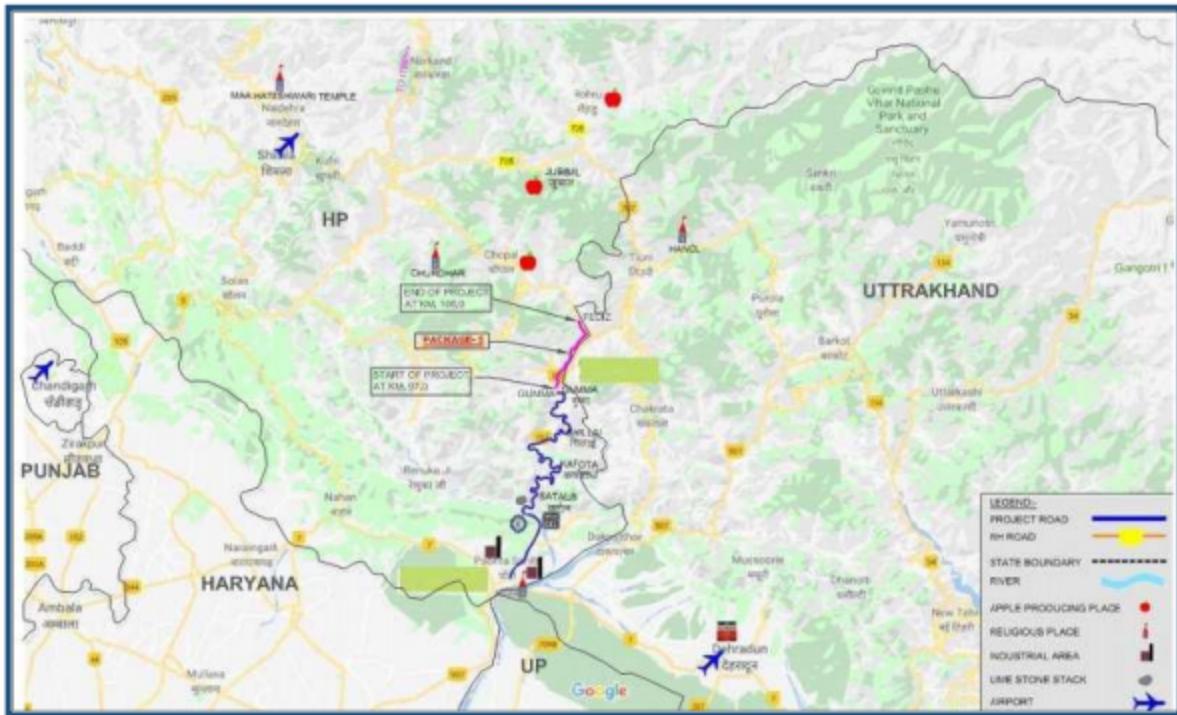


"REHABILITATION AND UPGRADATION TO INTERMEDIATE LANE OF PAONTA SAHIB RAJBAN SHILLAI MEENUS HATKOTI ROAD PORTION BETWEEN KM 97+000 TO 106+120 (GUMMA TO FEDIZ) (DESIGN RD 94+900 TO 103+550) OF NH 707 IN THE STATE OF HIMACHAL PRADESH"

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)



Submitted By:

Consulting Engineering Associates
S.C.O. 51, 2nd Floor, Swastik Vihar
Mansa Devi Road, Sector-5, Panchkula
Tel: 0172-2555529, Cell: 099145-75200
E-mail: ho@theghai.com



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1. INTRODUCTION

1.1 BACKGROUND

1.1.1 General

The Ministry of Road Transport & Highways, Govt. Of India has taken up massive development work of existing National Highways in the country. Up gradation, improvement, widening and strengthening of main and important arteries of National Highway network is taken up under National Highway Development Programme (NHDP). Also substantial length of single lane or intermediate lane National Highways (non-NHDP roads) has already been taken up for improvement in one scheme or the other. The Ministry of Road Transport and Highways with an aim to improve interconnectivity has undertaken development of many single or intermediate lane National Highways to 2 lane/2 lane with hard shoulders configuration under National Highways Interconnectivity Project (NHIIP) aided by the World Bank. The total number of Project Roads under this scheme is 33. One of these roads is Paonta- Gumma-Fediz section of NH-707 Km 96+180 to Km. 104+890 in Himachal Pradesh. The Ministry of Road Transport and Highways (MORT&H), has already got prepared DPR of Paonta-Sahib-Gumma Section (Km 0.000 to Km 96.180), for Rehabilitation and Upgrading to 2 Lane/2 Lane with paved shoulder configuration and strengthening.

Further a length of about 9 Kms from Gumma to Fediz (Km.96+180 to Km.104+890) has also been proposed to be upgraded under GNHP (Green National Highway Project). M/s Consulting Engineers Associates, Panchkula have been assigned the consultancy job for preparation of DPR of this section (Gumma to Fediz) on 08th March 2019 by the Executive Engineer NH-Division, Nahan. The survey work at site has been completed with a planning to complete the independent activities and submit the DPR in a month's time.

The main objective of the consultancy service is to establish the technical, environmental, social, economic and financial viability of the project and prepare detailed project reports for rehabilitation and upgrading of the existing single lane road to intermediate lane configuration.

1.1.2 Importance of Project

This project road is a part of the main road which continues from RD 96+180 near village Gumma on New NH 707 and ends at Fediz Km 104+890 on existing NH-707 which further leads to state capital Shimla via NH-707 (Rohru-Hatkoti-Theog).The complete length of this NH-707 has either been improved/upgraded or proposed to be improved/upgraded by MORT&H except this section i.e. from Gumma to Fediz. For the optimum utilization of the Highway (NH-707), this missing section (Km 96+180 to Km 104+890 of NH-707) needs to be upgraded to National Highway Standards. This complete NH project road is a vital life line for the people living in interiors of Shimla District. Many villages having substantial population will be directly benefitted from this project road besides many other small habitats living in close vicinity of this road since it is the only highway connecting the area for commutation of people. People of this area grow cash crops like Ginger, Potato, Cauliflower, Peas, Capsicum, Tomato, Walnuts etc. Rajmah, Kulth, Maize & Urd lentils of this area are known for their taste. All these produces are transported through this Highway for marketing at New Delhi,

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Chandigarh and Panchkula. Presently approx. 500 trucks per day ply on this highway to transport apple crop from Rohru, Jubbal and Chopal to New Delhi via Yamuna Nagar. On upgradation of this Highway it is expected that the number of trucks will increase as the part of the traffic presently using Solan-Parwanoo route will use this Highway being the shortest route to New Delhi via Yamuna Nagar.

Lime stone mines are situated in this area between (Sataun) Km 18/0 to (Bohrad) Km 48/0. This Highway is used to transport the lime stone to various industrial units all over India. On up gradation there will be a lot of saving in running and maintenance of these vehicles, ultimately leading to saving of fuel, transportation cost, time and environment. The project road will further improve the connectivity for tourists visiting various famous destinations like much famous Chanshal Valley Himalayan Raid de, pilgrimage places like Churdhar, Maa Hateshwari Temple, famous Mahasu Temple at Hanol and leading to much famous Chardham yatra.

This highway is important and strategic from defence point of view as it connects the other routes leading to Indo-China Border. Defence Research and Development Organization has their unit/base at RD 12/0 near Rajban on this highway. This highway will become a boon for the migratory Gaddi Communities who migrate to lower heights during winter. About 71 industrial units are operational along this highway and 17 more industries are expected to become operational along this highway in near future. Planning of setting up a major cement plant at Gumma is in pipeline. This highway will facilitate the transportation of goods to and fro from these industries. This highway will ease the movement of traffic to Yamunotri, Gangotri etc. With up gradation of this highway the most backward Chopal area of district Shimla will also get benefitted by way of improvement of their social and economic life. From the above it can be concluded that this project is of utmost importance as it will have direct impact on life of a common man and boost the industries of this area, ultimately leading to multi-dimensional growth of the area and raising the socioeconomic standards of people along this highway.

The map showing connectivity to different important states and roads is shown below:



Environmental Impact Assessment (EIA) for Rehabilitation and Up-gradation to Intermediate lane of Paonta Sahib Rajban Shillai Meenus Hatkoti road portion between Km 97+000 to 106+120 (Gumma to Fediz)(Design RD 94+900 to 103+550) of NH 707 in the state of Himachal Pradesh

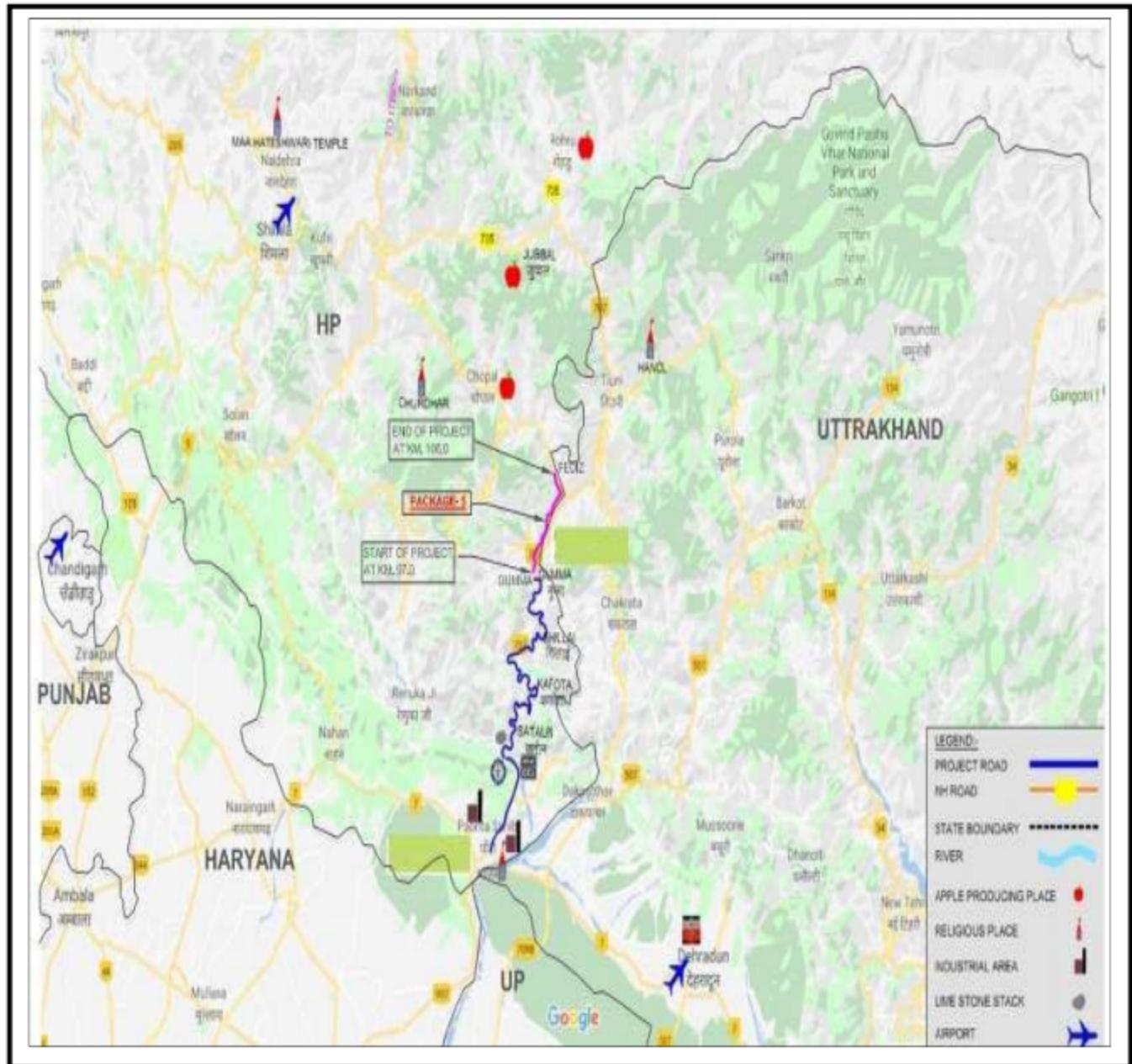


Figure 1-1 Connectivity of Different Important States and Roads

1.2 THE STUDY METHODOLOGY

The process of Environmental Impact Assessment is a detailed process, which requires considering of all aspects of environment which may be impacted due to the proposed project.

