires are old & when they come in contact with water even in the process of curing the surrounding area may get affected due to leakage in the electric current thus causing damage to the workers & supervision staff.	All wiring works to be inspected by experienced electrician. All wires to be properly insulated and fixed at height on temporary poles. No welding work should be permitted near damp area. The welders to be provided with welder's goggles & gloves. As far as possible machine in good condition should be used.
20	Construction Machinery & Lifts – Concrete Mixers – Safety precautions. A mixer with hopper tried to be operated by an helper could not release brake in time thus causing injury to the person near hopper- some times fatal one.	The Mixers with hopper should be operated by an experienced mixer operator and such mixers should not be allowed to be handled by a helper or a labour.
21	Construction Machinery & Lifts - Lifts - Safety precautions. (1) The lift pit if left unguarded the children of workers may fall in the pit resulting in fatal accident	(1) A brick protection wall of minimum 1.00 m height should be constructed around the Lift Pit, thus, preventing the children going near the pit. A special care should be taken to see that the children are not allowed to come near the machinery.
	(2) The manually operated brakes of the lift failed or the communication between the labour at the top and the liftman failed and thus, the lift was not controlled and resulted in fatal accident.	(2) The condition of the lift must be maintained properly. The lift operator should be well trained. The labour receiving the bucket at top should be smart and active enough to convey the message of stopping & releasing the lift-to-lift operator properly.
22	Water Storage Tank for general use & curing - chances of children of workers falling in the tank with fatal accident.	The water tanks constructed on site should be protected by at least 1.00 m high walls on four sides, so that the children do not fall.
23	Misuse of lift by labour and some times supervision staff The lifts that are meant for lifting materials used by labour to go to upper floors – The labour thus traveling many a times get injured.	No person should be allowed to go to upper floors by lifts that are mainly meant for conveying the building materials. Fatal accidents have taken place due to above action of workers.
24	Site Cleaning–Cleaning top floors of buildings – Upper portion of any structure – Throwing waste materials broken concrete pieces, brick bats, sand etc. straightway from top to ground injuring person below or even a passerby.	This dangerous practice should not be allowed at all. The materials should be brought to the ground with the help of lift or the use of rope over pulley with a bucket, thus bringing down materials safely.
25	Bar bending work-Helpers of bar benders to follow short cut method, throw surplus steel pieces from top floors to ground and may cause fatal injuries.	This is a very bad practice. The helpers should bring the rods to ground with the help of lift or rope & pulley.



GUIDELINES FOR SOIL EROSION AND SEDIMENTATION CONTROL

All materials shall meet commercial grade standards and shall be approved by the Engineer before being used in the work.

Construction Operations

Prior to the start of the relevant construction, the Contractor shall submit to the Engineer for approval, his schedules for carrying out temporary and permanent erosion/sedimentation control works as are applicable for the items of clearing and grubbing, roadway and drainage excavation, embankment/sub-grade construction, bridges and other structures across water courses, pavement courses and shoulders. He shall also submit for approval his proposed method of erosion/sedimentation control on service road and borrow pits and his plan for disposal of waste materials. Work shall not be started until the erosion/sedimentation control schedules and methods of operations for the applicable construction have been approved by the Engineer.

The surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and fill operations shall be limited to the extent practicable. The Contractor may be directed to provide immediate control measures to prevent soil erosion and sedimentation that will adversely affect construction operations, damage adjacent properties, or cause contamination of nearby streams or other watercourses. Such work may involve the construction of temporary berms, dikes, sediment basins, slope drains and use of temporary mulches, fabrics, mats, seeding, or other control devices or methods as necessary to control erosion and sedimentation.

The Contractor shall be required to incorporate all permanent erosion and sedimentation control features into the project at the earliest practicable time as outlined in his accepted schedule to minimize the need for temporary erosion and sedimentation control measures.

Temporary erosion/sedimentation and pollution control measures will be used to control the phenomenon of erosion, sedimentation and pollution that may develop during normal construction practices, but may neither be foreseen during design stage nor associated with permanent control features on the Project.

Where erosion or sedimentation is likely to be a problem, clearing and grubbing operations should be so scheduled and performed that grading operations and permanent erosion or sedimentation control features can follow immediately thereafter if the project conditions permit; otherwise temporary erosion or sedimentation control measures may be required between successive construction stages. Under no conditions shall a large surface area of erodible earth material be exposed at one time by clearing and grubbing or excavation without prior approval of the Engineer.

The Engineer may limit the area of excavation, borrow and embankment operations in progress, commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding and other such permanent erosion, sedimentation and pollution control measures, in accordance with the accepted schedule.

Temporary erosion is sometimes caused due to the Contractor's negligence, carelessness or failure to install permanent controls. Sedimentation and pollution control measures then become necessary as a part of The work as scheduled or ordered by the Engineer, and these shall be carried out at the Contractor's own expense. Temporary erosion, sedimentation and pollution control work required, which is not attributed to the Contractor's negligence, carelessness or failure to install permanent controls, will be performed as ordered by the Engineer.

Temporary erosion, sedimentation and pollution control may include construction work outside the right of way where such work is necessary as a result of road construction such as borrow pit operations, service roads and equipment storage sites.

The temporary erosion, sedimentation and pollution control features installed by the Contractor shall be maintained by him till these are needed, unless otherwise agreed by the Engineer.

GUIDELINES FOR MEDIAN PLANTATION AND GRASS TURFING

1 GENERAL DESCRIPTION

- 1.1 The species to be planted in median would be of low as medium height with ornamental value to enhance the visual experience of the road corridor. It will also act as a screen to prevent glare from the incoming vehicles.
- 1.2 One or two rows of flowering shrubs are recommended in accordance to the varying width of the median of different sections. In sections where median width is less than 1.5 meter, only grass turf is recommended. In median width of 3 meters, one row of shrub whereas in 5 meter median width, plantation of two rows of flowering shrubs are proposed.
- 1.3 Only two rows of shrubs will be planted on median width of 5 meters and these plants will be at a spacing of 1.5 meters from the inner edge of the median.
- 1.4 The plants will be at spacing of 3x3 meters and size of the pits for planting will be 0.6m dia and deep. Therefore, total no. of plants per km will be 333 in case where single row is proposed and 666 in case of two row.
- 1.5 The species recommended for median are mainly Bougainvillea and Kaner. Bougainvillea is considered as the most suitable species as it has a great aesthetic value and it is found in various colours and shades. It can also withstand extreme temperature and climate conditions and also has low requirements of water. These species have been proposed considering the climatic conditions, requirements of water and future management. However other species listed in the appendices may also be used.
- 1.6 The surface for the median plantation should be well prepared. The masses of loose debris on the median and any convexities will be removed and similarly and concavities are to be filled by good soil. The surface should have sufficient layer of good quality of soil so as to have a better growth and survival of grasses and shrubs.
- 1.7 The height of the plants will not be less than 1 ft. and need to be in polythene bags until the planting.
- 1.8 All plants supplied must be planted within three days of removal from the nursery.
- 1.9 The contractor will be required to water the area in case of sufficient rains water after planting.
- 1.10 Size of the pits for planting shrubs - 45x45x45 cm
- 1.11 No. of Plant per km - 666
- 1.12 Use of compost of manure with soil, and refilled - 1/3 of volume of pit mixed

Table-1: Activities schedule for Plantation along the Road/Median

Year	Month	Sl No.	Activities to be done
1 st Year	Jan to Mar	1	Surveying & Clearing of the area
		2	Digging of Pits
		3	Procurement of Angles Iron and Barbed wire (or other fencing material), and erecting the fence
2 nd Year	April to June	1	Purchase of Farm yard manure
		2	Brick/Iron etc. guard for 1 st row
		3.	Plantation along the road
		4	Filling up of pits with Farm yard manure and soil
	July to August	1	Transportation of Plants

Year	Month	SI No.	Activities to be done
		2	Planting of Sapling
		3	Watering
		4	Weeding and Hoeing
	Sept to Nov	1	Weeding of Hoeing
		2	Watering 4 times a month
	Dec to Feb	1	Weeding of Hoeing
		2	Maintenance
	March	1	Watering 4 times a month
3 rd Years	April to June	1	Watering 6 times a month
	July to August	1	Casualty Replacement (20% of the total plants)
		2	Weeding
		3	Maintenance by Mali
	Sep to Nov	1	Watering 2 times a month
		2	Maintenance by Mali
	Dec to Feb	1	Maintenance by Mali
	March	1	Watering 4 times a month
		2	Maintenance by Mali
4 th Year	April to March	1	Watering
		2	Casualty Replacement (10% of the total plants)
		3	Maintenance by Mali

2 PLANTATION

Scope

Contractor to furnish all materials, labor and related items necessary to complete the work indicated on drawing and specified herein.

2.1 Materials

Saplings

- Saplings/Seedlings shall be well-formed and free from defects such as knots, sun-scaled, windburn, injuries, abrasion or disfigurement. All saplings shall be healthy, sound, free from plant diseases, insect's pests, of their egg and well-developed root systems.
- No plant will be accepted, if branches are damaged or broken. All the plant material must be protected from the sun and weather until planted.
- Any nursery stock shall have been inspected and approved by the Environment officer.
- All saplings will be delivered with legible identification labels.
- The root system shall be conducive to successful transplantation. While necessary, the root-ball shall be preserved by suitable material. On soils where retention of a good ball is not possible, the roots should be suitably protected in some other way, which should cause any damage to roots.

Topsoil/Good Earth

- Topsoil or good earth shall be a friable loam, typical of cultivated topsoil of the locality containing at least 2% of decayed organic matter (humus).

- Stored topsoil will be used for plantation at median and also for roadside plantation. Otherwise it could be taken from a well-drained arable site.
- It shall be free of subsoil, stones, earth skids, sticks, roots or any other objectionable extraneous matter or debris.
- It shall contain no toxic material.
- No topsoil shall be delivered in a muddy condition.

Manure

Only organic manure will be used for plantation. Composts from municipal solid wastes and distillery waste may be used. Manure shall be free from extraneous matter, harmful bacteria insects or chemicals (Subjected to safety norms).

General Condition

Shrubs shall be substantially free from pests and diseases, and shall be materially undamaged. Torn or lacerated roots shall be pruned before dispatch. No roots shall be subjected to adverse conditions such as prolonged exposure to drying winds or subjection to water logging, between lifting and delivery.

Supply and Substitution

Upon submission of evidence that certain materials including plant materials are not available at time of contract, the contractor shall be permitted to substitute other and plants, with an equitable adjustment of price. All substitutions shall be of the nearest equivalent species and variety to the original specified and shall be subjected to the approval of the Landscape Architect. Packaging shall be adequate for the protection of the plants and such as to avoid heating or drying out.

Each specimen of tree and shrub, or each bundle, shall be legibly labeled with the following particulars:

- Its name (Both common and Scientific)
- The name of the supplier, unless otherwise agreed.
- The date of dispatch from the nursery.

2.2 Planting

Plants and Shrubs

All saplings should be supplied with adequate protection as approved. After delivery, if planting is not to be carried out immediately, balled plants should be placed and the ball covered with sand to prevent drying out. Bare rooted plants can be heeled in by placing the roots in prepared trench and covering them with earth, which should be watered into, avoid air pockets round the roots. Shrubs shall be planted as suggested by Environment officer.

Digging of Pits

- Tree pits shall be dug a minimum of three weeks prior to backfilling.
- The pits shall be 60 to 90cms in diameter and 90 to 120cms deep.
- While digging the pits, the topsoil upto a depth of 30cms may be kept aside, if found good (depending upon site conditions), and mixed with the rest of the soil.
- If the soil is normal it shall be mixed with manure.
- The bottom of the pit shall be forked to break up the subsoil.

Back Filling

The soil back filled watered through end gently pressed down, a day previous to planting, to make sure that it may not further settle down after planting. The soil shall be pressed down firmly by treading it down, leaving a shallow depression all round for watering.

Planting

- No pits shall be dug until final position has been pegged out for approval.
- Care shall be taken that the plant sapling when planted is not be buried deeper than in the nursery, or in the pot.
- Planting should not be carried out in waterlogged soil.
- Plant shrubs at the original soil depth; soil marks on the stem is an indication of this and should be maintained on the finished level, allowing for setting of the soil after planting.
- All plastic and other imperishable containers should be removed before planting.
- Any broken or damage roots should be cut back to sound for healthy growth.
- The bottom of the planting pit should be covered with 50mm to 75mm of soil.
- Bare roots should be spread evenly in the planting pit; and small mound in the center of the pits on which the roots are well aid on and evenly spread.
- Soil should be placed around the roots, gently shaking the shrubs to allow the soil particles to shift into the root system to ensure close contact with all roots and prevent air pockets.
- Back fill soil should be firmed as filling proceeds, layer by layer, care being taken to avoid damaging the roots.

Staking

Newly planted shrubs must be held firmly although not rigidly by staking to prevent a pocket forming around the stem and newly formed fibrous roots being broken by mechanical pulling as the tree rocks.

Methods:

The main methods of staking shall be:

- A single vertical stake, 900mm longer than the clear stem of the shrubs driven 600mm to 900mm into the soil.
- Two stakes as above driven firmly on either side of the shrubs with a cross bar to which the stem is attached. Suitable for bare- rooted or Ball material.
- A single stake driven in at an angle at 45 degrees and leaning towards the prevailing wind, the stem just below the lowest branch being attached to the stake. Suitable for small bare- rooted or Ball material
- For plant material 3m to 4.5m high with a single stem a three- wire adjustable guy system may be used in exposed situations.

The end of stake should be pointed and the lower 1m to 1.2m should be coated with a non-injurious wood preservative allowing at least 150mm above ground level.

Tying

Each shrubs should be firmly secured to the stake so as to prevent excessive movement. Abrasion must be avoided by using a buffer, rubber or Hessian, between the shrubs and stake. The shrubs should be secured at a point just below its lowest branch, and also just above ground level; normally two ties should be used for shrubs. These should be adjusted or replaced to allow for growth.

Watering

The Landscape Contractor should allow for the adequate watering in of all newly planted trees and shrubs immediately after planting and during the growing season, keep the plant material well watered.

Manure/Fertilizer usage

The fertilizers/manure usage should be such that the turn of all the fertilizers comes after, every 15 days from the beginning of the monsoon till the end of winter:

Organic well-rotted dry farm yard manure: 0.05 cum or tussle.

- Urea 25gm.
- Ammonium sulphate 25gm.
- Potassium sulphate 25gm.

All shrubs, which are supplied pot grown, shall be well soaked prior to planting.

Watering in and subsequent frequent watering of summer planted container- grown plants is essential.

Application of inorganic manure should as for possible be avoided. Form yard manure as biofertilizer with for better option.

Shrub Planting in Planter Beds

All areas to be planted with shrubs shall be excavated, trenched to a depth of 750mm, followed by refilling the excavated earth after breaking clods and mixing with sludge in ratio 8:1 (8 parts of stacked volume of earth after reduction by 20%: 1 part of stacked volume of sludge after reduction by 8%.)

For planting shrubs and ground cover shrubs in planters, good earth shall be mixed with sludge in the proportion as above and filled in planters.

Positions of planters should be marked out in accordance with the architectural drawing.

3 GRASS TURFING

The specifications for grass turfing are to be referred from 'specifications for Roads and Bridge works' by MOST, Section 300, Clauses 307.1, 307.2, 307.3.

Preparation of Ground

During period prior to planting, the ground shall be maintained free from weeds. Grading and preparation of the area shall be completed at least three weeks prior to the actual sowing. Regular watering shall be continued until sowing by dividing the area into portions of approximately 5 m squares by constructing small bunds to retain water. These 'bunds' shall be leveled just prior to sowing of grass plants; it shall be ensured that the soil has completely settled.

Soil

The soil itself shall be ensured to the satisfaction of Landscape Architect to be a good-Fibrous loam, rich in humus.

Sowing the grass roots

Grass roots (*cynodon dactylon* or a local genus approved by the Landscape Architect) shall be obtained from a grass patch, seen and approved before hand.

The grass roots stock received at site may be stored and shall be manually cleared of all weeds with water sprayed over areas.

Small roots shall be dibbled about 5 cm apart into the prepared grounds. Grass will only be accepted as reaching practical completion when germination has proved satisfactory and all weeds have been removed.

Maintenance

As soon as the grass is approximately a 3 cm high it shall be rolled with a light wooden roller – in fine, dry weather – and when it has grown to 5 to 8 cms, above to the ground weeds must be removed and regular cutting with the scythe and rolling must begun. A top-dressing of an ounce of guano to the square yard or well decomposed well broken sludge manure shall be applied. When the grass is sufficiently secure in the ground to bear the moving machine, the blades must be raised an inch above the normal level for the first two or three cuttings. That is to say, the grass should be cut so that it is from 4 to 5 cms in length, instead of the 3 cm necessary for mature grass.

In the absence of the rain, during the monsoon, the lawn shall be watered every ten days heavily, soaking the soil through to a depth of at least 20 cms.

Damage failure or dying back of grass due to back neglect of watering especially for seeding out normal season shall be the responsibility of the contractor. Any shrinkage below the specified levels during the contract or defect liability period shall be rectified at the contractor's expense. The contractor is to exercise care in the use of rotary cultivator and moving machines to reduce to a minimum the hazards of flying stones and brickbats. All rotary mowing machines are to be fitted with safety guards.

Rolling

A light roller shall be used periodically, taking care that the area is not too wet and sodden.

Edging

These shall be kept neat and must be cut regularly with the edging shears.

Manuring / Fertilizer use

The area shall be fed once in a month with liquid manure prepared by dissolving 45 grams of ammonium sulphate in 5 litres of water.

Watering

Water shall be applied at least once in three days during dry weather. Watering whenever done should be thorough and should wet the soil at least up to a depth of 20 cms.

Weeding

Prior to regular mowing the contractor shall carefully remove rank and unsightly weeds.

Maintenance

The Contractor shall maintain all planted areas within contract boundaries for the entire contract period (for one year until the area is handed over in whole or in phases). Maintenance shall include replacement of dead plants, watering, weeding, cultivating, control of insects, fungus and other diseases by means of spraying with an approved insecticide or fungicide, pruning, and other horticulture operations necessary for proper growth of the plants and for keeping the landscape sub-contract area neat in appearance.

Pruning and Repairs

Upon completion of planting work of the sub-contract (for plantation) all trees should be pruned and all injuries repaired where necessary. The amount of pruning shall be limited to the necessary to remove dead or injured twigs and branches and to compensate for the loss of roots and the result of the transplanting operations. Pruning shall be done in such a manner as not to change the natural habit or special shape of trees.

Nursery Stack

Planting should be carried out as soon as possible after reaching the site. Where planting must be necessary he delayed, care should be taken to protect the plants from pilfering or damage from people animals. Plants with bare-roots should be heeled- in as soon as received or otherwise protected from drying out and others set closely together and protected from the wind. If planting is to be delayed for more than a week, packaged plants should be unpacked, the bundles opened up and each group of plants heeled in separately and clearly labeled. If for any reason the surface of the roots becomes dry the roots should be thoroughly soaked before planting.

4. COMPLETION

On completion, the ground shall be formed over and left tidy.

Special Conditions and Particular Specifications:

- Wherever applicable, work shall be done according to C.P.W.D. specifications
- At the time of invitation of tender.
- Water shall be made available, near the tube well at one point. Contractors shall make their own arrangement for drawing water from there. Water charges as per the value of work done shall be deducted from the contractors Bills.
- If electricity is required for the works, the same shall be made available at one point within the site of works, for which recovery at the prevailing rate per unit shall be deducted from the contractors' bill.
- The work mentioned in the schedule of Quantities include grassing as well as planting of trees and shrubs. 'Contractors' quoted rates shall include execution of these works at different levels. No extra cost shall be paid for any item, for working at these levels.
- The Contractor shall provide all facilities to subcontractor (plantation) / Environment Officer / or his authorized representatives to make frequent inspection of their Nursery and ascertain the process / quality of various categories of trees/plants etc., grown by them.
- The safe custody and up-keep of various categories of plants brought to site is the sole responsibility of the contractor and he shall employ sufficient supervisory personnel to ensure the safety of these items.
- The site of work may be handed over to the contractors for execution of work in phases, as soon as the same are available. Nothing extra shall be payable for such phased execution of work.
- While excavating / executing the work the contractors shall ensure that existing cables / pipe lines / structures / fittings are not damaged.
- The Contractor shall co-ordinate his work with other agencies employed by the Clients and ensures that the work of other agencies is not hampered in any way during the duration of contract.
- The Contractor shall keep the site of works neat and clean during the execution of the work. Any debris found at or near the site of work shall be rescued immediately as and when so required by the Contractor.
- On completion of the work, the site of work shall be thoroughly cleaned and all debris removed before the work is handed over satisfactorily.
- The Contractors shall, without any additional charge to the clients, renew or replace any dead or defective plants/grass and shall fully maintain the whole landscape for a period of 12 months after the certified date of completion.

- Shrubs/small tree shall be of minimum length straight and symmetrical with a crown and having a persistent main stem. The size of crown shall be in good over all proportion to the height of the tree.
- Small trees and shrubs shall be well formed with the crown typical of the species or variety.
- General Requirements of Plants:
 - Plants shall be typical of their species and variety, well-developed branches, and well foliated with fibrous root system. Plants shall be free from defects and injuries. Plants shall not be pruned before planting.
 - Plants shall be free from defects and injuries.
 - Plants shall not be pruned before planting.
 - Plants shall not be freshly dug and nursery grown.
 - Nursery grown plants shall have been at least once transplanted.
 - Bark shall be free from abrasion.
 - All trees, soon after planting, shall be properly supported with bamboo stocks to ensure their safety against winds or any other factor, which may affect it adversely.

5. GENERAL REQUIREMENTS OF EARTH MANURE AND FERTILIZERS

Earth: Good earth shall be agricultural soil of loamy texture, free from kankar, morrum, shingles, rocks, stones, building rubbish and any other foreign matter. The earth shall be free from clods or lumps of sizes bigger than 50mm in any direction. It shall have pH ranging between 6.5 to 7.5.

Manure: Manure shall be of well decayed organic matter obtained in dry state from the Municipal dump or other similar source approved by the Project Engineer. The manure shall be free from earth, stone or other extraneous matter. Manure shall be supplied, at site well screened.

Fertilizers: If the soil tests indicate pH value not as per the above specification namely between '6.5 to 7.5', following measures need to be taken.

- If pH exceeds 7.5, aluminium sulphate or equivalent fertilizer should be added at the rate of 1 kg per cubic metre to lower the pH by one full point.
- If pH is below 6.5, add ground limestone or equivalent fertilizer at the rate of 1 kg per cubic metre to raise pH by one full point.

GUIDELINES FOR THE STORAGE, HANDLING, USE AND EMERGENCY RESPONSE FOR HAZARDOUS CHEMICALS

A1. REFUELING/MAINTENANCE PROCEDURE

- Truck or suitable containers will bring in all fuel and fluids. There will be no storage of fuel, oil or fluids within 100m (or 50m) of the permanent water line.
- Prior to re-fueling or maintenance, drip pans and containment pans will be placed under the equipment. Absorbent blankets may also be required to be placed under the equipment and hoses where there is a possibility of spillage to occur.
- All used oils or fluids will be properly contained and transported to appropriately licensed (authorized) disposal facilities;
- Following re-fueling and maintenance, the absorbent blankets (if any) and spill pans will be picked up and the fuel truck or container moved outside of the 100m (or 50m) wide area.

Emergency Spill Procedure

Should a spill occur, either through spillage or equipment failure, the applicable emergency spill procedure outlined in sections A-2 to A-4 must followed.

A2. SPILL PROCEDURE (INSIDE THE STREAM)

In the case of a spill, overflow or release fluid into the stream waterway (whether water is flowing during the spill or not), do what is practical and safely possible to control the situation, then get help.

➤ **Stop the flow**

- Stop the release into the stream waterway
- Shutdown equipment
- Close valves and pumps
- Plug hoses

➤ **Remove Ignition Sources**

- Shut off vehicles and other engines
- Do not allow tiger torches, vehicles, smoking or other sources of ignition near the area. Keep a fire extinguisher on hand but keep it a safe distance away from the potential ignition source (if a fire starts, the extinguisher must be easily accessible).

➤ **Contract the environmental Officer and initiate Emergency Response**

- Notify the site supervisor and the Contractor's Environmental Officer as soon as possible
- The Environmental Officer will review the situation and decide if Emergency Services like Fire Brigade are required
- Appropriate parties to be notified of the spill are
 - ❖ The contractor's Project Manager
 - ❖ The Engineer through his designated Environmental Officer
 - ❖ The Client
 - ❖ Regulatory Agencies like Pollution Control Board, Municipal Authorities, as applicable.

❖ Site Safety Officer

➤ **Cleanup and Disposal**

- Emergency Services will be engaged for the containment, cleanup and disposal of contamination release into the environment

➤ **Reporting**

- The contractor's Environmental Officer will document the event and submit reports to the Engineer, the Client and appropriate regulatory agencies like the Pollution Control Board (s).

➤ **Procedure Review**

- The Engineer will review the report, determine if changes are required to procedures and recommend implementation of all required changes....

A3. SPILL PROCEDURE (ON LAND)

In the case of a spill, overflow or release fluid onto land, do what is practical and safety possible to control the situation, then get help.

➤ **Stop the flow**

- Stop the release into the water body
- Shut down equipment
- Close valves and pumps
- Plug hoses

➤ **Remove Ignition Sources**

- Shut off vehicles and other engines
- Do not allow tiger torches, vehicles, smoking or other sources of ignition near the area. Keep a fire extinguisher on hand but keep it a safe distance away from the potential ignition sources (if a fire starts the extinguisher must be easily accessible).

➤ **Contain the Spill**

- Dike around the spill to contain the material
- Spread absorbent or place a spill blanket on the spill
- Enlist the help of personnel on site
- Notify your supervisor as soon as possible

➤ **Notification**

- Appropriate parties to be notified of the spill are:
 - ❖ The Contractor's Project Manager
 - ❖ The Engineer through his designated Environmental Officer
 - ❖ The Client
- Regulatory Agencies like Pollution Control Board, Municipal Authorities, as applicable
- Site Safety Coordinator

➤ **Cleanup and Disposal**

- The Engineer's Environmental Officer will ensure that a proper cleanup and disposal method is determined.

➤ **Reporting**

- The Contractor's Environmental Officer will document the event and submit reports to the Engineer, the Client and appropriate regulatory agencies like the Pollution Control Board (s).

➤ **Procedure Review**

- The Engineer will review the report, determine if changes are required to procedures and recommend implementation of all required changes.

A4. Spill Procedure (within ponds)

In the case of a spill, overflow or release fluid due to equipment or hose failure, do what is practical and safely possible to control the situation, then get help

➤ **Stop the flow**

- Stop the release
- Shut down equipment
- Close valves and pumps
- Plug hoses

➤ **Remove Ignition Sources**

- Shut off vehicles and other engines
- Do not allow tiger torches, vehicles, smoking or other sources of ignition near the area. Keep a fire extinguisher on hand but keep it a safe distance away from the potential ignition sources (if a fire starts the extinguisher must be easily accessible).

➤ **Contain the Spill**

- Stop any pumps that may be moving the water from the area where the spill occurred
- Enlist the help of personnel on site
- Notify your supervisor as soon as possible

➤ **Notification**

- Appropriate parties to be notified of the spill are:
 - ❖ The Contractor's Project Manager
 - ❖ The Engineer through his designated Environmental Officer
 - ❖ The Client
 - ❖ Regulatory Agencies like Pollution Control Board, Municipal Authorities, as applicable
- Site Safety Coordinator

➤ **Cleanup and Disposal**

- The Engineer's Environmental Officer will ensure that a proper cleanup and disposal method is determined. Absorbent pads will soak up the spilled material. The pads will be contained and removed from site for disposal at a licensed (authorized) facility.

➤ **Reporting**

- The Contractor's Environmental Officer will document the event and submit reports to the Engineer, the Client and appropriate regulatory agencies like the Pollution Control Board (s)

➤ **Procedure Review**

- The Engineer will review the report, determine if changes are required to procedures and recommend implementation of all required changes.



GUIDELINES FOR ARRANGEMENT WITH FOREST DEPARTMENT

Regulatory framework

- The PRDBD under the provisions of the Forest (Conservation) Act, 1980 will submit a diversion proposal in the prescribed format through the State Forest Department to the concerned Regional Office of the Ministry of Environment and Forests, of the Govt. of India. The Regional Office is the competent authority to dispose of such proposal irrespective of the area involved. While issuing such approval, the Regional Office may stipulate a condition that for every tree cut at least two trees have to be planted.
- Forest Department of the Government of Punjab after having identified the lands on the embankment and toes of the road will delineate the proposed area of compensatory afforestation on a suitable map. The Department of Forest will thereafter prepare an afforestation scheme providing therein the details of work schedule, the cost structure and proposed monitoring mechanism.

Funding Mechanism

- The Ministry of Environment and Forests under their order dt. the 24th, April, 2004 have constituted an authority known as Compensatory Afforestation Fund Management and Planning Authority for the purpose of management of money received from user agencies for compensatory afforestation. The PRDBD being the user agency in this project will be required to deposit the money as estimated by the State Forest Department to the CAMPA .
- CAMPA shall release funds to the State in predetermined installments through the State Level Management Committee as per the Annual Plan of Operations drawn by the State Forest Department

Selection of tree species

- Trees to be selected for planting should be site-specific taking into account the type of soil, features of the planting site e.g for saline and alkaline soils and water logged area will require special attention.
- Browse hardiness, good growth rate, resistance to insects/pests disease and biotic interference etc should be given appropriate weightage in selection of species.
- Evergreen / semi-evergreen species should be preferred to deciduous species.
- In urban /semi-urban stretches of road , flowering trees should be preferred to add to aesthetics of the surround.
- Trees having large tomentose leaves may be included in stretches where particulates are likely to be high.
- In the matter of selection of species for planting, stakeholders need be consulted and their views accommodated keeping view the site- specifics.