EIA process mainly consists of following broad steps:

- i. Reconnaissance & Study of Background information on project
- ii. Screening Report Preparation
- iii. Survey Part-1 (Baseline Survey or Baseline Data Collection).
- iv. Survey Part-2 (socio-economic survey)
- v. Analysis of practical Impacts.
- vi. Meeting with concerned Stakeholders
- vii. Mitigation Measures Adoption
- viii. Environment Management Plan

1.2.1 Environmental Assessment

The latitude and longitude of project road are as follows:

- a) Start Point: Gumma (30°48'1.21"N, 77°43'41.23"E)
- b) End Point: Fediz (30°50'59.34"N, 77°44'40.37"E)

The existing highway alignment passes through North Eastern part of Himachal Pradesh. The Existing project road predominantly passes through 8.650 km mountainous terrain. The project influence area is predominantly a mountain with deep valleys lying between ranges of varying elevations, longest length from west to east 77 km & maximum width from north to south are 80 km. This part has undulated topography of varying thicknesses of overburden consisting of reddish lateritic soil mixed with boulders of up to 1 m in diameter. The slope is well covered by trees. The uphill slope has good catchment, and the rainwater generally drains out through the natural streams on both flanks of the slide.

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1.3 STRUCTURE OF THE REPORT

The report has been divided into 8 chapters including this Introduction as follows:

1. **Chapter 2: Project Description.** In this section Project road details are described from an environmental perspective with salient features such as ROW, roadway improvements proposed, cross sections, cross drainage structures etc.
2. **Chapter 3: Policy, Legal and Institutional Framework** within which the project is set. The major stakeholder departments of the State and Central Governments with their specific roles along with applicable Acts and Laws are described. At the end of this chapter clearance requirements are presented.
3. **Chapter 4: Baseline Environmental** situation includes the meteorological baseline, components of the biophysical and natural environments.
4. **Chapter 5: Public Consultation** was carried out during the project preparation stage.
5. **Chapter 6: Analysis of Alternatives** considered during the project design. The minimization of environmental impacts by considering design alternatives.
6. **Chapter 7: Potential Environmental Impacts** on each of the environmental components due to the proposed project.
7. **Chapter 8: Mitigation, Avoidance and Enhancement Measures** for the adverse impacts identified in earlier section. This section forms the basis for Environmental Management Plan.

2. DESCRIPTION OF THE PROJECT

2.1 GENERAL DESCRIPTION

Total length of the NH-707 is 161 km., out of which 117 km is in the state of Himachal Pradesh and remaining 42.13 km is in the state of Uttarakhand. This NH takes off from junction with NH-07 at Badripur Chowk near Paonta Sahib and terminate at Hatkoti in Himachal Pradesh. The first section from Km.0.00 to Km.104+890 (Paonta to Fediz) traverses in Himachal Pradesh and it enters Uttarakhand at Fediz. After traversing for a length of about 42.13 Kms in Uttarakhand it re-enters Himachal Pradesh at v.Snail. Further about 12.75 Km length of this NH from Snail to Hatkoti is in Himachal Pradesh. This highway connects built-up areas like Rajban, Sataun, Kafota, Shillai, Meenus, Gumma, Antrauli & Fediz in Himachal Pradesh, Tuini in Uttrakhand and Hatkoti in Himachal Pradesh. The detailed project report for widening and upgradation of section Km.0.00 to Km.96.180 (Design Ch. 94+900) stands already submitted to the MORT&H/World Bank. The section from Km.0.00 to Km.94+900 is proposed to be got executed in four packages. To upgrade the missing link from Gumma (Design Ch. Km.94+900) to Fediz (Design Km. 103+550), the DPR is being prepared now. The existing bridge on river Tons at Fediz falling in the present project is being constructed under NH (O). The existing section of this NH in Uttarakhand has been repaired and strengthened. Further the section from Snail to Hatkoti in Himachal Pradesh state has also been strengthened by MORT&H. This (Design Ch. km 94+900 to 103+550) is the only stretch left out which is neither widened nor strengthened. DPR of this remaining stretch i.e. from Gumma to Fediz km 94+900 to km 103+550 (Design Chainage) is now proposed to be prepared.

This report deals with the section from Gumma to. Fediz (Existing Chainage Km.96+180 to Km.104+890 and Design Chainage km 94+900 to 103+550 Km.).This section of NH- 707, ends at RD 103+550 which falls after Fediz bridge which is under construction on Tons river/HP-UK Border. Total length of the project road as per existing Chainage is 8+710 Km and passes entirely through Himachal Pradesh.

2.2 ENGINEERING DESIGNS AND IMPROVEMENT PROPOSALS

2.2.1 Design Standards [Including Geometric Design and Regulation of Access]

a) Introduction

The design standards for the project highway has been adopted after reviewing the relevant latest Indian Roads Congress Codes (IRC) such as IRC:SP:48-1998 Hill Road Manual , IRC :37:2018 , IRC:78 - 2014 and international standards such as AASHTO etc.

The various design elements and factors, which govern the functioning of any highway, can be broadly grouped under the following:

- ❖ Geometric Design Standards;



- ❖ Terrain classification & Design Speed
- ❖ Cross sectional Element
- ❖ Horizontal Alignment
- ❖ Vertical Alignment
- ❖ Standards for Interchange elements
- ❖ Subsurface drainage
- ❖ Design parameters for Bridges and Cross drainage Structures

The basic design philosophy is based on the consideration of providing suitable alignment, cross-sectional layout, geometrics, safety and access control to cater to the fast and uninterrupted movement of through traffic. It is also based on the consideration that the widening proposals will be adjusted in the existing ROW to the extent feasible, involving minimum land acquisition for curves ,intersections, improvement of geometrics ,realignment and bypasses ,uprooting of trees, dismantling of structures/ buildings and maximum utilization of existing road / structures.

b) Terrain Classification & Design Speed

The design speed is the guiding criteria for correlating features such as sight distance, curvature and super elevation upon which the safe operation of the vehicle depends.

The terrain in the project stretch is virtually all mountainous with the general cross slope of the country remaining more than 25 % and less than 60%.

The ruling design speed considered in this project is 50 Km/Hr as per hill road manual.

c) Right Of Way (Row):

The available Right of Way (ROW) along the existing alignment of the project highway varies from 24.0 m to 25.0 m.

2.2.2 CROSS SECTIONAL ELEMENTS

The details of cross sectional elements adopted for the project road are as per Hill road Manual: IRC:SP:48

2.2.2.1 Carriageway: -

The carriageway width in open and built up areas as well shall be 5.5 m.

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2.2.2.2 Shoulders:-

As the project road is proposed as intermediate lane configuration so the earthen shoulder on BHS have been provided 1.5 m.

2.2.2.3 Cross fall

- The cross fall on straight sections of road carriageway, paved shoulders and paved portion of median shall be 2- 2.5 percent for thin bituminous surface and 2.0 percent for high bituminous surface.
- The cross fall shall be unidirectional for either side carriageway sloping towards the shoulder in straight reaches and towards the lower edge on horizontal curves. The camber on the existing road shall be modified to unidirectional cross fall.
- The cross fall for earthen shoulders on straight portions shall be at least 0.5 percent steeper than the slope of the pavement and paved shoulder subject to a minimum of 3.0 percent. On super elevated sections, the earthen portion of the shoulder shall have the same cross fall as the pavement.

2.2.2.4 Typical Cross-Sections

Broadly typical cross-sections of Project Highway for various locations are given as below:

Typical cross sections (TCS) for various configurations proposed in built up area and open country area in rolling/hilly terrain are shown on pages from 16 to 19. Improvement proposal along with type of cross-section are given below:

Table 2-1 Type of cross-section

S. No.	Configura tion of road	Type of Cross - Section	Existing Chainage		Proposed Chainage		Design Length (km)	Terrain
			from	to	from	to		
1	Inter-lane carriageway	TCS-3 a to TCS 3 f	96+180	104+890	94+900	103+550	8.650	Steep

Table 2-2 The Typical cross section

S. No.	Configura tion of road	Type of Cross - Section	Design Chainage		Main carriage way width (m)	Earthen shoulders	Design Length (km)	Remarks
			from	to				
1	Inter-lane carriageway	TCS-A TO TCS 3 F	94+900	103+550	5.5	1.5 m on BHS	8.650	--

Complete Plan and Profile along with TCS have been provided in separate volume of Drawings.



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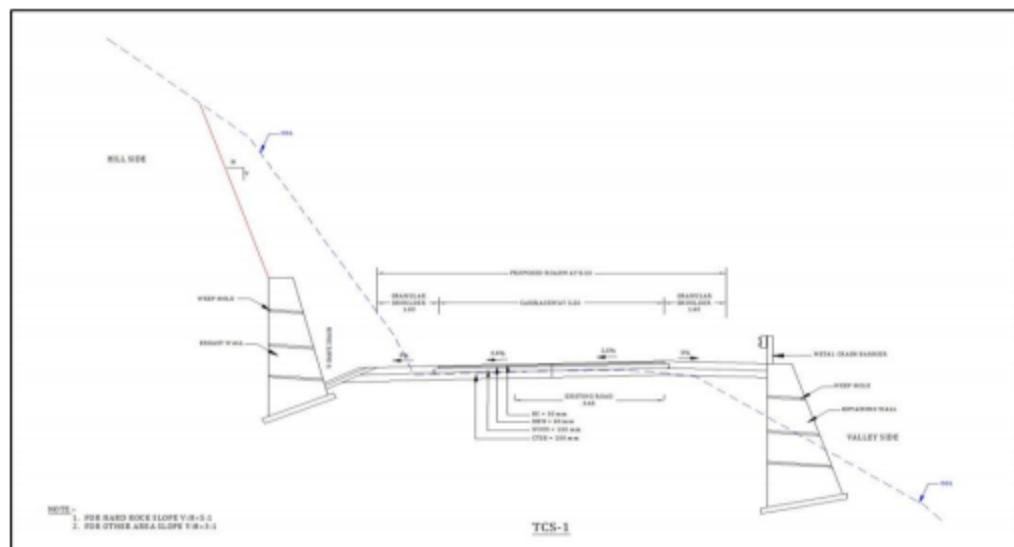


Figure 2-1 TCS for Proposed intermediate lane new construction

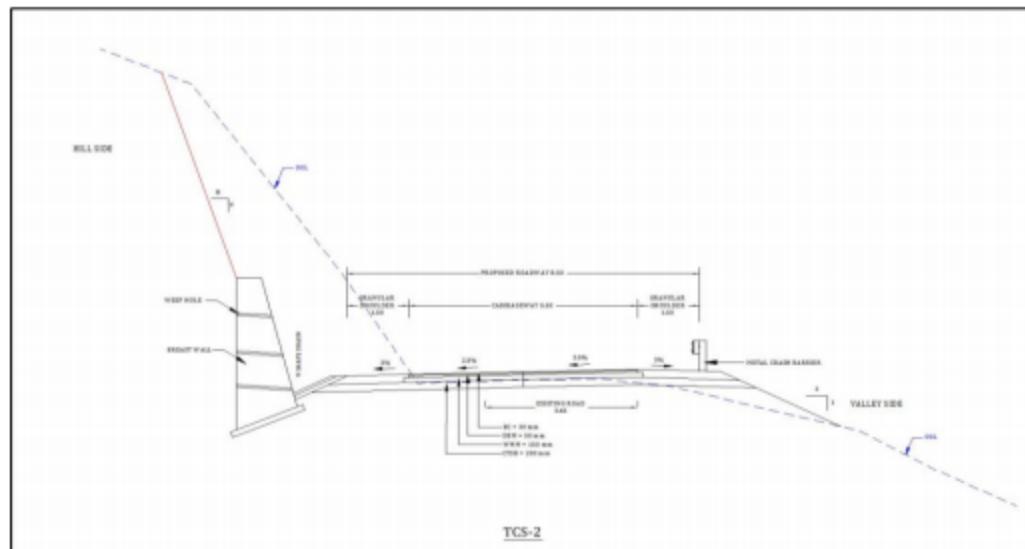


Figure 2-2 TCS for Proposed intermediate lane new construction

Environmental Impact Assessment (EIA) for Rehabilitation and Up-gradation to Intermediate lane of Paonta Sahib Rajban Shillai Meenus Hatkoti road portion between Km 97+000 to 106+120 (Gumma to Fediz)(Design RD 94+900 to 103+550) of NH 707 in the state of Himachal Pradesh