Planting Pattern

- Monoculture planting should be avoided. Mixed culture of shade-giving, flowering and fruit-bearing species should be preferred.
- The first row may be composed of a mix of species of flowering trees; such mix may consist of trees coming into flowers in different seasons.

- The second row may have representation of middle-sized evergreen and fruit-bearing species.
- The third row wherever feasible should be of broad-leaved evergreen species; the species should be so chosen as to make sure that they grow taller than trees planted in the first and second rows.

Management and monitoring

- Strip plantations should be properly fenced to prevent damages by biotic interference.
- Wherever possible live- hedges may be provided; in such stretches live-hedges need be grown a year ahead of actual planting; such hedges may be reinforced by weaving with split bamboos.
- It may also be explored as to whether communities along the roads can be involved in protection and maintenance of such plantations through a mechanism of sharing of usufructs.
- Local voluntary organisations, sports/youth clubs may also be encouraged for protection of such plantations through provision of incentives.

Reporting Formats



P1: IDENTIFICATION OF DISPOSAL SITE LOCATIONS

(To be filled by the Contractor)

Name of Corridor _____

Link No. _____

(Give chainages and nearest settlements from both ends)

Sl. No.	Criteria on which information for each site is to be collected	Site 1	Site 2	Site 3	Site 4
1	Existing Land Use				
2	Area covered (m ²)				
3	Total Material that can be dumped within the site (m ³)				
4	Depth to which dumping is feasible (m)				
5	Distance of nearest watercourse (m)				
6	Nearest Settlement (m)				
7	Date/s of Community Consultation/s				
8	Whether the community is agreeable to siting of dumping site (Y/N)				
9	Date of Permission from Villager/local community				
10	Proposed future use of the Site				
11	Selected Site (tick any one column only)				

Enclosures (Tick as appropriate)

1. Map of each location
2. Photographs
 - a. Each Disposal location
 - b. Each community consultation
3. Photo copy of Agreement

Remark

Submitted

Signature

Name

Designation

Contractor

Checked

Signature

Name

Environmental Engineer.
Supervision Consultant

Approved

Signature

Name

Executive Engineer PWD

P2: SETTING-UP CONSTRUCTION CAMP AND STORAGE AREA**(To be filled by the Contractor)**

Name of Corridor _____

Link No. _____

Construction Stage Report: Date _____ Month _____ Year _____

(Site Layout of Construction camp and working drawings of dwelling units with allied facilities to be attached with format)

Format to be submitted before target date of establishing camps

Location of Camp

Sl. No.	Item	Unit	Details	Remarks by CMU if any
1.	Detail of item camp			
a.	Size of Camp	m x m		
b.	Area of Camp	Sq.m		
c.	Distance from Nearest Settlement			
d.	Distance from Nearest Water Source	Type/Size/Capacity/ present Use/Ownership		
	Date of camp being operational dd/mm/yy			
	Present land use			
	No of trees with girth > 0.3m.			
e.	Details of Storage area (Availability of impervious surface)	Mxm		
f.	Availability of separate waste disposal from storage area	Cum		
2.	Details of topsoil stacking			
a.	Quantity of top soil removed	sq.m		
b.	Detail of storage of topsoil	Describe stacking arrangement		
3.	Details of workforce			
a.	Total No of Labourers	Nos		
b.	Total no of Male Workers	Nos		
c.	No of Male Workers below 18 years of ago	Nos		
d.	Total No of Female Workers	Nos		
e.	No of Female workers below 18 years of ago	Nos		
f.	No of children	Nos		
4.	Details of dwelling units			
a.	No of dwellings/huts	Nos		
b.	Minimum Size of Dwelling	Mxm		
c.	No. of openings per dwelling	Nos		
d.	Minimum size of opening	Mxm		
e.	Walls	specifications		
f.	Roofing	specifications		
g.	Flooring	specifications		
h.	Drinking Water Tank	specifications		
i.	Capacity of Drinking water Tank	Cum		

Sl. No.	Item	Unit	Details	Remarks by CMU if any
j.	Size of Drinking Water Tank	Mxm		
k.	Total no of WC	Nos		
l.	No of Wcs for female workers	Nos		
m.	Minimum Size of WC	Mxm		
n.	Total No of Bathrooms for female workers	Nos		
o.	Size of septic tank for WC/Baths	Mxm		
p.	Capacity of Water Tank for WCs/ Bathrooms and general purpose			
q.	Fencing around camp	Y/N		
5	Details of facilities			
a.	Availability of security guard 24 hrs a day	Yes/No		
b.	Details of First Aid Facility	Yes/No		
c.	Availability of Dav Care Centre	Yes/No		
d.	Availability of dust bins (capacity 60 Itr)	Nos		

Remark

Submitted

Signature

Name

Designation

Contractor

Checked

Signature

Name

Environmental Engineer.
Supervision Consultant

Approved

Signature

Name

Executive Engineer CMU

P3: ESTABLISHMENT OF BORROW AREAS
(To be Submitted by Contractor for taking consent for opening of Borrow area)

Name of Corridor _____

Link No. _____

Sl No.	Location				Area (m ²)	Quantity of Available Material	Type of Material	Distance from nearest Water Course (m)	Distance from nearest Settlement	Land Use		No. of Trees to be Affected	Approved by EO (Y/N)	Remark
	Name of Village	Chainage (km)	Side (LHS / RHS)	Haul road length (m)						Before	After			

Attach Photograph of Proposed Site, Location Map, Agreement

Rehabilitation Plan Measures

Location 1:

Location 2:

Remarks

Submitted

Signature

Name

Designation

Contractor

Checked

Signature

Name

Environmental Engineer.
Supervision Consultant

Approved

Signature

Name

Executive Engineer CMU

P4: ESTABLISHMENT OF HOT MIX PLANT / BATCH MIX PLANT

(To be Submitted by Contractor for taking permission from CMU)

Name of Corridor _____

Link No. _____

SI No.	Location				Area (m ²)	Distance from nearest Water Course (m)	Distance from nearest Settlement	Existing Land Use	Prevalent Wind Direction	Weather in Down Wind Direction (Y/N)	Approved by EO (Yes / No)	Remarks
	Name of Village	Chainage (km)	Side (LHS / RHS)	Haul road length (m)								

1. Attach Photograph of Proposed Site

Remark

Submitted
 Signature
 Name
 Designation
 Contractor

Checked
 Signature
 Name

 Environmental Engineer.
 Supervision Consultant

Approved
 Signature
 Name

 Executive Engineer CMU

P5: ROAD SAFETY REPORTING FORMATS

Name of Corridor _____

Link No. _____

One time reporting before commencement of construction in the Construction Zone

Sketch of construction zone showing all sub zones and location of signs, etc. to be attached with format
(Reporting by Contractor to CMU)

Format on Acquisition of Temporary diversions to be attached with format

Construction stage: Monthly Report - Date Month.....Year.....

DIVERSION NO. ___ Location (km ___)

Sl. No.	Item	Unit	Compliance	Remarks
Details of Construction Zone				
1.	Length of Construction Zone	km		
2.	Distance between this and next construction zone	km		
3.	Length of transition sub zone (should be min 50 for a speed of 50 km / hr)			
4.	Length of work sub zone in urban stretch (should be <2 km)	km		
5.	Length of work sub zone in rural stretch (5-10 km)	km		
6.	Distance between two work sub zones			
Signage's in Construction Zones				
1.	Sign saying 'Men at Work' 1 km ahead of transition sub zone	Y/N		
2.	Supplementary sign saying diversion 1 km provided	Y/N		
3.	Sign saying 'Road Closed ahead' provided	Y/N		
4.	Compulsory Right Turn / Left sign provided	Y/N		
5.	Detour sign placed			
6.	Sharp deviation sign placed at end of advance warning sub zone	Y/N		
Signage in Transition Sub Work Zone				
1.	Signage saying 'Keep Right / Left' provided	Y/N		
2.	Delineators placed along length of transition	Y/N		
Signage in work sub zone				
1.	Hazard Marker placed where railing for CD structure on diversion starts	Y/N		
2.	Barricade on either side of work sub zone	Y/N		
Signage in Termination sub zone				
1.	Sign for indication of end of work zone 120 m from end of termination sub zone	Y/N		
Road Delineator				
1.	Roadway indicators provided			
2.	Hazard Makers provided			
3.	Object Makers Provided			

Remark

Submitted
Signature
Name
Designation
Contractor

Checked
Signature
Name
Environmental Engineer.
Supervision Consultant

Approved
Signature
Name
Executive Engineer CMU

P6: ARRANGEMENT FOR TEMPORARY LAND
Reporting by Contractor to CMU (PRBDB)

Name of Corridor _____

Link No. _____

Construction stage: quarterly Report – Date: _____ Month _____ Year _____

(Site Layout of all locations to be attached with format)

Sl. No.	Item	Target date for Establishment	Date of Establishment	Location					Present Land use	Size (mxm)	Existing Trees >30 cm girth	Dist. From nearest settlement	Dist. From nearest water source	Site approved or not (Y/N)	Remarks by CMU (PRBDB), if any
				Name of Village	Chainage (km)	Side (LHS / RHS)	Area (m ²)	Haul road length (m)							
1.	Borrow Areas														
	BA1														
2.	Workers Camps														
	WC1														
3.	Site for Batching Plant														
	BP1														
4.	Site for Hot Mix Plant														
	HMP1														
5.	Stock Yard														
	SY1														

Remarks

Submitted

Signature

Name

Designation

Contractor

Checked

Signature

Name

Environmental Engineer.
Supervision Consultant

Approved

Signature

Name

Executive Engineer CMU

P7: POLLUTION MONITORING

Name of Corridor _____

Link No. _____

Construction Stage: Report – Date: _____ Month _____ Year _____

Mitigation measures suggested in last report complied or Not.....

If not reasons thereof.....

(Location at which monitoring to be conducted as per EMP)

S. No.	Chainage (km)	Details of locations	Duration of monitoring	Instruments used	Completion	Standards	Results	Reasons for exceeding standards	Mitigation Measures suggested	Type of area (Residential / Industrial / Commercial)	Remarks
1. Air Monitoring											
						SPM RSPM HC SOx NOx	SPM RSPM HC SOx NOx				
2. Water Monitoring											
						pH TSS TDS Turbidity Hardness Coliform BOD COD Oil & Grease	pH TSS TDS Turbidity Hardness Coliform BOD COD Oil & Grease				

S. No.	Chainage (km)	Details of locations	Duration of monitoring	Instruments used	Completion	Standards	Results	Reasons for exceeding standards	Mitigation Measures suggested	Type of area (Residential / Industrial / Commercial)	Remarks
3. Soil Monitoring											
						pH Organic Matter Alkalinity Conductivity Water holding capacity Pb	pH Organic Matter Alkalinity Conductivity Water holding capacity Pb				
4. Noise Monitoring											
						L day equivalent L night equivalent L equivalent	L day equivalent L night equivalent L equivalent				

Remark

Submitted
Signature
Name
Designation
Contractor

Checked
Signature
Name

Environmental Engineer.
Supervision Consultant

Approved
Signature
Name

Executive Engineer (CMU)

P8: TREE CUTTING/STUMP REMOVAL

Name of the Road:

Date: _____ Month _____ Year _____

Sl. No.	Section (Km)	Distance from edge of existing road	Identification Number Marked in Field	Species		Girth (cm)	Dry / Green	Average Height (m)	Remarks
				Local	Botanical Name				

Remark

Submitted
 Signature
 Name
 Designation
 Contractor

Checked
 Signature
 Name
 Environmental Engineer.
 Supervision Consultant

Approved
 Signature
 Name
 Executive Engineer (CMU)

C1: DETAILS OF EARTHWORK
(To be filled by the Contractor)

Name of Corridor _____

Link No. _____

Monthly Report for Each Borrow Area under use

Reporting _____ Month.....
Date of Submission.....

Location of Borrow Area under use

	Name of Village	Chainage (km)	Side (LHS / RHS)	Haul road length (m)
I				
II				

(Show on a Sketch Plan clearly indicating distance and approach roads)

2. Details of Borrow Areas

2.1	Capacity of the Borrow Area	
2.2	Percentage of the capacity exhausted	
2.3	Total quantity of the Earth Excavated (in cum)	
2.4	Quantity of Top Soil removed from the Borrow Areas	
2.5	Location of Top Soil stored removed	
2.6	Quantity of Top Soil stored at the beginning of the month	
2.7	Quantity of Top Soil utilized at the end of the month	
2.8	Location (s) where Top Soil has been utilized (Specify on a location plan)	
2.9	Quantity of earthwork excavation from existing road	
2.10	Total quantity of earthwork reused in cum. (5%)	
2.11	Location disposal (if other than sites) (Specify clearly on a location plan)	
2.12	Quantity of earthwork re-used in fill operation	
2.13	Location of borrow areas in disuse / exhausted	
2.14	Outline a rehabilitation plan for each of the exhausted borrow areas with special reference to Erosion Protection Measures. Also, submit at separate detailed rehabilitation plan for exhausted borrow areas for approval supported adequately with layouts, plans and drawings.	

Remark

Submitted
Signature,
Name,
Designation,
Contractor

Checked
Signature,
Name,
Environmental Engineer,
Supervision Consultant

Approved
Signature,
Name,
Executive Engineer (CMU)

C2: DETAILS OF HOT MIX PLANT

(To be filled by the Contractor)

Name of Corridor _____

Link No. _____

Monthly Report for Each Hot Mix Plant

Reporting Month.....

Date of Submission.....

1. Environment Features of the surrounding area

1.1	Name and location of Hot Mix Plant (w.r.t. PWD km ch.)	
1.2	Wind direction	
1.3	Name (s), distance population and type of settlements in a 1.5 km radius of site.	

2. Draw Sketch Plan of HMP clearly indicating distance and approach roads.

3. Details of HMP and Mitigation Measures taken

3.1	Installed Capacity	
3.2	Average Utilization	
3.3	Make	
3.4	Model	
3.5	Last Serviced	

4. Explain Air Pollution Control Measures taken at the HMP site

5. Explain Noise Pollution Control Measures taken at the HMP site

Remark

Submitted

Signature

Name

Designation

Contractor

Checked

Signature

Name

Environmental Engineer.
Supervision Consultant

Approved

Signature

Name

Executive Engineer (CMU)

C3: DETAILS OF LAND FILL OPERATIONS
(To be filled by the Contractor)

Name of Corridor _____

Link No. _____

Monthly Report for Each Contract Package

Reporting Month.....

Date of Submission

1. Environment Features of the surrounding area

1.1	Location of each land fill site (Provide sketch Map below)	Name of Village	Chainage (km)	Side (LHS/RHS)	Haul road length (m)
	I				
	II				
1.2	Capacity of each land fill site				
1.3	Safety measure taken at land fill site (s)				
1.					
2.					
3.					
4.					
5.					