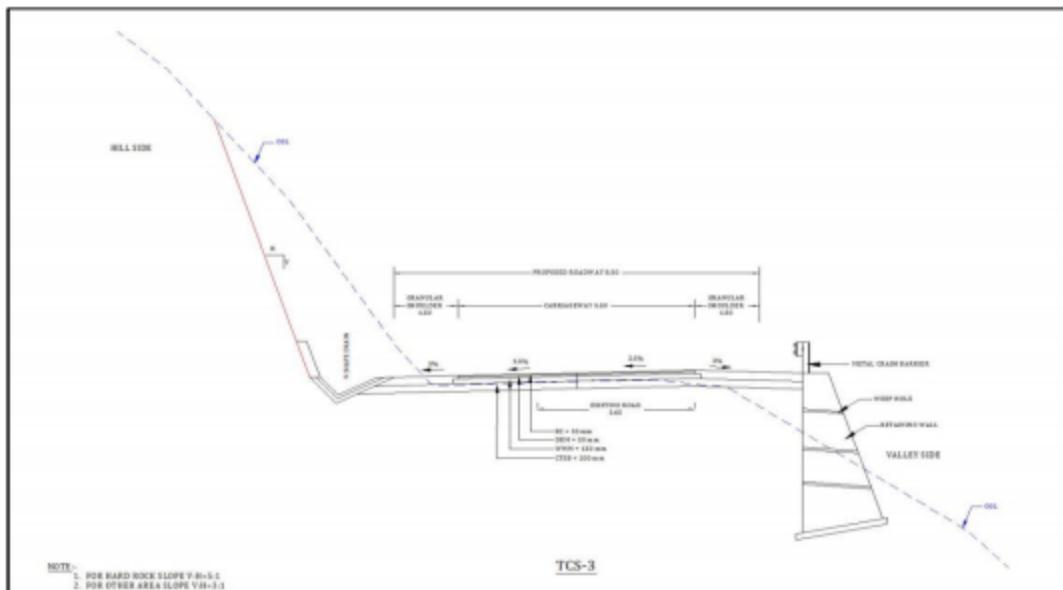


Figure 2-3 TCS for Proposed intermediate lane new construction

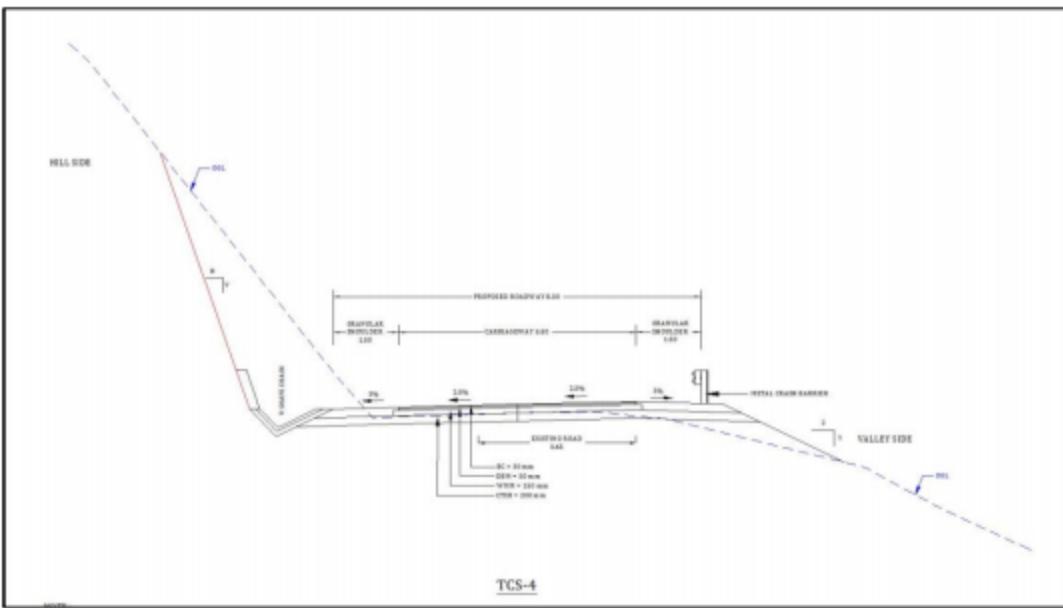


Figure 2-4 TCS for Proposed intermediate lane new construction

Environmental Impact Assessment (EIA) for Rehabilitation and Up-gradation to Intermediate lane of Paonta Sahib Rajban Shillai Meenus Hatkoti road portion between Km 97+000 to 106+120 (Gumma to Fediz)(Design RD 94+900 to 103+550) of NH 707 in the state of Himachal Pradesh

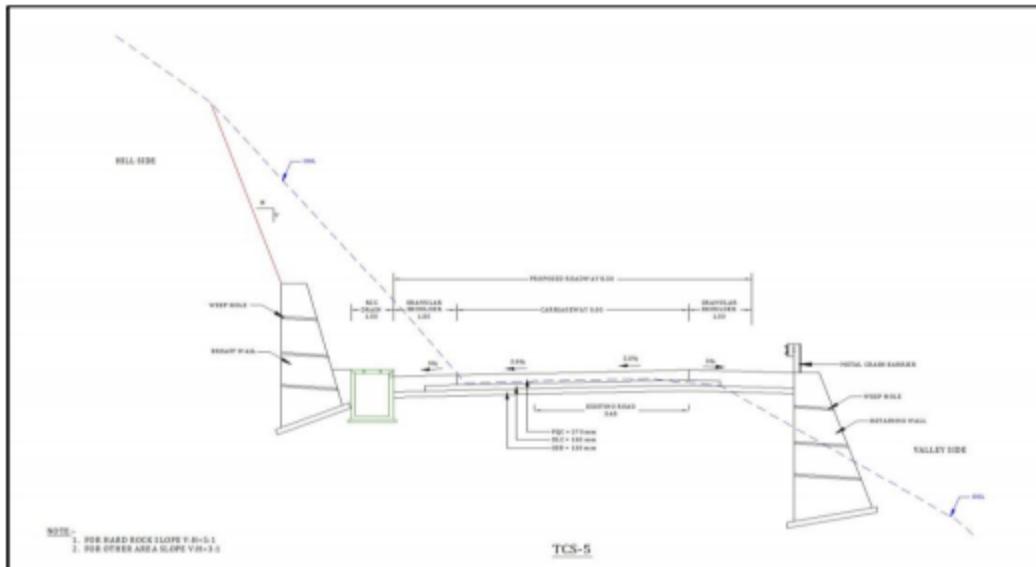


Figure 2-5 TCS for Proposed intermediate lane new construction

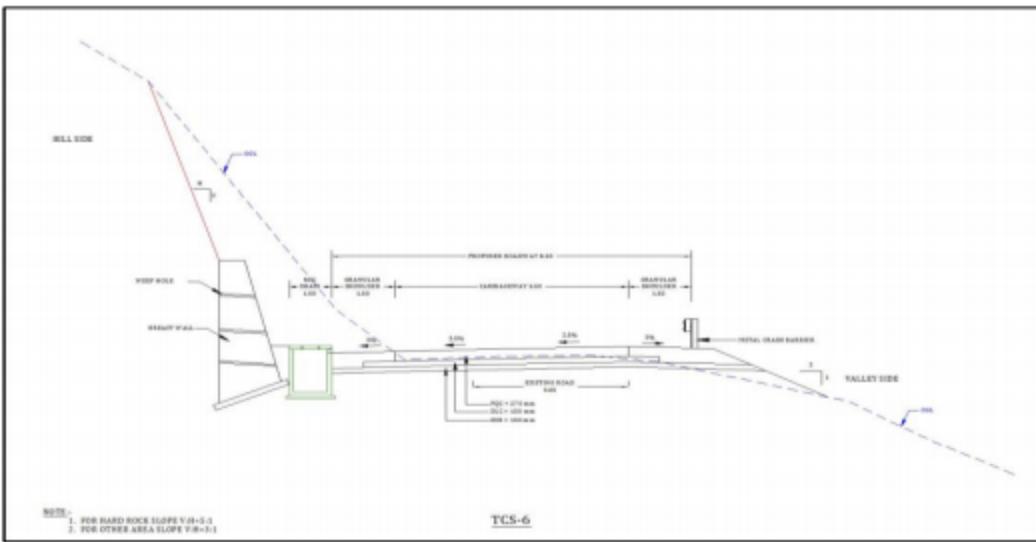


Figure 2-6 TCS for Proposed intermediate lane new construction

Environmental Impact Assessment (EIA) for Rehabilitation and Up-gradation to Intermediate lane of Paonta Sahib Rajban Shillai Meenus Hatkoti road portion between Km 97+000 to 106+120 (Gumma to Fediz)(Design RD 94+900 to 103+550) of NH 707 in the state of Himachal Pradesh

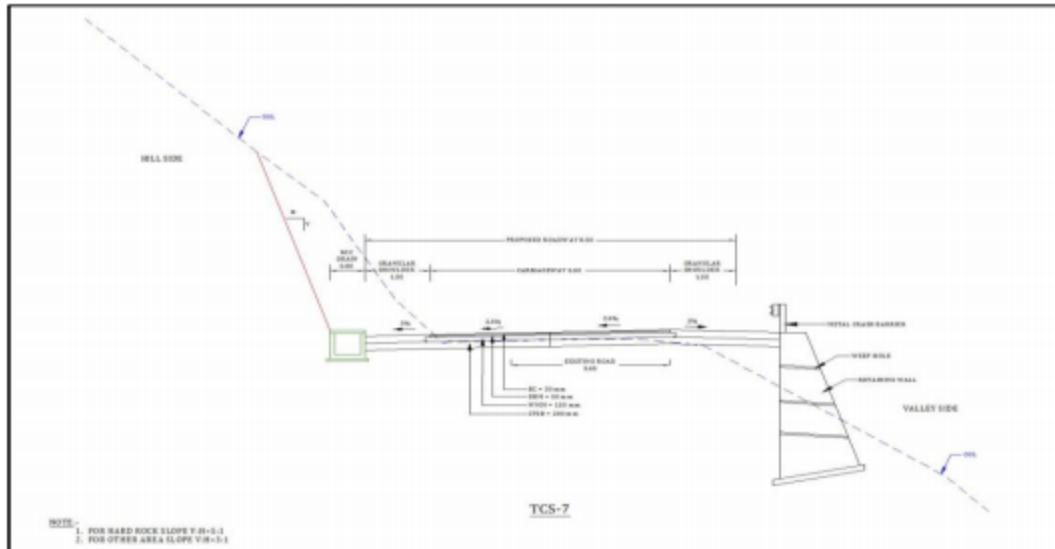


Figure 2-7 TCS for Proposed intermediate lane new construction

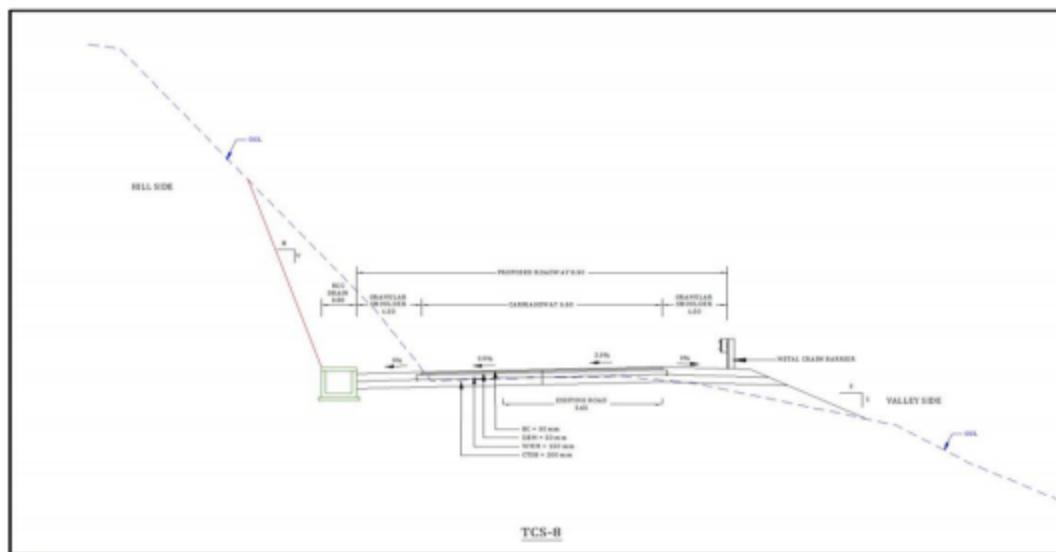


Figure 2-8 TCS for Proposed intermediate lane new construction

Environmental Impact Assessment (EIA) for Rehabilitation and Up-gradation to Intermediate lane of Paonta Sahib Rajban Shillai Meenus Hatkoti road portion between Km 97+000 to 106+120 (Gumma to Fediz)(Design RD 94+900 to 103+550) of NH 707 in the state of Himachal Pradesh

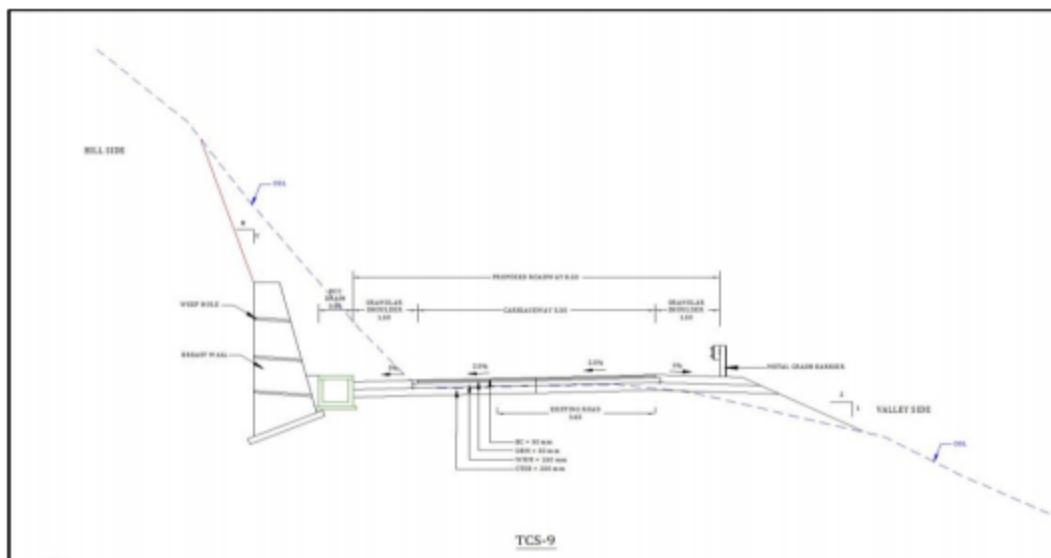


Figure 2-9 TCS for Proposed intermediate lane new construction

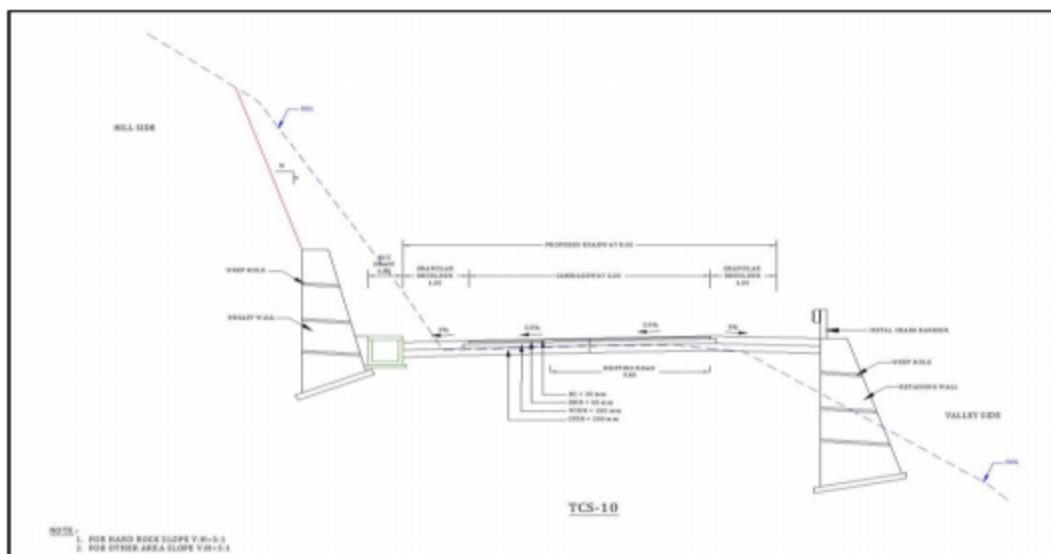


Figure 2-10 TCS for Proposed intermediate lane new construction

Environmental Impact Assessment (EIA) for Rehabilitation and Up-gradation to Intermediate lane of Paonta Sahib Rajban Shillai Meenus Hatkoti road portion between Km 97+000 to 106+120 (Gumma to Fediz)(Design RD 94+900 to 103+550) of NH 707 in the state of Himachal Pradesh

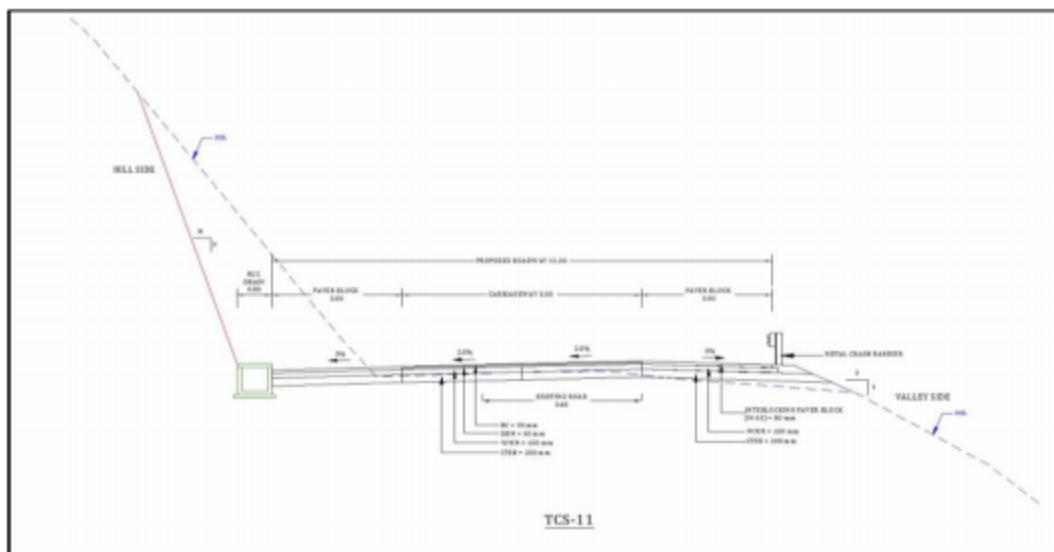


Figure 2-11 TCS for Proposed intermediate lane new construction

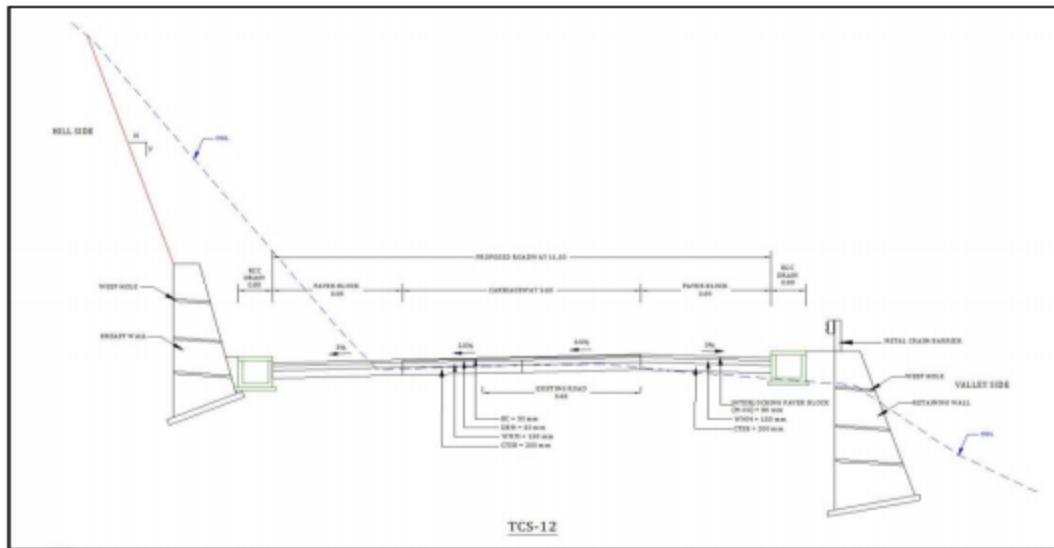


Figure 2-12 TCS for Proposed intermediate lane new construction

Environmental Impact Assessment (EIA) for Rehabilitation and Up-gradation to Intermediate lane of Paonta Sahib Rajban Shillai Meenus Hatkoti road portion between Km 97+000 to 106+120 (Gumma to Fediz)(Design RD 94+900 to 103+550) of NH 707 in the state of Himachal Pradesh

2.2.2.5 Intersections

The existing 01 Nos. of major junction and 5 No. minor junctions are proposed to be developed and the details of the same is shown in the table below:

Table 2-3 Details of Intersection

S. No.	Chainage	Type of Junction	Side	Remarks
1	103+250	T	LHS	-

Table 2-4 Intersection description

S. No.	Chainage	Type of Junction	Side	Remarks
1	94+900	y	LHS	Road to vill. Bohar
2	95+250	y	RHS	Road to residences
3	97+960	y	LHS	Village road
4	98+350	y	LHS	Road to vill. Pawana
5	102+750	y	LHS	Road to village

2.2.2.6 Improvement Proposals

These improvements will include widening, realignment, design and strengthening of pavement with the improvements of geometrics; widening and reconstruction of culverts; providing drainage; junction improvements; providing road marking; signs and other safety devices etc. to enable all road users to use the facility without degrading the environment. The summary of improvement proposal is shown in the table below:

Table 2-5 Summary of Improvement Proposal

S. No.	Particulars	Details
1	Length (km)	8.650 Km (Design Chainage from km 94+900 to km 103+550) Flexible Pavement length=7.4 km and Rigid pavement length=1.25 km

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2	Carriageway Width (m)	Carriageway-5.5 m+ Earthen Shoulders-1.5m BHS		
3	Right of Way (m)	24.0-25.0 m		
4	Junctions:			
A	Major Junction	1 at RD 103+250		
B	Minor Junction	5 Nos. At RD 94+900, RD 95+250, RD 97+960 ,98+350 & RD 102+750		
5	Cross Drainage Structure:			
A	Major Bridge	1 No. But not in the scope of this project .Taken separately under NH(O) project		
B	Minor Bridge	Nil		
C	Culverts	2x2 m box culverts in place of existing hume pipe culverts =29 no. Reconstruction of slab culverts with: Box culvert size 3x3 m=2 no. Box culvert size 4x4 m=1 no Box culvert size 6x6 m=2 no New Construction Box Culverts of size 2x2=4 no. Total no of culverts=38 no.		
6.	RCC COVERED DRAIN	FROM	TO	LENGTH (m)
	RCC Covered Drain LHS	97+950	98+340	390
	RCC Covered Drain LHS	99+220	99+450	230
	RCC Covered Drain BHS	103+050	103+190	140X2=280

Environmental Impact Assessment (EIA) for Rehabilitation and Up-gradation to Intermediate lane of Paonta Sahib Rajban Shillai Meenus Hatkoti road portion between Km 97+000 to 106+120 (Gumma to Fediz)(Design RD 94+900 to 103+550) of NH 707 in the state of Himachal Pradesh