Remark

Submitted
Signature
Name
Designation

Checked
Signature
Name
Environmental Engineer
Supervision Consultant

Approved
Signature
Name
Executive Engineer (CMU)

C4: DETAILS OF MACHINERY IN OPERATION

(To be filled by the Contractor)

Name of Corridor _____

Link No. _____

Monthly Report for Each Contract Package

Reporting Month.....

Date of Submission

(Attach copy of PPCB emission control certificate every 3 months)

1. Details of Machinery Operation

1.1	Total machinery in operation (Nos.)	
1.2	Number of pavers	
1.3	Number of rollers	
1.4	Number of excavators	
1.5	Number of graders	Nos.
1.6	Number of dumpers	Nos.
1.7	No. of workshops with repairs facility (furnish location and type of facility provided)	Workshop on Location Facility Provided
1.8	Number of vehicles in repair at each location	
1.9	Number of oil interceptor provided in each repair / fuelling site	
1.10	Total quantity of oil and wastes recovered in each interceptor during last month.	Oil waste Liters, Kg.
1.11	Details of waste disposal. (Whether Sold/ Disposed)	

Remark

Submitted

Signature

Name

Designation

Contractor

Checked

Signature

Name

Environmental Engineer.
Supervision Consultant

Approved

Signature

Name

Executive Engineer (CMU)

C5: REDEVELOPMENT OF BORROW AREAS
(To be filled by the Contractor)

Name of Corridor _____

Link No. _____

Construction stage: Monthly Report – Date: _____ Month _____ Year

Drawing for Redevelopment to be attached for each Borrow Area, (photographs of sites before use & after rehabilitation to be attached)

Sl. No.	Borrow Area No.	Borrow Area Location					Land use	Rehabilitation Measures	Date of approval of Rehabilitation	Date of Handing Over to Owner	Remarks
		Name of Village	Chainage (km)	Side (LHS / RHS)	Area (M ²)	Haul road length (m)					

Remark

Submitted

Signature

Name

Designation

Contractor

Checked

Signature

Name

Environmental Engineer.
Supervision Consultant

Approved

Signature

Name

Executive Engineer (CMU)

C6: SAFETY CHECK LIST
(To be filled by the Contractor)

1 **Contract No.** _____
 2 **Name of Contractor** _____
 3 **Representation** _____
 4 **Name of Safety Officer** _____
 5 **Date of Inspection** _____

Location 1 Location 2 Location 3

Adequate at time of Inspection Needs Improvement Needs Immediate Attention	Location 1			Location 2			Location 3			Remark
	A	B	C	A	B	C	A	B	C	
General										
House keeping										
Stacking of Material										
Passageway										
Lighting										
Ventilation										
Others										
Electrical										
Switches										
Wirings										
Fixed Installation										
Portable Lighting										
Portable Tool										
Welding Machine										
Others										
Fire Prevention										
Fire Fighting Appliance										
Dangerous Goods Store										
Gas Welding Cylinders										
Others										
Others										
Dust Control										
Noise Control										
First Aid Equipment										
Washing Facility										
Latrine										
Canteen										
Provision of Personal Protective										
Helmet										
Eye Protector										
Ear Protector										
Respirator										
Safety Shoes										
Safety Belts										
Others										

Remark

Submitted
 Signature
 Name
 Designation
 Contractor

Checked
 Signature
 Name
 Environmental engineer.
 Supervision Consultant

Approved
 Signature
 Name
 Executive Engineer (CMU)

C7: ACCIDENT REPORT
(To be completed on Occurrence of Injury by the Safety Officer)

Type of Accident

D01 ()	Fall of person from a height	D11 ()	Explosion
D02 ()	Slip, trip or fall on same level	D12 ()	Fire
D03 ()	Struck against fixed objects	D13 ()	Contact with hot or corrosive substances
D04 ()	Struck by flying or falling objects	D14 ()	Contact with poisonous gas or toxic substances
D05 ()	Struck by moving objects	D15 ()	Contact with electric current
D06 ()	Struck / caught by cable	D16 ()	Hand tool accident
D07 ()	Stepping on nail etc.	D17 ()	Vehicle / Mobile plant accident
D08 ()	Handling without machinery	D18 ()	Machinery operation accident
D09 ()	Crushing / burying	D19 ()	Other (please specify)
D10 ()	Drowning or asphyxiation		

Agent Involved in Accident

E01 ()	Machinery	E11 ()	Excavation / underground working
E02 ()	Portable power appliance	E12 ()	Floor, ground, stairs or any working, surface
E03 ()	Vehicle or associated equipment / machinery	E13 ()	Ladder
E04 ()	Material being handled, used or stored	E14 ()	Scaffolding/gondola
E05 ()	Gas, vapour, dust, fume or oxygen	E15 ()	Construction formwork, shuttering and falsework
E06 ()	Hand tools	E16 ()	Electricity supply cable, wiring switchboard and associated equipment
E07 ()	Floor edge	E17 ()	Nail, splinter or chipping
E08 ()	Floor opening	E18 ()	Other (Please specify)
E09 ()	Left shaft	E19 ()	
E10 ()	Stair edge		

Unsafe Action Relevant to the Accident

F01 ()	Operating without authority	F11 ()	Failure to use eye protector
F02 ()	Failure to secure objects	F12 ()	Failure to use respirator
F03 ()	Making safety devices inoperative	F13 ()	Failure to use proper clothing
F04 ()	Working on moving or dangerous equipment	F14 ()	Failure to use warn others or given proper signals
F05 ()	Using un-safety equipment	F15 ()	Horseplay
F06 ()	Adopting unsafe position or posture	F16 ()	No unsafe action
F07 ()	Operating or working at unsafe speed	F17 ()	Others (please specify)
F08 ()	Unsafe loading, Placing, mixing etc.	F18 ()	
F09 ()	Failure to use helmet	F19 ()	
F10 ()	Failure to use proper footwear		

G01 ()	No Protective gear	G08 ()	Unsafe layout of job, traffic etc.
G02 ()	Defective protective gear	G09 ()	Unsafe process of job methods
G03 ()	Improper dress / footwear	G10 ()	Poor housekeeping
G04 ()	Improper guarding	G11 ()	Lack of warning system
G05 ()	Improper ventilation	G12 ()	Defective tool, machinery or materials
G06 ()	Improper illumination	G13 ()	No unsafe condition
G07 ()	Improper procedure	G14 ()	Others (please specify)

Personal Factor Relevant to the Accident

H01 ()	Incorrect attitude / motive	H04 ()	Unsafe act by another person
H02 ()	Lack of knowledge or skill	H05 ()	No unsafe personal factor
H03 ()	Physical defects	H06 ()	Other (please specify)

Remark

Submitted

Signature

Name

Designation

Contractor

Checked

Signature

Name

Designation

Environmental engineer.
Supervision Consultant

Approved

Signature

Name

Designation

Executive Engineer (CMU)

Part-II – To be completed Upon Finalization of Employee’s Compensation Claim

- 101 () No permanent incapacity
- 102 () Less than 5% incapacity
- 103 () More than 5% incapacity
- 104 () Fatal

Submitted

Signature

Name

Designation

Contractor

Checked

Signature

Name

Environmental engineer.
Supervision Consultant

Approved

Signature

Name

Executive Engineer (CMU)

C8: POLLUTION MONITORING

Name of Corridor _____

Link No. _____

Construction Stage: Report – Date: _____ Month _____ Year _____

Mitigation measures suggested in last report complied or Not.....

If not reasons thereof.....

(Location at which monitoring to be conducted as per EMP)

Sl. No.	Chainage (km)	Details of locations	Duration of monitoring	Instruments used	Completion	Standards	Results	Reasons for exceeding standards	Mitigation Measures suggested	Type of area (Residential / Industrial / Commercial)	Remarks
1. Air Monitoring											
						SPM RSPM HC SOx NOx	SPM RSPM HC SOx NOx				
2. Water Monitoring											
						pH TSS TDS Turbidity Hardness Coliform BOD COD Oil & Grease	pH TSS TDS Turbidity Hardness Coliform BOD COD Oil & Grease				

Sl. No.	Chainage (km)	Details of locations	Duration of monitoring	Instruments used	Completion	Standards	Results	Reasons for exceeding standards	Mitigation Measures suggested	Type of area (Residential / Industrial / Commercial)	Remarks
3. Soil Monitoring											
						pH Organic Matter Alkalinity Conductivity Water holding capacity Pb	pH Organic Matter Alkalinity Conductivity Water holding capacity Pb				
4. Noise Monitoring											
						L _{day} equivalent L _{night} equivalent L _{equivalent}	L _{day} equivalent L _{night} equivalent L _{equivalent}				

Remark

Submitted
 Signature
 Name
 Designation

Checked
 Signature
 Name

Approved
 Signature
 Name

Contractor

Environmental engineer.
 Supervision Consultant

Executive Engineer (CMU)

C10: RESTORATION OF CONSTRUCTION SITES

(To be filled by the Contractor)

Name of Corridor _____

Link No. _____

(Reporting by Contractor to CMU)

Construction stage: Monthly Report – Date Month Year.

Sl. No.	Contract Package	Labor Camp		Construct ion Camp		Plant Site		Borrow areas		Disposal Locations		Top Soil	
		O	R	O	R	O	R	O	R	O	R	Preserved	Restored

Remark

Submitted

Signature

Name

Designation

Contractor

Checked

Signature

Name

Designation

Environmental engineer.
Supervision Consultant

Approved

Signature

Name

Designation

Executive Engineer (CMU)

O1: POLLUTION MONITORING

Name of Corridor _____

Link No. _____

Construction Stage: Report – Date: _____ Month _____ Year _____

Mitigation measures suggested in last report complied or Not

If not reasons thereof.....

(Location at which monitoring to be conducted as per EMP)

S. No.	Chainage (km)	Details of locations	Duration of monitoring	Instruments used	Standards	Results	Reasons for exceeding standards	Mitigation Measures suggested	Type of area (Residential / Industrial / Commercial)	Remarks
					SPM RSPM HC SOx NOx	SPM RSPM HC SOx NOx				
					pH TSS TDS Turbidity Hardness Coliform BOD COD Oil & Grease	pH TSS TDS Turbidity Hardness Coliform BOD COD Oil & Grease				
					pH Organic Matter Alkalinity Conductivity Water holding capacity Pb	pH Organic Matter Alkalinity Conductivity Water holding capacity Pb				
					L day equivalent L night equivalent L equivalent	L day equivalent L night equivalent L equivalent				

Remark

Submitted

Signature

Name

Designation

Contractor

Checked

Signature

Name

Designation

Environmental Engineer.
Supervision Consultant

Approved

Signature

Name

Designation

Executive Engineer (CMU)

O2: CLEANING OF CULVERT OPENINGS AND LONGITUDINAL DRAINS

(To be filled by CMU, PRBDB)

Name of Corridor _____

Link No. _____

Construction Stage: Report – Date _____ Month _____ Year

Sl. No.	Structural No	Pre monsoon	Date	Post monsoon	Date
Name of the Corridor					
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

Remark

Submitted
 Signature
 Name
 Designation
 Contractor

Checked
 Signature
 Name
 Designation
 Environmental engineer.
 Supervision Consultant

Approved
 Signature
 Name
 Designation
 Executive Engineer (CMU)

CMU 1: FORMAT FOR KEEPING RECORDS OF CONSENT OBTAINED BY CONTRACTOR

Name of Corridor _____

Link No. _____

Construction Stage: Report – Date: _____ Month _____ Year _____

Sl. No.	Contractor's Name	Clearance	Applicable Acts	Agencies	Obtained on	Valid upto	Remarks
	Name of Corridor						

Remark

Submitted

Signature

Name

Designation

Contractor

Checked

Signature

Name

Designation

Environmental engineer.
Supervision Consultant

Approved

Signature

Name

Designation

Executive Engineer (CMU)

CMU 2: CHECKLIST FOR ENVIRONMENT INSPECTION
(Points / Issues to be covered)

Name of Road _____

Date of Inspection _____

Sl. No.	ESMP Measures
1	Provision of a personnel accountable for implementation of ESMP / Safety Measures with Contractor
2	Consent of PCB to Establish HMP
3	Consent of PCB to operate HMP
4	Compliance of PCB Conditions for HMP installation and operation
5	Whether compliance reported through monthly Progress report to Divisional Office of Executive Engineer
6	PUC taken for all Construction vehicles
7	Concrete platform with trap under bitumen boiler, Fuel Tank for HMP and generator set provided or not
8	Precautions to prevent contamination of soil by emulsion, Bitumen, oil and lubricant taken while storing
9	Providing cover to fine construction material & bituminous mix during transportation
10	Borrow areas:
	a) Borrow areas approved by Department
	b) Existing land was used
	c) Nos Opened
	d) Available Quantity
	e) Utilized Quality
	f) Balance Quantity
11	Spoil and debris disposal:
	a) Present status of land
	b) Closure and completion plan
12	Site specific traffic Safety management Plan:
	a) Contractor installed the warning / regulatory Traffic signs at the construction site
	b) The arrangement adequate
13	Safety equipment i.e helmet, gloves, gumboot, mask, earplugs etc. provided to workers
14	Health Facility at camp and work site i.e. First Aid kit & suitable vehicle for conveyance in case of emergency / accident
15	Permit for Procuring River sand
16	Licence from Department of mines for quarrying
17	Consent to establish / operation of crusher
18	Provision of labour camp with sanitation & potable water
19	Fire precautions at Hot Mix Plant and site Office
20	Air and noise monitoring done in camp site
21	Whether any cultural property is being impacted
22	Status of drainage provision in camp area
23	General House Keeping

Remark _____

Submitted

Signature

Name

Designation

Contractor

Checked

Signature

Name

Designation

Environmental engineer.
Supervision Consultant

Approved

Signature

Name

Designation

Executive Engineer (CMU)

CMU3: SUMMARY SHEET

(To be filled monthly by CMU and Submitted to HO, PRBDB)

Name of the corridor _____

Link No. _____

Month _____

Date _____

Sl No.	Description	Remarks
1	No Objection Certificate	
A	Hot mix Plant	
	Location 1	
	Location 2	
	Location 3	
B	Cement Batching Plant	
	Location 1	
	Location 2	
	Location 3	
2	Pollution Under Certificate	
	Vehicles	
	Machineries	
3	No Objection Certificate for Diesel Gen set	
	Location 1	
	Location 2	
4	Labour Camps	
	No. of sites Identified	
	Approved	
	Opened	
	Conforms to conditions imposed at the time of opening of sites	
	Closed	
5	Workers	
	No of workers employed	
	No of male workers	
	No of female workers	
	No of day workers	
6	Borrow Area	
	No. of sites identified	
	Approved	
	Opened	
	Quantity of available material	
	Quantity of material Utilized	
	Quantity of Topsoil preserved	
	Quantity of top soil used	
	No of sites closed	
	No. of sites Rehabilitated	

Sl No.	Description	Remarks
7	Quarry	
	No. of sites identified	
	Approved	
	Opened	
	Material available	
	Material obtained	
	No. of sites Rehabilitated	
8	Disposal Locations	
	No. of sites identified	
	Approved	
	Opened	
	Amount of Waste disposed	
	Type of waste disposed	
	No. of sites Rehabilitated	
9	Road Safety	
	Road Safety norms followed as per guidelines, SP-55 and approved Traffic plan	
10	Cleaning of Culvert/ drains	
	No. of culverts/ drains	
	Nos Cleaned	
11	Trees	
	No of trees marked for cutting in field	
	No of trees cut	
	No of trees to be Planted	
	Trees Planted	
12	Haul Roads	
	Adequacy of maintenance of Haul Road Network	