	RCC Covered Drain at Junction LHS	103+260	-	1 5 0
			TOTAL LENGTH	1050
7.	Paver Blocks on shoulders:			
	Paver Blocks on shoulders up to drain 3 m wide BHS	99+300	99+450	150x2=300
	Paver Blocks on both side of shoulders	103050	103190	140x2=280
			Total length	580 m or 0.58 km
8.	Slope Protection Work:			
A	Boulder apron in wire Crates	0.200 km		
B	Breast Wall	3.390 km		
C	Retaining Wall	2.000 km		
D	Toe Wall	NIL		
9.	Road Safety and Appurtenances:			
A	Metal Beam Crash Barriers	km 94+850 to km 103+550 on Valley side		
B	Road Sign	3819 no.		
10	Project Facilities:			
A	Bus lay bye/bus stops	At 98+300 (RHS existing), 99+420(RHS), 101+700 (RHS), 102+125 (RHS) and 103+115 (RHS)		

Environmental Impact Assessment (EIA) for Rehabilitation and Up-gradation to Intermediate lane of Paonta Sahib Rajban Shillai Meenus Hatkoti road portion between Km 97+000 to 106+120 (Gumma to Fediz)(Design RD 94+900 to 103+550) of NH 707 in the state of Himachal Pradesh

B	Passing Place	3 no. at RD 95+360 (RHS), RD 98+680 (RHS) and RD 102+240 (RHS)
C	Wayside Amenities	1 no. at RD 98+030 ON LHS
D	Medical Aid Centre	1 no. at RD 98+030 ON LHS
E	Traffic Aid Centre	1 no. at RD 98+030 ON LHS
F	Field lab., site office and labour camp Hutmets	1 no. at RD 98+030 ON LHS
H	Solar Lighting	In Built up area at RD 98+050-98+400, RD 99+300-99+450
I	Electric Lighting	At Junction RD 103+260

2.2.2.7 Roadside Drainage

Design of drains in plain/rolling terrain has been carried out for self-cleansing velocity, for the runoff it will carry, considering the available fall. For trapezoidal drain on hill side, standard section as given in Hill Road Manual (IRC SP 48) is opted. It has been ensured that there are minimum three nos. of cross drainage structures are present in each km to carry the run-off of the roadside drainage. The details of roadside drainage is shown in the table below,

Table 2-6 Summary of Proposed RCC Drain

S. No.	Type of Cross - Section	Design Chainage		Length (km)	Terrain	Remarks
1	Rectangular	97+950	98+340	0.390	steep	LHS
2	Rectangular	99+220	99+450	0.230	steep	LHS
3	Rectangular	103+050	103+190	0.140	steep	BHS

Table 2-7 Detail of Proposed V Shaped PCC Drain

S. No.	Type of Cross - Section	Design Chainage		Net Length (km)	Terrain	Remarks
1	V Shaped Without Breast Wall	94+8 50	103+550	8.565	steep	LHS
2	V Shaped With Breast Wall	94+8 50	103+550	3.390	steep	LHS

2.2.2.8 Pavement Design

The existing pavement thorough out the project length is flexible. Green highway design has been adopted in place of conventional design.

- (i) Design life for flexible pavement - 20 years
- (ii) Effective CBR value for subgrade soil - 12%
- (iii) Design traffic - 20 msa
- (iv) Bituminous concrete BC - 30 mm
- (v) Dense bituminous macadam DBM - 50 mm
- (vi) Granular Base course - Wet Mix Macadam 150 mm
- (vii) CTSB - Granular mix material 200 mm

The details of proposed pavement crust is shown in the table below,

Environmental Impact Assessment (EIA) for Rehabilitation and Up-gradation to Intermediate lane of Paonta Sahib Rajban Shillai Meenus Hatkoti road portion between Km 97+000 to 106+120 (Gumma to Fediz)(Design RD 94+900 to 103+550) of NH 707 in the state of Himachal Pradesh

Table 2-8 Summary of Proposed Pavement Crust composition

S. No.	Existing Chainage (km)		Length (km)	Existing crust layers	Design Chainage (km)		Crust layers proposed for new construction			
	From	To			From	To	CTSB (mm)	WMM (mm)	DBM (mm)	BC (mm)
1	96+180	104+890	8.710	To be scraped and removed	94+900	103+550	200	150	50	30

2.2.2.9 Improvement Proposal for Cross Drainage Structures

Culverts

Culverts less than 10 m wide in hills and 12 m wide in plain/rolling terrain shall be widened. All 33 nos. of existing culverts (29 nos. of pipe culvert and 04 nos. of slab culvert) and 1 no. causeway shall be reconstructed being in poor condition, having inadequate waterway and damaged condition. All the existing pipe culverts (29 no.) and slab culverts (4 no.) shall be replaced with new construction box culverts. Additional 4 nos. of new box culverts are proposed at the locations where cross drainage is found inadequate. One no. culvert of box size 6x6 m in place of causeway shall also be constructed for proper drainage at the existing location. Thus finally there will be in all 38 nos. of culverts in the project road.

The details of improvement proposal of culverts are shown in the table below.

Table 2-9 Detail of culverts proposed for new construction

Sr. no.	Design Chainage (km)	Type of culvert	No. of span & Size of culvert in m	Outer to outer width of culvert in m	Remarks
1.	94+920	Box	1x2x2	11.0	New
2.	95+218	Box	1x2x2	11.0	Reconstruction
3.	95+318	Box	1x2x2	11.0	Reconstruction
4.	95+415	Box	1x2x2	11.0	Reconstruction
5.	95+603	Box	1x2x2	11.0	Reconstruction
6.	95+820	Box	1x2x2	11.0	Reconstruction
7.	96+008	Box	1x2x2	11.0	Reconstruction
8.	96+152	Box	1x2x2	11.0	Reconstruction

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9.	96+300	Box	1x2x2	11.0	Reconstruction
10.	96+620	Box	1x2x2	11.0	New
11.	96+940	Box	1x2x2	11.0	Reconstruction
12.	97+188	Box	1x2x2	11.0	Reconstruction
13.	97+494	Box	1x2x2	11.0	Reconstruction
14.	97+702	Box	1x2x2	11.0	Reconstruction
15.	97+955	Box	1x3x3	11.0	Reconstruction
16.	98+150	Box	1x3x3	11.0	Reconstruction
17.	98+470	Box	1x2x2	11.0	New
18.	98+959	Box	1x2x2	11.0	Reconstruction
19.	99+220	Box	1x2x2	11.0	New
20.	99+618	Box	1x2x2	11.0	Reconstruction
21.	99+912	Box	1x2x2	11.0	Reconstruction
22.	100+117	Box	1x2x2	11.0	Reconstruction
23.	100+247	Box	1x2x2	11.0	Reconstruction
24.	100+378	Box	1x2x2	11.0	Reconstruction
25.	100+615	Box	1x2x2	11.0	Reconstruction
26.	100+808	Box	1x2x2	11.0	Reconstruction
27.	100+968	Box	1x2x2	11.0	Reconstruction
28.	101+176	Box	1x2x2	11.0	Reconstruction
29.	101+494	Box	1x2x2	11.0	Reconstruction
30.	101+745	Box	1x4x4	11.0	Reconstruction
31.	101+838	Box	1x2x2	11.0	Reconstruction
32.	102+088	Box	1x2x2	11.0	Reconstruction
33.	102+288	Box	1x6x6	11.0	Reconstruction
34.	102+483	Box	1x2x2	11.0	Reconstruction
35.	102+780	Box	1x2x2	11.0	Reconstruction

Environmental Impact Assessment (EIA) for Rehabilitation and Up-gradation to Intermediate lane of Paonta Sahib Rajban Shillai Meenus Hatkoti road portion between Km 97+000 to 106+120 (Gumma to Fediz)(Design RD 94+900 to 103+550) of NH 707 in the state of Himachal Pradesh

36.	103+014	Box	1x2x2	11.0	Reconstruction
37.	103+386	Box	1x2x2	11.0	Reconstruction
38.	103+500	Box	1x6x6	11.0	Reconstruction

2.2.2.10 Stability of Slopes

Stability of slopes is important for hill road. Disturbance can occur due to erosion caused by rainfall and run-off and consequent slides. Therefore slope stability and erosion control becomes very vital for control and prevention of landslides/slips.

2.2.2.11 Landslide Zone

Weak spots which are chronic by way of hill slides are identified. The most active sliding zone is in km 95 – km 99 & km 101-km 103. Thorough study of these spots reveals that the causes of landslides may be mechanical weathering, chemical alteration, influence of seasonal fluctuation of temperature, rains, which generally result in the deterioration of the strength characteristics of slope forming materials.

2.2.2.12 Breast Wall

Other areas where hill slopes are made of soft and highly weathered rocks, earthen boulders etc. and the cut slopes fail by slumping, sliding and toe failures due to erosion. Such spots are identified and toe protection of slopes is proposed by constructing the breast walls. The height of breast wall is proposed as 1.5m as suggested in 'Hill Road Manual'. The front batter is kept 1:3 and top width 60 cm. The breast walls are provided in Stone Random Rubble masonry in 1:6 cement mortars. Road side drains are also constructed with breast wall.

Table 2-10 Details of Breast Wall (3 m Height)

S. No.	Proposed Chainage		Length (in m)	Side
	From	To		
1.	94+840	94+890	50	LHS
2.	95+100	95+215	115	LHS
3.	95+400	95+430	30	LHS
4.	95+520	95+570	50	LHS
5.	96+250	96+280	30	LHS

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6.	96+630	96+660	30	LHS
7.	98+090	98+140	50	LHS
8.	98+800	98+850	50	LHS
9.	100+000	100+230	230	LHS
10.	100+230	100+500	270	LHS
11.	100+800	101+000	200	LHS
12.	101+840	102+270	430	LHS
13.	102+600	102+760	160	LHS
14.	102+785	102+850	65	LHS
15.	103+130	103+180	50	LHS
Total		1810		

Table 2-11 Details of Breast Wall (5 m Height)

S. No.	Proposed Chainage		Length (in m)	Side
	From	To		
1.	95+000	95+050	50	LHS
2.	95+720	95+750	30	LHS
3.	95+900	95+930	30	LHS
4.	96+050	96+100	50	LHS
5.	96+450	96+570	120	LHS
6.	97+750	97+800	50	LHS
7.	97+850	97+950	100	LHS
8.	98+160	98+340	180	LHS
9.	98+350	98+450	100	LHS

Environmental Impact Assessment (EIA) for Rehabilitation and Up-gradation to Intermediate lane of Paonta Sahib Rajban Shillai Meenus Hatkoti road portion between Km 97+000 to 106+120 (Gumma to Fediz)(Design RD 94+900 to 103+550) of NH 707 in the state of Himachal Pradesh

10.	98+520	98+550	30	LHS
11.	98+850	98+990	140	LHS
12.	99+550	99+680	130	LHS
13.	99+920	100+000	80	LHS
14.	100+500	100+800	300	LHS
15.	101+000	101+270	270	LHS
16.	101+370	101+470	100	LHS
17.	101+690	101+735	45	LHS
18.	102+490	102+600	110	LHS
19.	103+050	103+130	80	LHS
Total			1995	LHS

2.2.2.13 Retaining Wall

Retaining wall is provided on the earthen shoulder edge of valley side of the project road where the existing slope does not allow construction of embankment and the road is to be retained by means of a solid protection work. The details of the retaining wall is shown in the table below:

Table 2-12 Schedule of Retaining Wall (4, 6 and 8m Heights)

S. No.	Design Chainage		Length (m)	Side
	From	To		
1.	94+900	94+930	30	RHS (valley side)
2.	95+020	95+085	65	RHS(valley side)
3.	95+100	95+140	40	RHS(valley side)
4.	95+205	95+255	50	RHS(valley side)
5.	95+260	95+275	15	RHS (valley side)
6.	95+300	95+340	40	RHS(valley side)

Environmental Impact Assessment (EIA) for Rehabilitation and Up-gradation to Intermediate lane of Paonta Sahib Rajban Shillai Meenus Hatkoti road portion between Km 97+000 to 106+120 (Gumma to Fediz)(Design RD 94+900 to 103+550) of NH 707 in the state of Himachal Pradesh