Remark

Submitted	Checked	Approved
Signature	Signature	Signature
Name	Name	Name
Designation	Designation	Designation
Contractor	Environmental engineer. Supervision Consultant	Executive Engineer (CMU)



Annexures



Soil Quality Monitoring Results

Name of Sampling Site	Chainage (km)	Parameters					
		pH	Electrical Conductivity	Organic Carbon (%)	P2O5 Kg/Acre	K2O Kg/Acre	Texture
Desirable Value	-	7.0-8.7	<0.82	0.4-.0.75	5-9	.55-135	-
Dhura	61.00	7.4	0.25	0.495	10	55	Sandy loam
Benra	67.00	7.4	0.18	0.360	13	100	Sandy
Birdwal	59.600	7.3	0.33	0.750	12	134	Loamy sand

Source: Department of Agriculture, Sangrur, Punjab




**List of River/Canal/Nalla/Drains Crossing the road
Malerkotla-Dhuri-Sangrur**

Sl. No.	Name/ Type	Chainage (km)	Side (Right/Left/ Both)	Location	Remark
1	Drain	47.270	Both	Gurdev Nagar Village	Seasonal
2	Canal	51.445	Both	Sanglai Village	Seasonal
3	Canal	54.790	Both	Bhasaure Village	Seasonal
4	Canal	57.090	Both	Bhasaure Village	Seasonal
5	Canal	57.790	Both	Babban pur Village	Perrineal
6	Canal	57.850	Both	Babban pur Village	Perrineal
7	Canal	59.570	Both	Dhuri town	Seasonal
8	Canal	64.780	Both	Dhuri town	Perrineal
9	Drain	74.240	Both	Gurdaspura Village	Perrineal

List of Ponds along the Road

Malerkotla-Dhuri-Sangrur

Sl. No.	Location	Type	Chainage	Side	Distance from C/L (m)	Ownership	Impact	Remark	Photograph of Pond
1	Ratoda Village	Pond	48.600	Right	70	Gram Panchayat	No Impact (Far away from the corridor)	Fish Pond	
2	Bhasaur Village	Pond	54.750	Right	9	Gram Panchayat	1. Siltation 2. Reduction in capacity 3. Increases TSS / TDS 4. Degradation of water quality	Community waste water	

**List of Deep Tubewell along the Road
Malerkotla-Dhuri-Sangrur**

Sl. No.	Chainage (km)	Side (Right/Left)	Distance from C/L (m)	Location
1	47.600	Left	20	Govind Nagar Village
2	47.900	Left	20	Govind Nagar Village
3	47.950	Right	20	Govind Nagar Village
4	49.600	Right	25	Ratoda Village
5	49.750	Left	17	Ratoda Village
6	50.600	Right	30	Ratoda Village
7	51.300	Right	35	Sangli Village
8	53.600	Right	20	Rustamgarh Village
9	53.880	Right	30	Rustamgarh Village
10	54.200	Right	22	Bhasaur Village
11	54.250	Right	20	Bhasaur Village
12	55.900	Right	25	Bhasaur Village
13	57.100	Left	25	Bhasaur Village
14	57.250	Left	23	Bhasaur Village
15	57.400	Left	22	Birdwal Village
16	58.950	Right	20	Birdwal Village
17	59.100	Left	13	Birdwal Village
18	59.350	Left	15	Birdwal Village
19	59.450	Right	14	Birdwal Village
20	59.500	Right	17	Birdwal Village
21	59.600	Left	16	Birdwal Village
22	66.450	Right	12	Benera Village
23	68.200	Left	12	Benera Village
24	68.580	Left	15	Benera Village
25	68.630	Right	10	Benera Village
26	69.350	Left	15	Banera Village
27	69.360	Right	30	Benera Village
28	69.630	Right	50	Benera Village
29	70.050	Right	40	Ladda Kothi Village
30	70.390	Right	30	Ladda Kothi Village
31	73.470	Right	13	Khui Sahib Village
32	73.700	Right	15	Khui Sahib Village
33	73.980	Right	13	Khui Sahib Village
34	74.000	Right	10	Gurudaspura Village
35	75.500	Right	12	Gurudaspura Village



Surface Water Quality Monitoring Results

Sl. No.	Parameter	Units	Permissible limits	SW1	SW2	SW3	Protocol
1	pH		6.5-8.5	7.3	-	-	IS:2296
2	Temperature	°C	-	21	-	-	IS:2296
3	Dissolved Oxygen	Mg/l	4	3.8	-	-	IS:2296
4	Conductivity	microcimens/cm	-	3300	-	-	IS:2296
5	Total Suspended Solids	mg/l	-	12	-	-	IS:2296
6	Total Dissolved Solids	mg/l	500	198	-	-	IS:2296
7	Alkalinity as (CaCo3)	mg/l	-	284	140	110	IS:2296
8	Total Hardness as (CaCo3)	mg/l	300	198	110	90	IS:2296
9	Calcium as (CaCo3)	mg/l	-	108	16	16	APHA
10	Magnesium as (CaCo3)	mg/l	-	90	17	10	APHA
11	Sodium	mg/l	-	20	-	-	APHA
12	Potassium	mg/l	-	9	-	-	APHA
13	Chloride	mg/l	600	145	-	-	IS:2296
14	Phosphate	mg/l	-	0.6	-	-	IS:2296
15	Sulphate	mg/l	400	48	-	-	IS:2296
16	Nitrate	mg/l	50	9	-	-	IS:2296
17	Oil & Grease	mg/l	-	BDL	-	-	IS:2296
18	Silica	mg/l	-	BDL	-	-	IS:2296
19	Phenolic Compounds	mg/l	0.002	BDL	-	-	IS:2296
20	Chemical Oxygen Demand	mg/l	-	20	-	-	IS:2296
21	Biological Oxygen Demand	mg/l	3	2	-	-	IS:2296
22	Arsenic	mg/l	0.2	BDL	-	-	APHA
23	Mercury	mg/l	0.001	BDL	-	-	APHA
24	Lead	mg/l	0.1	BDL	-	-	APHA
25	Cadmium	mg/l	0.01	BDL	-	-	APHA
26	Hexavalent Chromium	mg/l	<0.01	BDL	-	-	APHA
27	Total Chromium	mg/l	0.05	BDL	-	-	APHA
28	Copper	mg/l	1.5	BDL	-	-	APHA
29	Zinc	mg/l	15	0.5	-	-	APHA
30	Selenium	mg/l	0.12	BDL	-	-	APHA
31	Iron	mg/l	50	2.0	-	-	APHA

Note: SW1: Kotla Hydropower Project Babbanpur Village, Malerkotla Sangrur Road
 SW2: Lehargagga, Sangrur City
 SW3: Lehargagga, Sangrur City

Source: i) SW1 Mantac Consultants Noida

ii) SW2 & SW3 Water Quality Testing Laboratory, Punjab Water Supply and Sewerage Board, Sangrur

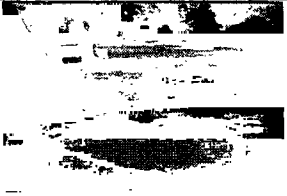



Groundwater Quality Monitoring Results

Sl. No.	Parameter	Units	Permissible Limit in absence of Alternate Source	GW1	GW2	GW3	Protocol
1.	pH		6.5-8.5	7.25	7.23	7.3	IS:10500
2.	Temperature	°C	-	28.0	22	22	IS:10500
3.	Dissolved Oxygen	mg/l	-	-	4.5	4.0	IS:10500
4.	Conductivity	micro cimen s/cm	-	1838	1035	1135	IS:10500
5.	Total Suspended Solids	mg/l	-	-	9	10	IS:10500
6.	Total Dissolved Solids	mg/l	-	-	340	681	IS:10500
7.	Alkalinity as (CaCo3)	mg/l	200-600	-	205	330	IS:10500
8.	Total Hardness as (CaCo3)	mg/l	300-600	460	108	198	IS:10500
9.	Calcium as (CaCo3)	mg/l	75-200	114	97	130	IS:10500
10.	Magnesium as (CaCo3)	mg/l	-	42.5	26	93	IS:10500
11.	Sodium	mg/l	-	120	7	30	APHA
12.	Potassium	mg/l	-	35.3	118	6	APHA
13.	Chloride	mg/l	250-1000	192	0.8	112	IS:10500
14.	Phosphate	mg/l	-	-	70	0.7	IS:10500
15.	Sulphate	mg/l	200-400	72	12	80	IS:10500
16.	Nitrate	mg/l	45-100	2.5	BDL	10	IS:10500
17.	Oil & Grease	mg/l	-	-	BDL	BDL	IS:10500
18.	Silica	mg/l	-	-	BDL	BDL	IS:10500
19.	Phenolic Compounds	mg/l	0.001-0.002	-	BDL	BDL	IS:10500
20.	Chemical Oxygen Demand	mg/l	-	-	BDL	BDL	IS:10500
21.	Biological Oxygen Demand	mg/l	-	-	BDL	BDL	IS:10500
22.	Arsenic	mg/l	0.05-0.05	-	BDL	BDL	APHA
23.	Mercury	mg/l	0.001-0.001	-	BDL	BDL	APHA
24.	Lead	mg/l	0.05-0.05	-	BDL	BDL	APHA
25.	Cadmium	mg/l	0.01-0.01	-	BDL	BDL	APHA
26.	Hexavalent Chromium	mg/l	-	-	BDL	BDL	APHA
27.	Total Chromium	mg/l	0.05-0.05	-	BDL	BDL	APHA
28.	Copper	mg/l	0.05-1.5	-	BDL	BDL	APHA
29.	Zinc	mg/l	5.0-15.0	-	BDL	BDL	APHA
30.	Selenium	mg/l	0.01-0.01	-	BDL	BDL	APHA
31.	Iron	mg/l	0.3-1.0	0.34	0.2	0.2	APHA

Note : GW1 : Hand Pump, Malerkotla, Malerkotla Sangrur Road
 GW2 : Hand Pump, Village Dhuri, Malerkotla Sangrur Road
 GW3 : Hand Pump, Sangrur City, Malerkotla Sangrur Road

*Source: (GW1 CES Screening Report)
 (GW2, GW3) Mantec Consultants, Noida*

**List of Hand Pump to be Relocated
Malerkotla-Dhuri-Sangrur**

Sl. No.	Chainge (km)	Side (Right/Left)	Distance from C/L (m)	Location	Ownership	Photograph of Hand Pumps
1	46.000	Left	8	Malerkotla Town	Town community	
2	51.900	Right	9	Sangli Village	Village community	
3	61.540	Left	9	Dhuri Town	Village community	
4	63.950	Right	8	Janta Nagar Village	Village community	
5	70.450	Left	9	Ladda Kothi Village	Village community	
6	75.000	Left	9	Gurudaspura Village	Village community	

Air Quality Monitoring Results

Sl. No.	Parameter	Units	Permissible Limits	AQ1	AQ2	AQ3	AQ4	Category of Area
1	Suspended Particulate Matter	$\mu\text{g}/\text{m}^3$	200	406	298	168	721	Residential Area
2	Respirable Suspended Particulate Matter	$\mu\text{g}/\text{m}^3$	100	124	120	108	248	Residential Area
3	Oxide of Nitrogen	$\mu\text{g}/\text{m}^3$	80	26.4	20	18	32.5	Residential / Commercial
4	Sulphur dioxide	$\mu\text{g}/\text{m}^3$	80	15.1	25	22	22.4	Residential / Commercial

Note : AQ1 : Malerkotla (Meeting Point of Khanna Malerkotla), Malerkotla Sangrur Road

AQ2 : Kotla Hydropower, Babban Pur Village, Malerkotla Sangrur Road

AQ3 : Sujit and Gulati Dhaba, Sangrur Market, Malerkotla Sangrur Road

AQ4 : Govt Hospital Sangrur City, Malerkotla Sangrur Road

Source: i) AQ1 and AQ4 (CES Screening Reprot)

ii) AQ2 and AQ3 Mantec Consultants Noida

Noise Quality Monitoring Results

Sl. No.	Sampling Location	Distance in (m) from road edge	Time of Sampling	Noise Level (dB)A		Category of Area
				Min	Max	
1.	Modern Public School Malerkotla Town, Malerkotla Sangrur Road	2.5m	12.25 pm	39.0	54.0	Silience

Source: CES Screening Report

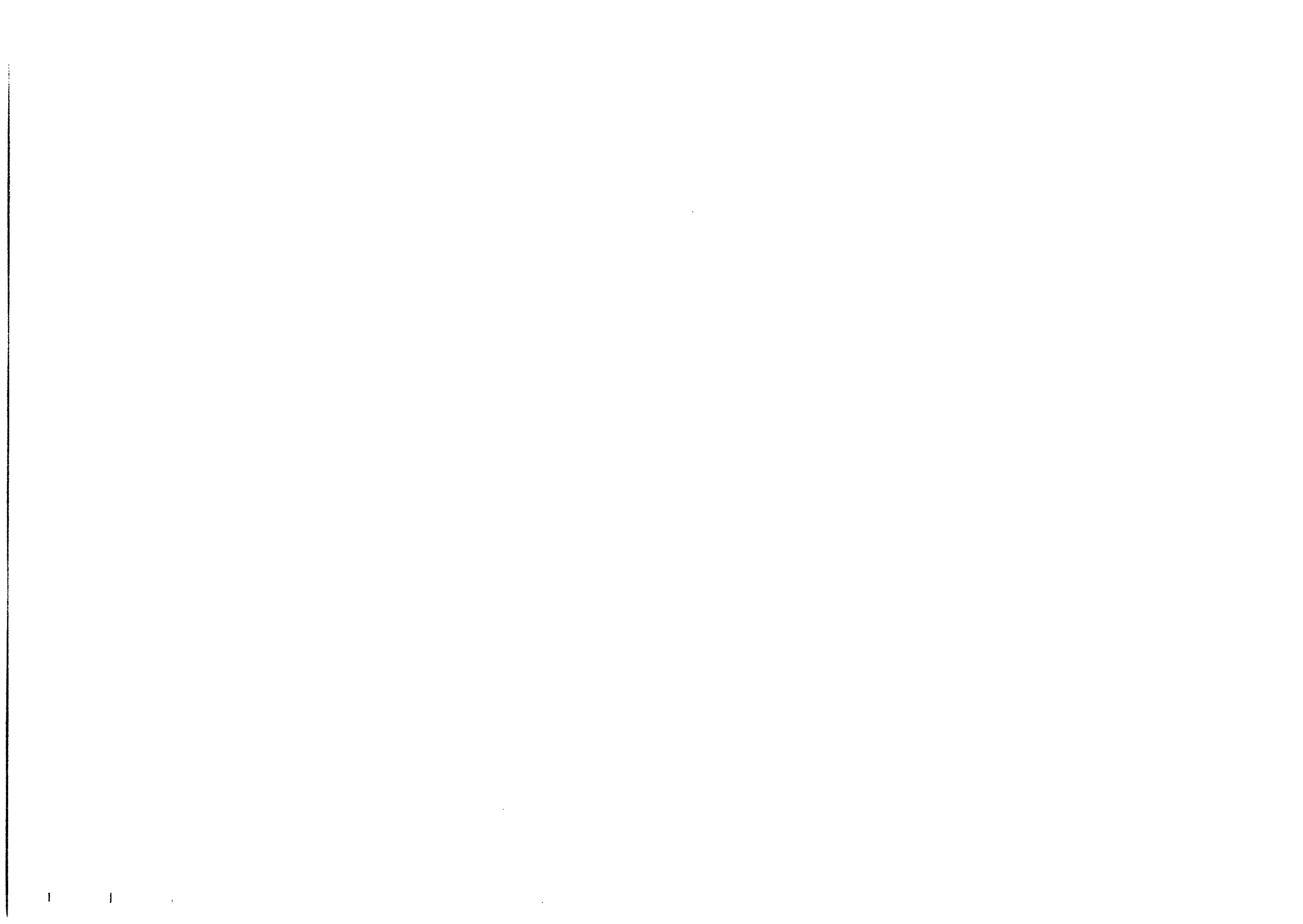
Sl. No.	Location	Distance from the edge of the road	Parameter	Day dB(A)	Night dB(A)	Equivalent Noise dB(A)	Remarks
1.	Near Hydro Power Project Babbanpur Village, Malerkotla sangrur Road	3m	L ₁₀	62.0	41.3	60.2	Residential
			L ₅₀	57.1	37.9	52.3	
			L ₉₀	41.3	36.4	37.5	
			L _{deq}	63.1	-	-	
			L _{neq}	-	38.3	-	
			L _{eq}	-	-	60.9	
2.	Near Springel Sr. Secondary School, Sangrur city, Malerkotla sangrur Road	4m	L ₁₀	63.1	44.5	63.1	Silence
			L ₅₀	55.5	37.3	49.8	
			L ₉₀	44.5	35.4	36.7	
			L _{deq}	61.3	-	-	
			L _{neq}	-	38.7	-	
			L _{eq}	-	-	61.4	
3	Govt. Hospital at Sangrur City, End of the Project Road	3m	L ₁₀	62.1	43.2	62.2	Silence
			L ₅₀	54.5	35.3	48.7	
			L ₉₀	43.5	34.3	35.8	
			L _{deq}	60.3			
			L _{neq}		37.6		
			L _{eq}			60.4	

Source: Mantec Consultants, Noida



**Location of Green Tunnel
Malerkotla-Dhuri-Sangrur Road**

Sl. No.	Chainage (km)		Location	Species of Tree	Length (KM)
	From	To			
1	53.000	54.000	Rustamgarh	Sisham , Neem	1.0
2	57.000	57.500	Bhasaur Village	Eucalyptus	0.5
3	57.800	59.200	Birdwal	Eucalyptus	1.4
4	69.000	71.000	Benra, Laddakothi Village	Neem, Eucalyptus	2.0
5	71.000	73.000	Bangawala Village	Sirish, Neem	2.0
6	73.000	74.500	Gurudaspura Village	Sirish, Dek	1.5
Total					8.4



**List of Trees in COI
Malerkotla-Dhuri-Sangrur Road**

Chainage (km)	LEFT												
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	Others	Total
45.00 : 46.00	3						1					1	5
46.00 : 47.00	15		1		5					1			22
47.00 : 48.00	21			2	5						1	2	31
48.00 : 49.00	17												17
49.00 : 50.00	23			1			3						27
50.00 : 51.00	6		1		1								8
51.00 : 52.00	13	15	1		1								30
52.00 : 53.00			1										1
53.00 : 54.00		1	1	3									5
54.00 : 55.00		2	46	4	1					1	1		55
55.00 : 56.00	4	4	10	1	3							2	24
56.00 : 57.00	11	14	1	20			10					2	58
57.00 : 58.00	12	46	2	27	5		14			1		1	108
58.00 : 59.00				1			3						4
59.00 : 60.00	2		2	1			4						9
60.00 : 61.00			1										1
61.00 : 62.00													
62.00 : 63.00	1										1		2
63.00 : 64.00		2		1									3

Chainage (km)	LEFT												Total	
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	Others		
64.00 : 65.00			1											1
65.00 : 66.00														
66.00 : 67.00	3		1	1						1				6
67.00 : 68.00	3													3
68.00 : 69.00	3	4	3	6	2		3				3	8		32
69.00 : 70.00		2	3	8	5				1					19
70.00 : 71.00	4	4	5	1	4					3	2			23
71.00 : 72.00		4	1		6				1	1		1		14
72.00 : 73.00				1	7							5		13
73.00 : 74.00	2	4	5		20				2			36		69
74.00 : 75.00	38	21	17	21	10			34	5	1		10		157
75.00 : 76.00		17			2							4		23
76.00 : 77.00														
Total	181	140	103	99	77		38	34	9	9	8	72		770
Total Number of Trees: 770														

S1 -> DEK

S3 -> SAHTOOT

S5 -> EUCALYPTUS

S7 -> OTHER TREE

S9 -> LAUSRA

S11 -> BERRY

S2 ->SISHAM

S4 -> BABOOL

S6 -> NEEM

S8 -> ARJUN

S10 -> SIRISH

**List of Trees In COI
Malerkotla-Dhuri-Sangrur Road**

Chainage (km)	RIGHT												
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	Others	Total
45.00 : 46.00		3		1		5		1			1	1	12
46.00 : 47.00													
47.00 : 48.00		1	1					2					4
48.00 : 49.00			7										7
49.00 : 50.00	1	4	10			1		1					17
50.00 : 51.00	2	1	14										17
51.00 : 52.00	4	1	14										19
52.00 : 53.00	4		3										7
53.00 : 54.00	2				8			1					11
54.00 : 55.00					21								21
55.00 : 56.00					8								8
56.00 : 57.00	20		5	1	1								27
57.00 : 58.00	55	1	14	22		3	24			5		5	129
58.00 : 59.00		3	1	36		3	23		13	3	1	4	87
59.00 : 60.00		11	3	8	2	1			1	4		1	31
60.00 : 61.00													
61.00 : 62.00			5	25									30
62.00 : 63.00											1		1
63.00 : 64.00												1	1

Chainage (km)	RIGHT												
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	Others	Total
64.00 : 65.00	2											2	4
65.00 : 66.00												1	1
66.00 : 67.00			6		3								9
67.00 : 68.00		2			1	1					2		6
68.00 : 69.00		3	1		1	1							6
69.00 : 70.00	20	1	3		1	2		2					29
70.00 : 71.00	1	3	6		4	17		2			1	1	35
71.00 : 72.00	1	35	1		5	8		1				4	55
72.00 : 73.00	2	33	2		1	4					1		43
73.00 : 74.00	6	32	6		1	3		3			1		52
74.00 : 75.00	20	17	18		7	4		2					68
75.00 : 76.00	19	5						1					25
76.00 : 77.00													
Total	159	156	120	93	64	53	47	16	14	12	8	20	762
Total Number of Trees: 762													

S1 -> DEK

S3 -> SISHAM

S5 -> KIKAR

S7 -> SAHTOOT

S9 -> GULMOHAR

S11 -> PEEPAL

S2 -> OTHER TREE

S4 -> EUCALYPTUS

S6 -> NEEM

S8 -> BERRY

S10 -> SIRISH

**List of Trees in COI
Malerkotla-Dhuri-Sangru Road**

Chainage	Left								Right							
	G1	G2	G3	G4	G5	G6	G7	Subtotal	G1	G2	G3	G4	G5	G6	G7	Subtotal
45.00 : 46.00	1		1		3			5	3		2		1	2	4	12
46.00 : 47.00			2	7	7	5	1	22								
47.00 : 48.00	5	6	7	7	3	2	1	31	2	1					1	4
48.00 : 49.00			7	5	4	1		17		1	2	3	1			7
49.00 : 50.00	1	2	6	12	3	3		27	5	2	1	7	2			17
50.00 : 51.00	1		2	3	2			8	9	2	1	3	1	1		17
51.00 : 52.00	3	12	3	3	2	5	2	30	19							19
52.00 : 53.00							1	1	5	2						7
53.00 : 54.00	4						1	5	3	3	2	3				11
54.00 : 55.00	2	12	25	8	2	4	2	55	1	4	7	4	3	2		21
55.00 : 56.00	5	4	6	5	1	3		24		4	2	2				8
56.00 : 57.00	16	19	12	8	3			58	20	2	1	1	2	1		27
57.00 : 58.00	12	46	2	27	5	14	2	108	56	38	21	4	5	5		129
58.00 : 59.00	1			3				4	27	28	27	5				87
59.00 : 60.00	2		2	1	4			9	7	3	10	5	2	2	2	31
60.00 : 61.00		1						1								
61.00 : 62.00										4	7	9	5	4	1	30
62.00 : 63.00		1					1	2				1				1
63.00 : 64.00	2	1						3				1				1

Chainage	Left								Right							
	G1	G2	G3	G4	G5	G6	G7	Subtotal	G1	G2	G3	G4	G5	G6	G7	Subtotal
64.00 : 65.00						1		1	1	2			1			4
65.00 : 66.00												1				1
66.00 : 67.00		1	2	2	1			6		2	1	1	3	1	1	9
67.00 : 68.00						3		3		1	1	3	1			6
68.00 : 69.00	6	7	9	2	3	2	3	32	2	1		1	1		1	6
69.00 : 70.00	8	9	1	1				19	1	10	17	1				29
70.00 : 71.00	4	8	4	2	3		2	23		14	13	6	1	1		35
71.00 : 72.00	5	6	2	1				14	22	17	10	4	1		1	55
72.00 : 73.00	5	8						13	27	10	3	3				43
73.00 : 74.00	57	7	2	2	1			69	24	16	7	4			1	52
74.00 : 75.00	36	81	22	9	4	5		157	21	25	10	4	3	2	3	68
75.00 : 76.00	16	6	1					23	13	11	1					25
76.00 : 77.00																
Sub Total	192	237	118	108	51	48	16	770	268	203	146	76	33	21	15	762
% wise distribution	24.9	30.77	15.32	14.02	6.62	6.23	2.04		35.17	26.64	19.16	9.97	4.33	2.75	1.96	
Total Numbers of Trees: 1532																

G1 : 30 - 60 G2 : 60 - 90 G3 : 90 - 120 G4 : 120 - 150 G5 : 150 - 180 G6 : 180 - 270 G7 : > 270

List of Settlements
Malerkotla - Dhuri - Sangrur

Sl. No.	Village/Town	Chainage (km)		Length (km)	Side (Right/Left/Both)	Distance from C/L (m)
		From	To			
1	Malerkotala Town	45.000	47.300	2.300	Both	12
2	Ratola Village	47.000	48.600	1.600	Both	15
3	Sangali Village	51.000	51.600	0.600	Both	20
4	Bhasur Village	54.200	55.100	1.900	Both	25
5	Birdwal Village	59.600	60.000	0.400	Both	12
6	Dhuri Town	60.000	66.000	6.000	Both	25
7	Benera Village	66.500	68.000	1.500	Both	15
8	Gurudas Pura Village	74.550	75.450	0.900	Both	20
9	Sangrur Town	76.000	77.200	1.200	Both	20

**List of Religious Structures Along the Road
Malerkotla - Dhuri - Sangrur**

Sl. No.	Name/Type	Chainage (km)	Side Right/Left	Distance from C/L (m)	Location
1	Gurudwara	45.300	Right	6	Malerkotla Town
2	Masjid	45.450	Left	200	Malerkotla Town
3	Temple	45.900	Right	15	Malerkotla Town
4	Gurudwara	47.300	Right	18	Gurudev Nagar Village
5	Gurudwara	48.450	Right	15	Ratoda Village
6	Dargah	48.600	Right	35	Ratoda Village
7	Temple	54.700	Right	13	Bhasaur Village
8	Masjid	55.600	Right	60	Bhasaur Village
9	Radha Swami Satsang Vays	60.200	Right	13	Dhuri Market
10	Gurudwara	62.400	Right	13	Janta Nagar Village
11	Temple	68.050	Left	9	Benra Village
12	Radha Swami Satsang Vays	73.550	Left	25	Khui Sahib Village
13	Radha Swami Satsang Vays	76.300	Right	15	Sangrur Market


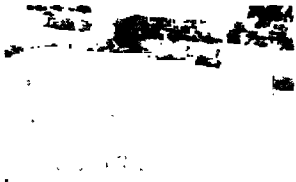
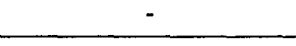


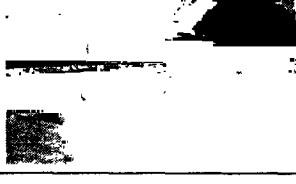

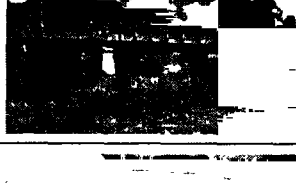


**List of Educational Institute
Malerkotla-Dhuri-Sangrur**

Sl. No.	Name/Type	Chainge (km)	Side (Right/Left)	Distance from C/L (m)	Location
1	Primary School	48.450	Right	15	Ratoda Village
2	Primary School	49.100	Right	30	Ratoda Village
3	Sr Secondary School	55.250	Right	11	Bhasaur Market
4	Primary School	55.300	Right	11	Bhasaur Market
5	College	59.100	Right	15	Birdwal Village
6	Public School	59.300	Right	20	Birdwal Village
7	Public School	59.400	Right	300	Birdwal Village
8	Govt. High School	67.250	Right	15	Benra Village
9	Sr Secondary School	70.650	Left	20	Ladda Khothi Village
10	Primary School	76.100	Right	20	Sangrur City

**List of Industries
Malerkotla-Dhuri-Sangrur**

Sl. No.	Name/Type	Chainge (km)	Side (Left/ Right)	Distance from C/L (m)	Location
1	Rice Mill	47.200	L	18	Govind Nagar Village
2	Rice Mill	47.800	R	15	Govind Nagar Village
3	Steel Factory	48.700	L	15	Ratoda Village
4	Iron Factory	48.850	L	15	Ratoda Village
5	Rice Mill	49.050	R	30	Ratoda Village
6	Hot Mix Plant	52.650	L	120	Ratoda Village
7	Polywood Industry	56.300	R	20	Bhasaur Village
8	KRBL.Industry	56.200	R	200	Bhasaur Village
9	Rice Mill	56.700	R	300	Bhasaur Village
10	Kotla Hydropower	57.800	R	50	Babban pur Village
11	Rice Mill	63.100	R	20	Janta Nagar Village
12	Polywood Industry	71.300	L	25	Ladda Kothi Village
13	Brick Kiln	71.950	L	30	Ladda Kothi Village
14	Brick Kiln	73.200	R	25	Khui Sahibe Village
15	Brick Kiln	73.700	R	50	Khui Sahibe Village