7.	95+400	95+430	30	RHS(valley side)
8.	95+590	95+620	30	RHS(valley side)
9.	95+805	95+835	30	RHS (valley side)
10.	95+930	95+920	20	RHS(valley side)
11.	96+000	96+020	20	RHS(valley side)
12.	96+130	96+170	40	RHS(valley side)
13.	96+290	96+310	20	RHS (valley side)
14.	96+370	96+400	30	RHS(valley side)
15.	96+510	96+530	20	RHS(valley side)
16.	96+610	96+630	20	RHS(valley side)
17.	96+710	96+740	30	RHS (valley side)
18.	96+770	96+795	25	RHS(valley side)
19.	96+920	96+960	40	RHS(valley side)
20.	96+980	97+005	25	RHS(valley side)
21.	97+040	97+060	20	RHS (valley side)
22.	97+180	97+200	20	RHS(valley side)
23.	97+470	97+`500	30	RHS(valley side)
24.	97+690	97+710	20	RHS(valley side)
25.	97+830	97+850	20	RHS(valley side)
26.	97+930	97+980	50	RHS (valley side)
27.	98+130	98+160	30	RHS(valley side)
28.	98+315	98+335	20	RHS(valley side)
29.	98+460	96+480	20	RHS(valley side)
30.	98+630	98+650	20	RHS (valley side)
31.	98+700	98+720	20	RHS(valley side)

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32.	98+860	98+900	40	RHS(valley side)
33.	98+945	99+000	55	RHS(valley side)
34.	99+080	99+100	20	RHS(valley side)
35.	99+210	99+230	20	RHS (valley side)
36.	99+470	99+500	30	RHS(valley side)
37.	99+530	99+550	20	RHS(valley side)
38.	99+590	99+630	40	RHS(valley side)
39.	99+900	99+920	20	RHS (valley side)
40.	100+100	100+150	50	RHS(valley side)
41.	100+235	100+255	20	RHS(valley side)
42.	100+300	100+340	40	RHS(valley side)
43.	100+370	100+390	20	RHS(valley side)
44.	100+605	100+625	20	RHS (valley side)
45.	100+800	100+820	20	RHS(valley side)
46.	100+960	100+980	20	RHS(valley side)
47.	101+170	101+200	30	RHS(valley side)
48.	101+485	101+510	25	RHS (valley side)
49.	101+550	101+580	30	RHS(valley side)
50.	101+720	101+770	50	RHS(valley side)
51.	101+735	101+750	15	LHS(valley side)
52.	102+000	102+020	20	RHS(valley side)
53.	102+080	102+100	20	RHS (valley side)
54.	102+250	102+310	60	RHS(valley side)
55.	102+280	102+295	15	LHS(valley side)
56.	102+470	102+490	20	RHS(valley side)

Environmental Impact Assessment (EIA) for Rehabilitation and Up-gradation to Intermediate lane of Paonta Sahib Rajban Shillai Meenus Hatkoti road portion between Km 97+000 to 106+120 (Gumma to Fediz)(Design RD 94+900 to 103+550) of NH 707 in the state of Himachal Pradesh

57.	102+760	102+790	30	RHS (valley side)
58.	103+005	103+020	15	RHS(valley side)
59.	103+050	103+125	75	RHS(valley side)
60.	103+135	10+175	40	RHS(valley side)
61.	103+270	103+400	130	RHS(valley side)
62.	103+430	103+530	100	RHS(valley side)
Total length			2000 m	

2.2.2.14 CC Interlocking Paver blocks:

CC Interlocking Paver blocks have been provided along the project highway in gap between RCC drain and main carriageway for vegetable market as below:

Table 2-13 Interlocking Paver blocks

S. No.	Design Chainage		Length (m)	Side
	From	To		
1	99+300	99+450	150	BHS
2	103+050	103+190	140	BHS

2.3 RIGID PAVEMENT IN WATER LOGGED AREA

There is water logged area from Chainage 100+200 to 102+300 along the project road. The road is not stable and durable in this area and gets badly damaged in short spell. To overcome this problem rigid pavement has been proposed with detail as below:

Table 2-14 Rigid Pavement

Sr. No.	Design Chainage (km)	Length in km	PQC (mm)	DLC(mm)	GSB(mm)
1.	99+920 to 101+170	1.250	280	150	150



2.3.1 Dumping Area

Additional land has been proposed to be acquired for dumping of remaining cut materials in the form of rock, soil and debris after maximizing its utilization in new construction of pavement, structures and slope protection work. After proper compaction and slope protection such locations can be used as medical/traffic aid center, wayside amenities and parking space. The details of such area along with its intake capacity is shown in the table below:

Table 2-15 Details of Dumping Area

S. No.	Design Chainage		Length in m	Side
	From	To		
1	96+220	96+350	130	Valley Side
2	99+050	99+250	200	Valley Side

2.4 ROAD SAFETY AND APPURTENANCES

Various provisions like w beam crash barriers, road studs, Road Signs and Road Markings is proposed along the project road to improve the safety for the commuters. The details of such provisions is shown in the section below:

2.4.1 Road Side Crash Barrier-

Metal W beam crash barrier is proposed in valley side throughout the complete project stretch (except the structures where RCC crash Barrier shall be provided) along the steep terrain and high embankment sections. The details of the same is shown in the table below:

Table 2-16 Details of Metal Beam Crash Barriers

S. No.	Design Chainage		Side of Crash Barrier	Net Length (m)
	From	To		
1	94+850	103+550	RHS	8185

2.4.2 Project Facilities

The project facilities proposed along the project stretch are shown in the below section.

2.4.3 Bus Shelter

The location of Bus Shelter is shown in the table below,

Environmental Impact Assessment (EIA) for Rehabilitation and Up-gradation to Intermediate lane of Paonta Sahib Rajban Shillai Meenus Hatkoti road portion between Km 97+000 to 106+120 (Gumma to Fediz)(Design RD 94+900 to 103+550) of NH 707 in the state of Himachal Pradesh

Table 2-17 Details of Proposed Bus Shelter

S. No.	Design Chainage	Side
1	98+300	RHS improvement of existing Bus lay bye
2	99+420	RHS
3	101+700	RHS
4	102+125	RHS
5	103+115	RHS

2.4.4 Passing Places

Passing Places have been proposed for convenience of HCV drivers so that they can park their trucks in some open space for some time for taking short rest or repairs, if need be. Detail of Passing Places is given as below.

Table 2-18 Detail of Passing Places

S. No.	Design Chainage	Side
1	95+360	RHS
2	98+680	RHS
3	102+240	RHS

2.4.5 Wayside Amenities

In compliance to the order of Hon'ble High Court of Himachal Pradesh CWPIL 06/2017 provision of wayside amenities along the project road has been made. The locations of the wayside amenities are shown in the table below:

Table 2-19 Details of Wayside Amenities

S. No.	Design Chainage	Name of the Village	Side
1	99+250	Near Vegetable market, Vill. Antrauli	LHS

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2.4.6 Medical Aid Centre

One no. medical aid center equipped with Ambulance and emergency are proposed at the following location:

Table 2-20 Details of Medical Aid Centre

S. No.	Design Chainage	Name of the Village	Side
1	99+300	Near Vegetable market, Vill. Antrauli	LHS

2.4.7 Loading/Unloading Platform

A platform is proposed to be developed as Loading/Unloading Platform and shown in the table below:

Table 2-21 Details of Loading/Unloading Platform

S. No.	Design Chainage	Name of the Village	Side
1.	99+425	Near Vegetable market, Vill. Antrauli	LHS

2.4.8 Solar Lighting

Provision for solar lighting will be made in all the built-up areas along the project stretch. The details of the same are shown in the table below:

Table 2-22 Details of Solar Lighting Location

S. No.	Name of village/ town	Design Chainage		Lengths (Km)
		From	To	
1	Antrauli	98+050	98+400	0.350
2	Vegetable Market (Subzi Mandi)	99+300	99+450	0.150

The design parameters of the project are given below:



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Table 2-23 Design Parameters of the Project

Sr. no.	Description	Details
1	Design Speed	30-40 kmph
2	Intermediate lane carriageway	5.5 m
3	Camber	
	i) Carriageway	2.5%
	ii) Earthen shoulders	3.0%
5	Maximum Super Elevation	7.0%
6	Minimum stopping sight distance	45 m
7	Minimum Intermediate sight distance	90 m
8	Minimum radius of horizontal curve	20 m
9	Minimum radius of horizontal curve without transition	Nil
10.	Ruling vertical gradient	5.0 %
11	Minimum length of Vertical curve	50 m
12	Maximum grade change not requiring vertical Curve	1.2 %
13	Vertical Clearance in mountainous areas	5.0 m

3. POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

3.1 ENVIRONMENTAL POLICY FRAMEWORK

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

3.1.1 National Environmental Policy Framework

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

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

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

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

3.2 LEGAL FRAMEWORK

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

The legislations/acts followed for present study has been summarized in Table below:

Environmental Impact Assessment (EIA) for Rehabilitation and Up-gradation to Intermediate lane of Paonta Sahib Rajban Shillai Meenus Hatkoti road portion between Km 97+000 to 106+120 (Gumma to Fediz)(Design RD 94+900 to 103+550) of NH 707 in the state of Himachal Pradesh

Table 3-1 Summary of Key Legislations Relevant to the Project

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

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		during the construction period.		
The Building and Other Construction Workers (Regulation of Employment and conditions of services)	1996	For welfare of Employees/labour/ workers	Yes	State Labour Commissioner
Hazardous Wastes (Management and Handling) Rules	1989	For protection against improper handling and disposal of hazardous waste	Yes	HPSPCB
Chemical Accidents (Emergency Planning, preparedness and response)Rules	1996	Protection against chemical accident while handling any chemical	Yes	HPSPCB

Other State Level Legislations and Acts

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

3.3 ENVIRONMENTAL CLEARANCE REQUIREMENTS

3.3.1 GOI Requirements

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

- (a) This project is widening of existing State Highway; it does not fall under any category for the environment clearance as per the EIA notification 2006 (and its subsequent amendments till date)
- (b) It does not pass through ecologically sensitive areas, and
- (c) It is not a highway include expressway.

3.3.2 State Level Clearance Requirements

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

Forest Clearances: Permission has to be taken from the Forest Department for cutting of the trees at junctions under the Forest (Conservation) Act, 1980 as the road side plantation in the state of Himachal Pradesh has been designated as Protected Forests. Forest clearance has also to be taken for cutting of private tree in the proposed bypasses.

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

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

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

3.3.3 World Bank Requirements

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

The various clearances required for highway project and their applicability viz this project is given in Table below:

Table 3-2 Clearances Required for the Project

S. No.	Regulatory Clearances	Corresponding Regulations	Approving Authority	Applicability to the Project	Typical Time Required	Responsibility for compliance	
						Execution	Supervision
Pre-Construction Stage							
01	Environmental Clearance	EIA Notification, 2006 and amended till date	State Environmental Impact Assessment Authority or CEIAA in MoEF, GoI	Not applicable	-	-	-
02	Consent to Establish	Water (Prevention and Control of Pollution) Act 1974; Air (Prevention and Control of Pollution) Act 1981	Himachal Pradesh State Pollution Control Board (HPSPCB)	Subject to establishing Labour camps, Hot mix plants, DG sets units, cement batching plant or any water/air pollution generating units.	3 Months	Contractor	HP PWD/CMU
03	Wild Life Clearance	Wild Life Act 1972	Hon'ble Supreme Court	Not applicable	-	-	-
05	Permission for felling & trimming of trees	Forest (Conservation) Act, 1980 and its amendments;	Regional Office MoEF Chandigarh	Applicable.	6 months	CMU/PWD	HP PWD
Construction Stage							
06	Permission for locating and operating Borrow pits	-	Mining Department/SEIAA, Local Administration –	Applicable if Earth is required	1 Month	Contractor	HP PWD



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S. No.	Regulatory Clearances	Corresponding Regulations	Approving Authority	Applicability to the Project	Typical Time Required	Responsibility for compliance	
			Municipal Government/ Panchayat			Execution	Supervision
07	Permission for Withdrawal of Ground Water	Environment Protection Act 1986	Central Ground Water Board	Applicable, if withdrawal is proposed	1 month	Contractor	HP PWD/CMU
08	Permission for withdrawal of Surface Water from River/Irrigation Canals		Irrigation Authorities for use of water from Irrigation Canal. River Board / Authorities for withdrawal of water from Rivers	Applicable if withdrawal is proposed	1 month	Contractor	HP PWD/CMU
09	Authorization to generate, store, transport and dispose of Hazardous Waste	The Hazardous Wastes (Management, Handling and Trans-boundary Movement) Rules, 2008 and amendments till date	Himachal Pradesh State Pollution Control Board (HSPSCB)	Applicable, if hazardous waste is generated in the project (disposal of bituminous wastes – verify with PPCB)	2 months	Contractor	HP PWD
10	Consent to Operate	Water (Prevention and Control of Pollution) Act 1974; Air (Prevention and	Himachal Pradesh State Pollution Control Board (HSPSCB)	Subject to establishing, Hot mix plants or any water/air pollution	3 Months	Contractor	HP PWD/CMU