List of Silt Fencing Locations

Sl. No.	Type	Chainage (km)	Side	Location	Photograph of Pond/Canals/Drains
1	Drain	47.270	Both	Gurdev Nagar Village	
2	Canal	51.445	Both	Sanglai Village	
3	Pond	54.750	Right	Bhasaur Village	
4	Canal	54.790	Both	Bhasaure Village	
5	Canal	57.090	Both	Bhasaure Village	
6	Canal	57.790	Both	Babban pur Village	
7	Canal	57.850	Both	Babban pur Village	
8	Canal	59.570	Both	Dhuri town	
9	Canal	64.780	Both	Dhuri town	
10	Drain	74.240	Both	Gurdaspura Village	



List of Culverts
Malerkotla – Dhuri - Sangrur

Hume Pipe Culverts		Arch Culverts		Location of Slab Culverts of Various Span			
Location	Pipe Details	Location	Span	0-1 m	1-2 m	2-3 m	3-6 m
55+530	1 X 0.450 dia	52+100	1 X 1.30 m	47+965	48+700	75+900	55+200
68+040	1 X 0.600 dia	-	-	59+210	69+110	-	74+390
68+775	1 X 0.600 dia	-	-	59+720	74+750	-	76+300
69+300	1 X 0.500 dia	-	-	59+900	-	-	-
69+650	1 X 0.600 dia	-	-	60+200	-	-	-
69+970	1 X 0.600 dia	-	-	68+195	-	-	-
72+150	1 X 0.300 dia	-	-	70+420	-	-	-
72+700	1 X 0.450 dia	-	-	70+460	-	-	-
73+000	1 X 0.450 dia	-	-	74+100	-	-	-
73+430	1 X 0.300 dia	-	-	-	-	-	-
74+950	1 X 0.450 dia	-	-	-	-	-	-
75+650	1 X 0.450 dia	-	-	-	-	-	-
Total	13		1	10	4	1	3
Grand Total							32



Abstract of Malerkota-Sangrur Link Road Drainage Design

CD Structure	Chainage			Length Typical	Av. Slope (Typical)	Total Discharge	Conveyance Required (Kr)	Type of Drain	Velocity	Adopted		Bed level of drain		Remarks
	Direction	From	To							Width (Bo)	Depth (De)+0.15m	From	To	
Left Side		(Km)	(Km)	(Km)	(%)	(Cumecs)			m/s	(m)	(m)	(m)	(m)	
	↓	45.000	45.220	0.220	-0.03	0.227	12.614	BMLRD (3b with Footpath)	0.4	1.5	0.5	244.650	244.579	
Outfall to the existing water body	↓	45.220	45.400	0.180	-0.33	0.412	7.190	BMLRD (3b with Footpath)	0.9	1.0	0.5	244.579	243.988	
Ridge(at Junction)	↑	45.400	45.960	0.560	0.24	0.577	11.849	BMLRD (3b with Footpath)	1.1	1.5	0.5	243.988	245.315	<25 yrs Returnperiod
	↓	45.960	47.096	1.136	-0.19	1.170	27.098	BMLRD (3b with Footpath)	1.1	1.5	0.5	245.515	243.397	<25 yrs Returnperiod
Bridge at 47.27	↓	47.096	47.260	0.164	-0.25	1.360	27.042	BMLRD (3b with Footpath)	1.3	1.5	0.5	243.397	242.982	<25 yrs Returnperiod
	↓	47.300	47.450	0.150	-0.65	0.174	2.154	BMLRD (Open)	1.0	1.0	0.32	245.242	244.263	
Culvert at 47.965	↓	47.450	47.965	0.515	-0.18	0.704	16.758	BMLRD (Open)	1.0	1.5	0.62	244.263	243.353	
Culvert at 48.100	↑	47.965	48.098	0.133	0.20	0.137	3.098	BMLRD (Open)	0.7	1.0	0.5	242.973	243.233	
Ridge	↑	48.102	48.400	0.298	0.20	0.307	6.818	BMLRD (Open)	0.8	1.1	0.5	243.357	243.961	
CULVERT at 48.700	↓	48.400	48.698	0.298	-0.23	0.307	6.407	BMLRD (Open)	0.9	1.0	0.5	243.761	243.077	
	↑	48.702	49.600	0.898	0.09	0.925	30.497	BMLRD (Open)	0.8	1.5	0.7	242.977	243.803	
Bridge at Ch 51.446	↓	51.400	51.446	0.046	-0.22	0.047	1.016	BMLRD (Open)	0.5	0.5	0.5	243.715	243.615	
CULVERT at 52.185	↓	51.640	52.183	0.543	-0.18	0.559	13.079	BMLRD (Open)	0.9	1.5	0.6	243.340	242.347	
	↓	54.820	54.977	0.157	-0.09	0.182	6.143	BMLRD (Open)	0.6	1.0	0.5	242.003	241.865	
Culvert at 55.223	↓	54.977	55.220	0.243	0.09	0.432	14.503	BMLRD (Open)	0.7	1.3	0.65	241.515	241.731	
Culvert at 55.445	↓	55.225	55.440	0.215	-0.11	0.221	6.628	BMLRD (Open)	0.6	1.0	0.5	241.581	241.341	
Bridge at Ch 57.087	↓	56.100	57.080	0.980	-0.17	1.009	24.563	BMLRD (Open)	1.1	1.5	0.6	242.083	240.428	<25 yrs Returnperiod
	↑	57.090	57.560	0.470	0.15	0.777	20.343	BMLRD (Open)	1.2	1.5	0.6	241.119	242.055	<25 yrs Returnperiod

CD Structure	Chainage			Length Typical	Av. Slope (Typical)	Total Discharge	Conveyance Required (Kr)	Type of Drain	Velocity	Adopted		Bed level of drain		Remarks
	Direction	From	To							Width (Bo)	Depth (De)+0.15m	From	To	
		57.560	57.760	0.200	1.07	0.232	2.247	BMLRD (Open)	1.2	1.0	0.35	242.055	244.187	
culvert at 59.211	↑	59.213	59.420	0.207	0.16	0.381	9.611	BMLRD (Open)	0.8	1.4	0.5	240.244	240.570	
		59.420	59.565	0.145	0.46	0.168	2.476	BMLRD (Open)	0.9	0.6	0.5	240.570	241.239	
culvert at 59.730	↓	59.575	59.730	0.155	-0.32	0.180	3.159	BMLRD (Open)	0.9	0.6	0.5	240.939	240.437	
culvert at 59.906	↓	59.730	59.904	0.174	-0.10	0.179	5.603	BMLRD (Open)	0.6	1.0	0.5	240.369	240.191	
culvert at 60.202	↑	59.908	60.200	0.292	-0.17	0.301	7.320	BMLRD (Open)	0.7	1.1	0.6	240.091	239.998	
Drain to be connected to the nearest outfall in the cross road	↑	63.250	63.900	0.650	0.14	0.669	17.933	BMLRD (3b with Footpath)	1.3	1.5	0.5	241.169	242.075	<25 yrs Returnperiod
Ridge(at Junction)	↓	63.900	64.580	0.680	-0.17	0.700	17.031	BMLRD (3b with Footpath)	0.8	0.5	0.5	239.668	238.518	
Bridge at Ch 64.780	↓	64.580	64.780	0.200	-0.15	0.906	23.403	BMLRD (Open)	1.1	1.5	0.5	238.518	238.218	<25 yrs Returnperiod
	↓	64.780	64.940	0.160	-0.42	0.186	2.847	BMLRD (3b with Footpath)	0.4	1.5	0.5	239.508	238.828	
culvert at ch 65.290	↓	64.940	65.300	0.360	-0.20	0.556	12.582	BMLRD (3b with Footpath)	1.1	1.5	0.5	238.828	238.124	<25 yrs Returnperiod
	↑	65.300	66.000	0.700	0.04	0.721	36.917	BMLRD (3b with Footpath)	1.4	1.5	0.5	238.524	238.791	<25 yrs Returnperiod
Culvert at Km. 68.00	↓	67.500	68.005	0.505	-0.08	0.520	18.505	BMLRD (3b with Footpath)	0.8	1.5	0.6	238.733	238.334	<25 yrs Returnperiod
Culvert at Km. 68.189	↓	68.010	68.187	0.177	-0.38	0.182	2.968	BMLRD (3b with Footpath)	0.9	0.6	0.5	238.424	237.756	
Culvert at Km. 68.700	↓	68.170	68.700	0.530	-0.13	0.546	14.863	BMLRD (3b with Footpath)	1.0	1.5	0.5	237.756	237.041	<25 yrs Returnperiod
	↓	74.760	74.940	0.180	-0.40	0.185	2.927	BMLRD (Open)	1.0	0.6	0.5	235.348	234.626	
Culvert at Ch 74.940	↓	74.945	75.620	0.675	-0.16	0.695	17.293	BMLRD (Open)	1.0	1.5	0.6	234.842	233.751	<25 yrs Returnperiod
Culvert at Ch 75.620	↓	75.625	75.880	0.255	-0.02	0.263	18.393	BMLRD (Open)	0.4	1.5	0.65	233.901	233.849	<25 yrs Returnperiod
Culvert at Ch 75.881	↑	75.882	76.040	0.158	0.46	0.163	2.399	BMLRD (Open)	1.0	0.5	0.5	233.999	234.726	
ROB	↓	76.040	76.313	0.273	-0.32	0.281	5.004	BMLRD (with footpath)	0.9	1.0	0.5	234.726	233.864	
Culvert at Ch 76.313	↑	76.313	77.240	0.927	0.13	0.955	26.352	BMLRD (with footpath)	1.2	1.5	0.7	233.564	234.781	<25 yrs Returnperiod

CD Structure	Chainage			Length Typical	Av. Slope (Typical)	Total Discharge	Conveyance Required (Kr)	Type of Drain	Velocity	Adopted		Bed level of drain		Remarks
	Direction	From	To							Width (Bo)	Depth (De)+0.15m	From	To	
Right Side														
Outfall to the existing water body	↑													
		45.400	45.960	0.560	0.24	0.577	11.849	BMLRD (3b with Footpath)	1.1	1.5	0.5	243.988	245.315	<25 yrs Returnperiod
Ridge(at Junction)	↓	45.960	47.096	1.136	-0.19	1.170	27.098	BMLRD (3b with Footpath)	2.2	1.5	0.5	245.515	243.397	<25 yrs Returnperiod
	↓	47.096	47.260	0.164	-0.25	1.360	27.042	BMLRD (3b with Footpath)	2.6	1.5	0.5	243.397	242.982	<25 yrs Returnperiod
Bridge at 47.27														
	↓	47.300	47.450	0.150	-0.65	0.174	2.154	BMLRD (Open)	1.0	1.0	0.32	245.242	244.263	
Culvert at 47.965	↓	47.450	47.965	0.515	-0.18	0.704	16.758	BMLRD (Open)	1.0	1.5	0.62	244.263	243.353	
	↑	47.965	48.098	0.133	0.20	0.137	3.098	BMLRD (Open)	0.7	1.0	0.5	242.973	243.233	
Culvert at 48.100														
	↑	48.102	48.400	0.298	0.20	0.307	6.818	BMLRD (Open)	0.8	1.1	0.5	243.357	243.961	<25 yrs Returnperiod
Ridge	↓	48.400	48.698	0.298	-0.23	0.307	6.407	BMLRD (Open)	0.9	1.0	0.5	243.761	243.077	
CULVERT at 48.700	↑	48.702	49.600	0.898	0.09	0.925	30.497	BMLRD (Open)	1.1	1.5	0.7	242.977	243.803	<25 yrs Returnperiod
	↓	51.400	51.446	0.046	-0.22	0.047	1.016	BMLRD (Open)	0.5	0.5	0.5	243.715	243.615	
Bridge at Ch 51.446	↓	51.640	52.183	0.543	-0.18	0.559	13.079	BMLRD (Open)	0.9	1.5	0.6	243.340	242.347	
CULVERT at 52.185														
	↓	54.820	54.977	0.157	-0.09	0.182	6.143	BMLRD (Open)	0.6	1.0	0.5	242.003	241.865	
	↓	54.977	55.220	0.243	0.09	0.432	14.503	BMLRD (Open)	0.9	1.0	0.65	241.515	241.731	<25 yrs Returnperiod
Culvert at 55.223	↓	55.225	55.440	0.215	-0.11	0.221	6.628	BMLRD (Open)	0.6	1.0	0.5	241.581	241.341	
Culvert at 55.445														
	↓	56.100	57.080	0.980	-0.17	1.009	24.563	BMLRD (Open)	1.2	1.5	0.6	242.183	240.528	<25 yrs Returnperiod
Bridge at Ch 57.087	↑	57.090	57.560	0.470	0.15	0.777	20.343	BMLRD (Open)	1.2	1.5	0.6	241.119	242.055	<25 yrs Returnperiod
	↑	57.560	57.760	0.200	1.07	0.232	2.247	BMLRD (Open)	1.2	1.0	0.35	242.055	244.187	
culvert at 59.211														
	↑	59.213	59.420	0.207	0.16	0.381	9.611	BMLRD (Open)	0.8	1.4	0.5	240.244	240.570	
		59.420	59.565	0.145	0.46	0.168	2.476	BMLRD (Open)	0.9	0.6	0.5	240.570	241.239	
	↓	59.575	59.730	0.155	-0.32	0.180	3.159	BMLRD (Open)	0.9	0.6	0.5	240.939	240.437	
culvert at 59.730														




CD Structure	Chainage			Length Typical	Av. Slope (Typical)	Total Discharge	Conveyance Required (K _r)	Type of Drain	Velocity	Adopted		Bed level of drain		Remarks
	Direction	From	To							Width (Bo)	Depth (De)+0.15m	From	To	
culvert at 59.906	↓	59.730	59.904	0.174	-0.10	0.179	5.603	BMLRD (Open)	0.6	1.0	0.5	240.369	240.191	
culvert at 60.202	↑	59.908	60.200	0.292	-0.17	0.301	7.320	BMLRD (Open)	0.8	1.0	0.6	240.091	239.998	<25 yrs Returnperiod
	↑	60.205	61.720	1.515	0.11	1.560	46.986	BMLRD (3b with Footpath)	1.9	1.5	0.7	239.298	240.969	<25 yrs Returnperiod
Drain to be connected to the nearest outfall in the cross road	↑													
Ridge(at Junction)		63.250	63.900	0.650	0.14	0.669	17.933	BMLRD (3b with Footpath)	1.3	1.5	0.5	241.169	242.075	<25 yrs Returnperiod
	↓	63.900	64.580	0.680	-0.17	0.700	17.031	BMLRD (3b with Footpath)	0.8	0.5	0.5	240.068	238.918	
Bridge at Ch 64.780	↓	64.580	64.780	0.200	-0.15	0.906	23.403	BMLRD (Open)	1.1	0.5	0.5	238.918	238.618	<25 yrs Returnperiod
	↓	64.780	64.940	0.160	-0.42	0.186	2.847	BMLRD (3b with Footpath)	0.4	1.5	0.5	239.508	238.828	
culvert at ch 65.290	↓	64.940	65.300	0.360	-0.20	0.556	12.582	BMLRD (3b with Footpath)	1.1	1.5	0.5	238.828	238.124	<25 yrs Returnperiod
	↑	65.300	66.000	0.700	0.04	0.721	36.917	BMLRD (3b with Footpath)	1.4	1.5	0.5	238.524	238.791	<25 yrs Returnperiod
	↓	67.500	68.005	0.505	-0.08	0.520	18.505	BMLRD (3b with Footpath)	0.8	1.5	0.6	238.733	238.334	<25 yrs Returnperiod
Culvert at Km. 68.00	↓	68.010	68.187	0.177	-0.38	0.182	2.968	BMLRD (3b with Footpath)	0.9	0.6	0.5	238.424	237.756	
Culvert at Km. 68.189	↓	68.170	68.700	0.530	-0.13	0.546	14.863	BMLRD (3b with Footpath)	1.0	1.5	0.5	237.756	237.041	<25 yrs Returnperiod
Culvert at Km. 68.700														
	↓	74.760	74.940	0.180	-0.40	0.185	2.927	BMLRD (Open)	1.0	0.6	0.5	235.348	234.626	
Culvert at Ch 74.940	↓	74.945	75.620	0.675	-0.16	0.695	17.293	BMLRD (Open)	1.0	1.5	0.6	234.842	233.751	<25 yrs Returnperiod
Culvert at Ch 75.620	↓	75.625	75.880	0.255	-0.02	0.263	18.393	BMLRD (Open)	0.4	1.5	0.65	233.901	233.849	
Culvert at Ch 75.881	↑	75.882	76.040	0.158	0.46	0.163	2.399	BMLRD (Open)	1.0	0.5	0.5	233.999	234.726	<25 yrs Returnperiod
ROB														
	↓	76.040	76.313	0.273	-0.32	0.281	5.004	BMLRD (with footpath)	0.9	1.0	0.5	234.726	233.864	
Culvert at Ch 76.313	↑	76.313	77.240	0.927	0.13	0.955	26.352	BMLRD (with footpath)	1.2	1.5	0.7	233.564	234.781	<25 yrs Returnperiod

**List of Hospital / Health Centre
Malerkotla-Dhuri-Sangrur**

Sl. No.	Name/Type	Chainge (km)	Side (Right/Left)	Distance from C/L (m)	Location
1	Hospital	45.100	Left	9	Malerkotla
2	Hospital	75.200	Left	15	Sangrur



**List of Enhancement Site
Malerkotla – Dhuri – Sangrur Road**

Sl. No.	Type	Location	Chainage (km)	Side	Distance from C/L (m)	Authorized Representative	Type of Enhancement		Drawing No.	Photographs of Enhancement Site
							Suggested	Proposed		
1	Gurudwara	Gurudev Nagar	47.300	Right	18	Harchan Singh Gurudwara Pradhan	Boundary wall, Brick pavement as an approach, Grass Park, Sitting arrangement, and Flowering tree plantation	Boundary wall Brick pavement, Sitting arrangement and Flowering tree plantation	PRBDB/ENV /ENH/MAL- SANG/ 01/03	
	Temple	Bhasaur Village	54.700	Right	13	Radhy Shyam Tiwari Priest of Temple	Boundary wall, Brick pavement as an approach sitting arrangement and Flowering tree plantation	Boundary wall, Sitting arrangement, Flowering tree plantation	PRBDB/ENV /ENH/MAL- SANG/ 02/03	
	Govt. High School	Benera Village	67.100	Right	15	Govt. High School	Boundary wall, Tree plantation and sitting arrangement etc.	Boundary wall, Sitting arrangement and Tree plantation	PRBDB/ENV /ENH/MAL- SANG/ 03/03	
	Educational Institute	Along the road	Refer Annexure 2.8 (10 Nos.)				Improved access to road	Improvement in access	As per site	-
	Bus Bays	Along the road	Refer Volume-I Main Report (14 Nos.)				Landscaping	Landscaping	PRBDB/ENV /ENH/STD/V B/11/12	-

Sl. No.	Type	Location	Chainage (km)	Side	Distance from C/L (m)	Authorized Representative	Type of Enhancement		Drawing No.	Photographs of Enhancement Site
							Suggested	Proposed		
	Village Gate	Ladda Kothi Village	70.100	Right	15	-	Landscaping & Hand Pump	Landscaping & Hand Pump	PRBDB/ENV/ENH/STD/V B/5/12	-
		Bhasaur Village	54.250	Left	12	-				-
	Waste water pond	Bhasaur Village	54.750	Right	9	Village Community	Landscaping	Landscaping	PRBDB/ENV/ENH/STD-WWP/02/12	-

National Ambient Air Quality Standards

Pollutants	Time weighted	Sensitive	Industrial Area	Residential Rural & Other	Method of Measurement
Sulphur Dioxide (SO ₂)	Annual*	15 µg/m ³	80 µg/m ³	60 µg/m ³	Improved West and Gaeke method
	24 hours**	30 µg/m ³	120 µg/m ³	90 µg/m ³	Ultraviolet fluorescence
Oxides of Nitrogen (NO _x)	Annual	15 µg/m ³	80 µg/m ³	65 µg/m ³	Jacob and Hochheiser modified (Na-Arsenate)
	24 hours**	30 µg/m ³	120 µg/m ³	91 µg/m ³	Gas phase Chemiluminescence
Carbon Monoxide (CO)	8 hours**	1000 µg/m ³	5000 µg/m ³	2000 µg/m ³	Non dispersive infrared spectroscopy
	1 hour	2000 µg/m ³	1000 µg/m ³	4000 µg/m ³	
Lead (Pb)	Annual*	0.50 µg/m ³	1.0 µg/m ³	0.75 µg/m ³	AAS Method 24 hours after sampling using EPM 20000 or equivalent filter paper
	24 hours**	0.75 µg/m ³	1.5 µg/m ³	1.00 µg/m ³	
Respirable Particulate	Annual*	50 µg/m ³	120 µg/m ³	60 µg/m ³	----
(RPM) – Size less than 10 µm	24 hours**	75 µg/m ³	150 µg/m ³	100 µg/m ³	----
Suspend Particulate Matter (SPM)	Annual*	70 µg/m ³	360 µg/m ³	140 µg/m ³	Average flow rate not less than 1.1 cu.m / minute
	24 hours**	100 µg/m ³	500 µg/m ³	200 µg/m ³	

Source Anon 1996-97, National Ambient Air Quality Monitoring Series NAQMS/a/1996-97, CPCB, Delhi.

* Average Arithmetic mean of minimum 104 measurements in a year taken for a week 24 hourly at uniform interval.

** 24 hourly/8hourly values should meet 98 percent of the time in a year.



National Ambient Noise Quality Standards

Sl. No.	Area Code	Category of Zone	Limit Leq in dB (A)	
			*Day	**Night
1	A	Industrial	75	70
2	B	Commercial	65	55
3	C	Residential	55	45
4	D	Silence Zone	50	40

* Day Time – 6.00 am – 10.00 pm (15 hours)

** Night Time – 10.00 pm – 6.00 am (9 hours)



Primary Water Quality Standards

Sl. No.	Designated Best Use	Class of Water	Criteria
1	Drinking Water source (with conventional treatment)	A	Total Coliform MPN/100 ml shall be 50 or less p ^H between 6.5 to 8.5 Dissolved Oxygen 6 mg /l or more Biochemical Oxygen demand (BOD) 5 days 20 ⁰ C 2 mg/1 or less
2	Outdoor bathing (organized)	B	Total Coliform MPN/100 ml shall be 500 or less P ^H between 6.5 to 8.5 Dissolved Oxygen 5 mg / 1 or more Biochemical Oxygen demand (BOD) 5 days 20 ⁰ C 3 mg/1 or less
3.	Drinking Water source (without conventional treatment)	C	Total Coliform MPN/100 ml shall be 5000 or less P ^H between 6 to 9 Dissolved Oxygen 4 mg / 1 or more Biochemical Oxygen demand (BOD) 5 days 20 ⁰ C 3 mg/1 or less
4.	Propagation of Wildlife	D	P ^H between 6.5 to 8.5 for fisheries Dissolved Oxygen 4 mg / 1 or more Free Ammonia (as N) 1.2 mg/1 or less
5.	Irrigation, Industrial Cooling, Controlled Waste	E	p ^H between 6.0 to 8.5 Electrical Conductivity at 25 ⁰ C μmhos/cm Max. 2250 Sodium absorption ratios Max. 26 Boron, Max.2 mg/1

Ref: CPCB (1999). Bio mapping of rivers, Parivesh New Letter, 5 (iv), Central Pollution Control Board, Delhi, PP.20



Indian Standard Drinking Water Specifications: IS 10500: 1983

Sl No.	Substance or Characteristics	Requirement (desirable limit)	Undesirable effect outside the desirable limit	Permissible limit in the absence of alternate source	Methods of test (ref. To IS)	Remarks
Essential Characteristics						
1.	Colour, Hazen Units, Max.	5	Above 5, consumer acceptance decreases	25	3025 (part4) 1983	Extended to 25 only if toxic substances, in absence of alternate sources.
2.	Odour	Unobjectionable	-	-	3025 (parts 5): 1984	A test cold and when heated Test at several dilution
3.	Taste	Agreeable	-	-	3025 (part 8): 1984	Test to be conducted only after safety has been established
4.	Turbidity NTU, Max.	5	Above 5, consumer acceptance decreases	10	3025 (part 7): 1984	-
5	P ^H value	6.5 to 8.5	Beyond this range the water will not effect the mucous membrane and /or water supply system	No relaxation	3025 (part 11): 1984	-
6.	Total hardness (as CaCO ₃) mg/l, Max.	300	Encrustation in water supply structures an adverse effect on domestic use	600	3025 (part 21): 1983	-
7.	Iron (as Fe) mg /l Max.	0.3	Beyond this limit taste/appearance are affected has adverse effect on domestic uses and water supply structures and promotes iron bacteria	1	3025 (part 21): 1983	-
8.	Chlorides (as Cl) mg/l Max.	250	Beyond this limit, taste corrosion and palatability are affected	1000	3025 (part 32): 1988	-
9.	Residual, free chloride, mg/l Min.	0.2			3025 (part 26): 1986	To be applicable only when water is chlorinated. Tested at consumer end. When

Sl No.	Substance or Characteristics	Requirement (desirable limit)	Undesirable effect outside the desirable limit	Permissible limit in the absence of alternate source	Methods of test (ref. To IS)	Remarks
						protection against viral infection is required, it should be Min. 0.5 mg/l
Desirable characteristics						
1.	Dissolved solids mg/l Max.	500	Beyond the palatability decreases and may cause gastro intestinal irritation	2000	3025 (part 16): 1986	-
2.	Calcium (as Ca) mg/l Max.	75	Encrustation in water supply structure and adverse effects on domestic use	200	3025 (Part 16) 1986	-
3.	Magnesium (as Mg) mg/l, Max.	30	Encrustation in water supply structure and adverse effects on domestic use	1.5	16,33,34 of IS 3025: 1964	-
4.	Copper (as Cu) mg/l Max.	0.05	Beyond taste, discoloration of pipes, fitting and utensils will be caused beyond this	0.3	35 of 3025: 1964	-
5.	Manganese (as Mn) mg/l, Max.		Beyond this limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures.	0.3	35 of 3025: 1964	-
6.	Sulphate (as 200 So ₂), mg/l, Max.	200	Beyond this causes gastro intestinal irritation when magnesium or sodium are present	400	3025(part 24):1986	May b extended up to 400 provided (as Mg) does not exceed 30
7.	Nitrate (as No ₂) mg/l, Max.	45	Beyond this methaemoglobinemia take place	100	3025 (part24): 1988	To be tested when pollution is suspected
8	Fluoride (as F) mg/l, Max.	1	Fluoride may be kept as low as possible. High fluoride may cause fluorosis	1.5	23 of 3025:1964	To be tested when pollution is suspected
9	Phenolic compounds (as C ₆ H ₅ OH) mg/l, Max.	0.001	Beyond this it may cause objectionable taste and odour	0.002	54 of 3025:1964	To be tested when pollution is suspected

Sl No.	Substance or Characteristics	Requirement (desirable limit)	Undesirable effect outside the desirable limit	Permissible limit in the absence of alternate source	Methods of test (ref. To IS)	Remarks
10	Mercury (as Hg) mg/1, Max.	0.001	Beyond this the water becomes toxic	No relaxation	(See not mercury ion analyses)	To be tested when pollution is suspected
11	Cadmium (as cd), mg/1, Max.	0.01	Beyond this the water becomes toxic	No relaxation	(See note)	To be tested when pollution is suspected
12	Selenium, (as Se). mg/1, Max.	0.01	Beyond this the water becomes toxic	No relaxation	28 of 3025:1964	To be tested when pollution is suspected
13	Arsenic (As) mg/1, Max.	0.05	Beyond this the water becomes toxic	No relaxation	3025 (part 37); 1988	To be tested when pollution is suspected
14	Cyanide (as CN) mg/1, Max.	0.05	Beyond this the water becomes toxic	No relaxation	3025 (part 27) 1988	To be tested when pollution is suspected
15	Lead (as Pb), mg/1, Max.	0.05	Beyond this the water becomes toxic	No relaxation	(See note)	To be tested when pollution is suspected
16	Zinc (as Zn) mg/1, Max.	5	Beyond this limit it can cause astringent taste and an opalescence in water	15	39 of 3025:1964	To be tested when pollution is suspected
17	Anionic detergents (as MBAS) mg/1, Max.	0.2	Beyond this it can cause a light froth in water	1	Methylene-blue extraction method	To be tested when pollution is suspected
18	Chromium (as Cr ⁶⁺) mg/1, Max.	0.05	May be carcinogenic above this limit	No relaxation	38 of 3025:1964	To be tested when pollution is suspected
19	Poly nuclear aromatic hydrocarbons (as PAH) mg/1, Max.	-	May be carcinogenic above this limit	-	-	-
20	Mineral oil mg/1, Max.	0.01	Beyond this limit undesirable taste and odour after chlorination take place.	0.03	Gas Chromatography method	-

Sl No.	Substance or Characteristics	Requirement (desirable limit)	Undesirable effect outside the desirable limit	Permissible limit in the absence of alternate source	Methods of test (ref. To IS)	Remarks
21	Pesticides mg/l, Max.	Absent	Toxic	0.001	-	-
22	Radioactive material	-	-	-	58 of 3025:1964	-
23	Alpha emitters bq/l, Max.	-	-	0.1	-	-
24	Beta emitters pci/l, Max.	-	-	1	-	-
25	Aluminium (as Al) mg/l, Max.	200	Beyond this limit taste becomes unpleasant	600	13 of 3025:1964	-
26	Aluminium (as Al) mg/l, Max.	0.03	Cumulate effect is reported to cause dementia	0.2	31 of 3025:1964	-
27	Boron mg/l, Max.	1	-	5	29 of 3029:1964	-

Source: Indian Standard Drinking Water Specification – IS 10500, 1983