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S. No.	Regulatory Clearances	Corresponding Regulations	Approving Authority	Applicability to the Project	Typical Time Required	Responsibility for compliance	
						Execution	Supervision
		Control of Pollution) Act 1981		generating units, Labour camps			
11	Traffic Police Clearance for diversion of routine traffic	Local Traffic Police Regulations and Bye-laws	Traffic Police Department	Applicable if diversion is required in urban/semi urban areas	1 Month	Contractor	CMU/ HP PWD
12	NOC from Archaeological Survey of India	The Ancient Monument and Archaeological sites and Remains Act 1958.	Department of Archaeology Govt. of Himachal Pradesh	Subject to chance finds, if any	2 Months	Contractor	CMU/ HP PWD
13	Permission for Sand Mining from river bed	Himachal Pradesh Mines and Minerals Concession Rules 1969	River Board Authorities/ Department of Mining Govt. of Himachal Pradesh	Applicable, if river sand is mined	6 Months	Contractor	CMU/ HP PWD
14	Permission for Opening of new Quarry sites	Himachal Pradesh Mines and Minerals Concession Rules 1969	Department of Mining Govt. of Himachal Pradesh Himachal Pradesh State Pollution Control Board	Applicable only if Contractor opens a new quarry site	6 Months 3 Months	Contractor	HP PWD /CMU



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4. BASELINE ENVIRONMENTAL STATUS

4.1 GENERAL

Physiographical, most of the areas form a part of hilly tract with undulating terrain. The elevation varies from 2500m to 3500m above mean sea level. The Shiwalik hills standing to a height of about 1 100m in the south of limestone deposits are separated from the bare lofty ridges of the lesser Himalayas in the north by the deep valley of river Giri, The project influence area is marked by deep valleys, river terraces, steep escarpments and innumerable streams.

The latitude and longitude of project road are as follows:

(a) Start Point: Gumma ($30^{\circ}48'1.21''N$, $77^{\circ}43'41.23''E$)

(b) End Point: Fediz ($30^{\circ}50'59.34''N$, $77^{\circ}44'40.37''E$)

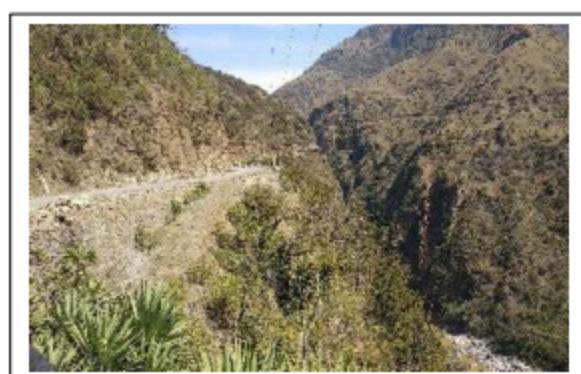


Figure 4-1 Hilly Terrain Topography Features of the Project Road



Figure 4-2 Plain Terrain Topography Features of the Project Road

Environmental Impact Assessment (EIA) for Rehabilitation and Up-gradation to Intermediate lane of Paonta Sahib Rajban Shillai Meenus Hatkoti road portion between Km 97+000 to 106+120 (Gumma to Fediz)(Design RD 94+900 to 103+550) of NH 707 in the state of Himachal Pradesh

The project road passes through North Eastern part of Himachal Pradesh. The project road section is of 8.650 km mountainous terrain. There is lot of undulations in the topography of the area. The uphill slope has good catchment, and the rainwater generally drains out through the natural streams on both flanks of the slide.

Different types of topographic pictures are given in Fig 4-1 & Fig 4-2.

4.1.1 Geological analysis of the Area

The project area primarily consists of alluvial deposits. The other geological formations in the project area comprise of sandstone. Primarily clay forms the top zone of project area. There is presence of variable sizes and types of rocks in the area. The geological features map of project area is given in Fig 4-3.



Figure 4-3 Geological Map of India

4.1.2 Seismology

The area is moderately earthquake prone. Earthquakes have been experienced in many parts of the state. The epicenters of various earthquakes experienced in the past lies outside the state boundaries as well.

As per the Bureau of the Indian Standards (BIS) map IS: 1983-1984, the district of Sirmour and Shimla lies in Zone V. Zone V is the highest earthquake zone. Map showing seismic zone of India is given below in **Figure 4-4**.

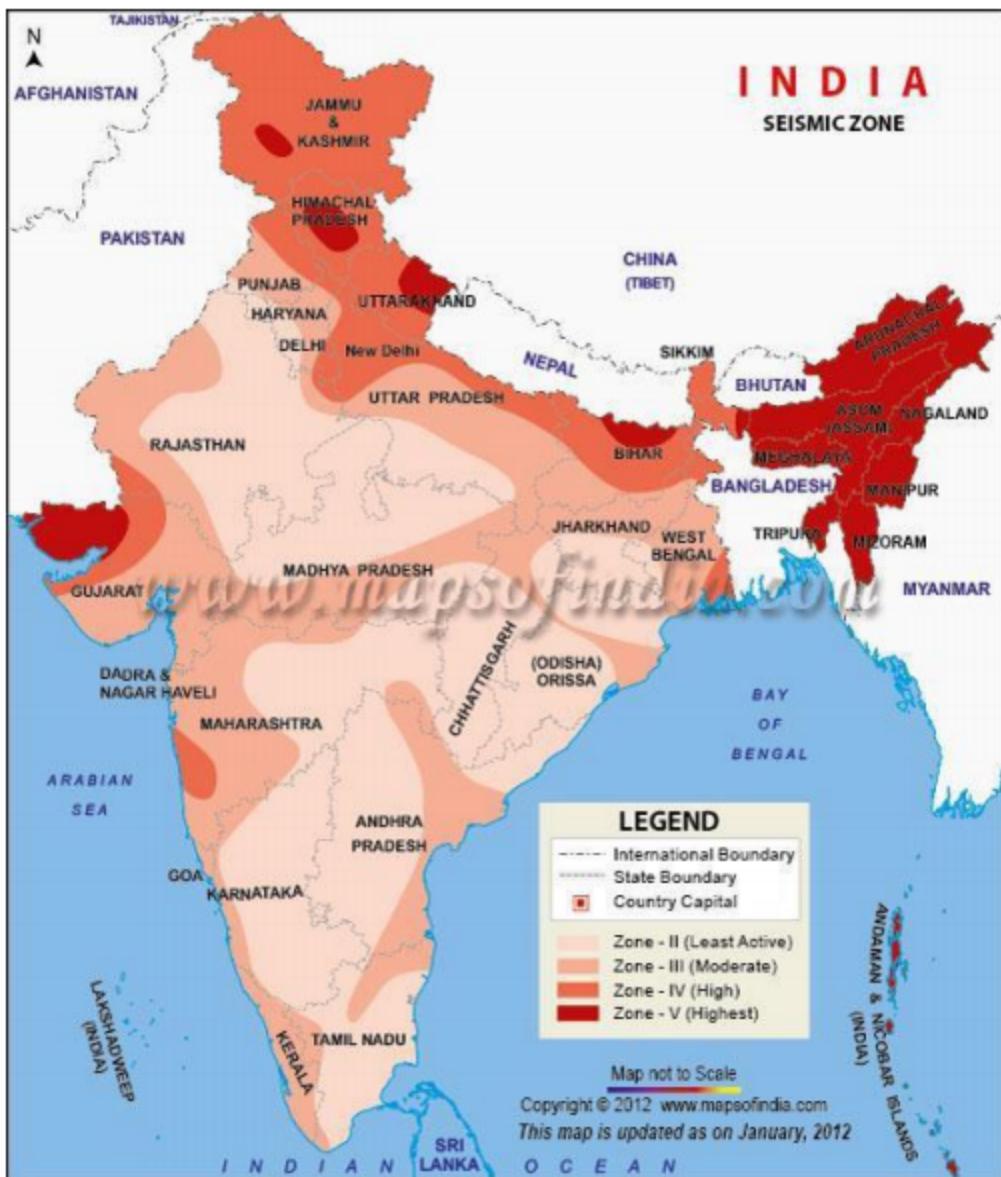


Figure 4-4 Seismic Zones of India

4.1.3 Soil Characteristics

Major soil types that are scattered throughout the state are alluvial soils and Brown Podzoic soils and similar variety is found in the Project area as well.

The problem of soil erosion is one of the major environmental problems affecting the Himalayan region, with millions of tons of soil being either washed or blown away in due course of time. This in turn affects soil fertility adversely.

4.1.4 Landslides

There is major issue of soil stability in the hilly terrain of the project area. This is accompanied by landslips, mud flows and flash floods affecting the entire area. The problem rises during rainy season and adversely affects the road structure. The environmental survey team has observed some weak areas as geologically unstable along the project road.

Landslide Zone: Weak spots which are chronic by way of hill slides are identified. The most active sliding zones are tabulated in the Table No. 1 below. Some other small spots are also observed. Thorough study of these spots reveals that the causes of landslides may be mechanical weathering, chemical alteration, influence of seasonal fluctuation of temperature, rains, which generally result in the deterioration of the strength characteristics of slope forming materials.

Table 4-1 SLIDING ZONES (As per Design Chainage)

S. No.	FROM (Km)	UPTO (Km)
1	95.530	95.580
2	95.400	95.430
3	96.520	96.570
4	98.800	98.850
5	101.170	101.270
6	101.370	101.470
7	101.690	101.730
8	102.630	102.690

4.1.5 Climate

The Project corridor (NH-707) is located in Humid Sub-Temperate region and the climate is distinguished by three distinct seasons.

- a. Summer Season (April to June)
- b. Rainy Season (July to Aug.)
- c. Winter Season (Nov. to Feb)

4.1.6 Rainfall

Annual average rainfall of the area lies between 1400mm to 1600mm, 75 % of which is received during monsoon season. The distribution throughout the year depends upon various other factors. During summers the area gets average of 130mm rainfall, during winters the area gets average of 60mm rainfall and during monsoon the area gets average of 1251mm rainfall.

During a heavy rainstorm may wash away as much as 90 tons of soil per acre. Most of the splashed soil particles don't leave the field; they clog surface pores, which in turn reduce water infiltration, increases water runoff, and increases soil erosion.

4.1.7 Variation in Temperature

The temperature in the project area varies, according to season and elevation. There is change from moderately hot to freezing cold temperature depending upon the time of the year or season. The period from 15th December to 15th February is the coldest period. Temperature increases gradually till June. The winter prevails from November to February, spring in March, summer from April to June and monsoon in July-August. The minimum temperature in winters is as low as 0°C and rises to 42°C in summers.

4.1.8 Humidity Condition

There is variation of relative humidity in the project area from 19.91 to 98%. However, mostly the relative humidity remains high throughout year. It is recorded lowest around the month of May and highest around the month of August.

4.1.9 Wind Characteristics

Intensity of wind is moderately blows throughout the season and keeps within the range of 1-19 km/hr. Some increase in the month of September is observed in recent years. During monsoon it varies from 0.6 to 1.12 m/sec. The direction of wind is mostly towards south. After monsoon is over the direction of wind is from East to West.

4.2 PHYSICAL ENVIRONMENT

4.2.1 Air Environment

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

The National Ambient Air Quality Standards (NAAQS) and ambient air quality monitoring results of previous studies carried out in the adjoining area are presented in tables below:

Environmental Impact Assessment (EIA) for Rehabilitation and Up-gradation to Intermediate lane of Paonta Sahib Rajban Shillai Meenus Hatkoti road portion between Km 97+000 to 106+120 (Gumma to Fediz)(Design RD 94+900 to 103+550) of NH 707 in the state of Himachal Pradesh

Table 4-2 National Ambient Air Quality Standards

Pollutant	Time Weighted Average	Concentration in Ambient Air		
		Industrial, Residential, Rural and other areas	Ecologically sensitive area(notified by central government)	Methods of measurement
(1)	(2)	(3)	(4)	(5)
Sulphur dioxide (SO ₂), µg/m ³	Annual*	50	20	-Improved West & Gaeke-Ultraviolet fluorescence
	24 hours**	80	80	
Nitrogen Dioxide (NO ₂), µg/m ³	Annual*	40	30	-Modified Jacob & Hochheiser (Na-Arsenite) chemiluminescence
	24 hours**	80	80	
Particulate Matter (Size less than 10m) or PM ₁₀ µg/m ³	Annual*	60	60	- Gravimetric - TOEM - Beta attenuation
	24 hours**	100	100	
Particulate Matter (Size less than 2.5m) or PM _{2.5} µg/m ³	Annual*	40	40	- Gravimetric - TOEM - Beta attenuation
	24 hours**	60	60	
Carbon Monoxide (CO) mg/ m ³	8 hours**	02	02	-Non Dispersive Infra Red (NDIR) spectroscopy
	1 hour**	04	04	
Avg. SPM (µg/m ³)	Annual*	360 & 140	70	- Gravimetric - TOEM - Beta attenuation
	24 hours**	500 & 200	100	

(Source: National Ambient Air Quality Standards, CPCB)

***Annual average: Annual Arithmetic Mean of minimum 104 measurements in a year taken twice a week 24-hourly at uniform interval**

****24 hourly or 08 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.**

4.2.1.1 Methodology

High volume ambient air samplers were used for the collection of samples in ambient air for 3 locations (One location at upwind direction and two locations at downwind direction) near the proposed alignment. The selection of the receptors was based on the following considerations:

- Covering the proposed ROW;
- Covering land use characteristics and socio-economic conditions observed along the route.

Samples were collected on 24 hourly basis for PM10, PM 2.5, NO_x, CO, Pb and SO₂. Samples for CO were collected for one-hour duration. The sampling and analysis has been done according to the relevant IS code and practices and guideline of PPCB.

4.2.1.2 Ambient Air Quality in Study Area

Out of total three (3) locations, at each location samples were collected for parameters PM10, SO₂ and NO_x and PM2.5 were collected for 24 hrs. Basis. The details of Locations are given in the **Table 4-3**.

Table 4-3 Details of Ambient Air Quality Monitoring Locations

Station Code	Location Name	Chainage	Land Use	Offset from pavement edge
AAQ-01	Gumma	95/00	Residential/ Commercial	45 m
AAQ-02	Antroli Village	98/300	Residential/ Commercial	05 m
AAQ-07	Fediz	104/00	Residential/ Commercial	6m

The Details of minimum, maximum and mean values of the ambient air quality parameters monitored along the project bypass are presented in **Table 4-4**.

Table 4-4 Onsite 24-Hourly Ambient Air Quality along the Project*

Station Code	Land Use	PM ₁₀	PM _{2.5}	SO ₂	NOx (µg/m ³)	CO (ppm)
AAQ - 1	Commercial	63.5	27.0	7.5	19.4	0.46
AAQ - 2	Commercial	53.0	21.1	6.85	16.0	0.34
AAQ - 7	Commercial	40.0	17.8	BDL (<6.5)	7.4	0.25
Maximum		63.5	27.0	7.5	19.4	0.46
Minimum		40.0	17.3	6.85	7.4	0.25
Mean		51.75	22.15	7.18	13.4	0.71

*Samples were collected in June 2015.

Note: Conversion Factor for Carbon Monoxide 1ppm CO = 1157 µg/m³

4.2.2 Noise Environment

Noise attributed to roads depends on factors such as traffic intensity, the type and condition of the vehicles plying on the road, acceleration/deceleration/gear changes by the vehicles depending on the level of congestion and smoothness of road surface (IRC: 104-1988).

4.2.2.1 Sampling Criteria

Hourly noise levels were recorded at 03 locations identified along proposed **Gumma to Fediz Section of NH-707**. Details of the locations are presented in table below.

The hourly noise values were used to calculate daytime and night time equivalent noise levels. In order to arrive at daytime noise levels the logarithmic average of hourly values was taken from 6:00 AM to 10:00 PM. The night time noise levels were derived by taking logarithmic average of hourly values from 10:00 PM to 06:00 AM. The hours of day and night were considered as specified durations for 'day' and 'night' in Noise Rules Published by the MoEF. Details of the recorded noise levels are given below:

Table 4-5 Recorded Noise Levels at Various Locations*

Location Code	Description of Location	Distance from Proposed ROW (m)	Noise Levels dB (A) Leq.	
			Day time	Night
Gumma to Fediz Section of NH-707				
NQ-1	Gumma	10m	63.8	43.3
NQ-2	Antroli Village	5m	54.2	40.2
NQ-3	Fediz at 104/00	7m	51.6	38.2

*Noise Quality (NQ) recorded in September, 2019.

Table 4-6 National Ambient Noise Levels Standards (as per CPCB)

Area Code	Category	Limits in Decibels (dBA)	
		Day Time	Night Time
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silence	50	40

Note: (1) Day Time: 6 AM to 10 PM, Night Time: 10 PM to 6 AM

(2) Silence zone is an area up to 100 m around premises as hospitals, educational institutions and courts. Source: Central pollution Control Board, New Delhi.

4.2.3 Water Environment

There are 1 Number of river flowing along the **Gumma to Fediz Section of NH-707**, which comprises the surface water resources of the Project area. The water resources of the Project Area is summarized in **table below:**

Table 4-7 Surface and Groundwater Sources in the Project Area

S. No.	Name of Project corridor	Water sources Nearby project		Water sources in direct influence area of road.			
		Canals	River	Wells	Tube wells	Hand pumps	Ponds/ Tanks
1	Gumma to Fediz Section of NH-707	-	01	-	-	-	-

4.2.3.1 Surface Water

Rivers Details of the Rivers in the project study area are as follows:

Yamuna River: -Yamuna is the most important and measure river of project region. It flows along the border of Himachal Pradesh and Uttarakhand. Project start at Paonta Sahib is situated near the bank of Yamuna.

Giri River: - The River Giri is an important tributary of the Yamuna River. It drains a part of South-Eastern Sirmour. The Giri rises from Kupar peak just above Jubbal town and flows down in the South- Eastern direction and divides the Sirmour district and crosses project highway in km 18 near Sataun.

Minus River: - The Minus River is a tributary of the Tonns River, which in turn drains into the river Yamuna. The Minus River crosses project highway in km 88 in Minus.

Tonns River: - This River is an important tributary of the Yamuna River and joins it at Kalsi in the North-Western part of Dehradun valley. It flows along about 25 kin length of the project highway which lies between km 90 and end point of the road i.e. Guinina.

4.2.3.2 Groundwater

The ground water resource occurs mainly in unconsolidated sediments of intermountain valleys and in sub mountain tract. The project districts, particularly their valley areas depend upon ground water. The exploitation is done through open wells and infiltration galleries. However to establish baseline quality of ground water four sampling locations were selected along the project highway. Samples were analyzed as per APHA and IS-3025 procedures.

4.2.3.3 Water Quality

Water quality is a concern for the numerous surface water sources and the groundwater sources. Two surface and one ground water samples have been collected from sources present along the proposed alignment to ascertain the baseline conditions of water quality. Location details of the surface water and ground water samples collected are presented in table below:

Table 4-8 Details of the Sampling Locations of the Surface and Ground Water

Sample Code	Description of source	Name of the Settlement	Type of Sample
GWHP-01	Hand Pump near Gumma	Gumma	Ground Water
SWHP-01	River at start of the project	Gumma	Surface Water
SWHP-02	River near Fediz Bridge	Fediz	Surface Water

The water quality of the surface water and ground water samples are presented in Table 4-9 and Table 4-10 respectively. These samples were analyzed for all essential characteristics and for most of the desirable characteristics specified in IS 10500: 2012, and are analyzed in accordance with the standard methods specified by IS codes.

Table 4-9 Characteristics of Surface Water*

S. No.	Parameters	Unit	SWHP-01	SWHP-02
1	PH Value at 25°C	-	7.82	8.12
2	Turbidity	NTU	1	3
3	Conductivity		455	410
4	Total Dissolved Solids	Mg/l	278	265
5	Total Suspended Solids	Mg/l	<5	<5
6	Total Hardness (as CaCO ₃)	Mg/l	156	198
7	Chlorides (as Cl)	Mg/l	52	43
8	Total Alkalinity	Mg/l	126	138
9	Sulphate (as SO ₄)	Mg/l	19	15
10	Nitrate (NO ₃)	Mg/l	4.8	5.6
11	Fluoride (as F)	Mg/l	0.1	0.1
12	Iron (as Fe)	Mg/l	<0.05	0.07
13	Zinc (as Zn)	Mg/l	<0.05	<0.05
14	Calcium (as Ca)	Mg/l	34	52
15	Magnesium (as Mg)	Mg/l	17.3	16.6
16	Cadmium as cd		<0.01	<0.01
17	Copper (As Cu)	Mg/l	<0.05	<0.05
18	Nickel (as Ni)	Mg/l	<0.01	<0.01
19	Lead (as Pb)	Mg/l	<0.1	<0.1

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20	Mercury (as Hg)	Mg/l	<0.001	<0.001
21	Total Arsenic (as As)	Mg/l	<0.025	<0.025
22	Phenolic Compound (as C ₆ H ₅ OH)	Mg/l	<0.001	<0.001
23	Phosphorous as (P)	Mg/l	<0.03	<0.03
24	Manganese (As Mn)	Mg/l	<0.01	<0.01
25	Cyanide as CN	Mg/l	<0.05	<0.05
26	Total Chromium (as Cr)	Mg/l	<0.05	<0.05
27	Anionic Detergent (MBAS)	Mg/l	<0.01	<0.01
28	Aluminum (as Al)	Mg/l	<0.03	<0.03
29	Oil & Grease	Mg/l	<2	<2
30	Chemical Oxygen Demand	Mg/l	6	10
31	Biological Oxygen Demand (27°C 3 Days)	Mg/l	<1	1.4
32	Dissolved Oxygen	Mg/l	8.3	7.8
33	Total Coliform	MPN/100ml	18	24

*Samples were collected in September, 2019.

Table 4-10 Characteristics of Ground Water*

S. No.	Parameters	GWHP-01	Max. Requirement as per (IS-10500-2012) Amend 1	
			Acceptable Max.	Permissible (in Absence of alternate source) Max.
1	Color	5	5	15
2	Taste	Agreeable	Agreeable	Agreeable
3	Odour	Agreeable	Agreeable	Agreeable
4	Turbidity (NTU)	<1	1	5
5	Ph Value	7.54	6.5 to 8.5	No Relaxation
6	Total Hardness as CaCO ₃ , (mg/l)	162	200	600
7	Iron as Fe (mg/l)	0.09	0.1	No Relaxation
8	Chloride as Cl (mg/l)	52	250	1000
9	Total dissolved Solids (mg/l)	281	500	2000
10	Calcium as Ca (mg/l)	35	75	200
11	Copper as Cu (mg/l)	<0.02	0.05	1.5
12	Manganese as Mn (mg/l)	<0.05	0.1	0.3
13	Sulphate as SO ₄ (mg/l)	18	200	400
14	Nitrate as NO ₃ (mg/l)	4.6	45	No Relaxation
15	Fluoride as F (mg/l)	0.2	1.0	1.5
16	Phenolic compounds as C ₆ H ₅ OH (mg/l)	<0.001	0.001	0.002
17	Selenium as Se (mg/l)	<0.01	0.01	No Relaxation
18	Zinc as Zn (mg/l)	0.07	5	15
19	Anionic detergents as MBAS	<0.01	0.2	1.0
20	Total Alkalinity (mg/l)	128	200	600
21	Aluminium as Al (mg/l)	<0.02	0.03	0.2

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22	Boron	<0.1	0.5	1.0
23	Cadmium as Cd (mg/l)	<0.003	0.003	No Relaxation
24	Cyanide as CN (mg/l)	<0.005	0.05	No Relaxation
25	Lead as Pb. (mg/l)	<0.01	0.01	No Relaxation
26	Total Chromium (mg/l)	<0.05	0.05	No Relaxation
27	Magnesium as Mg (mg/l)	18.1	30	100
28	Mineral Oil	<0.5	0.5	No Relaxation
29	Mercury as Hg (mg/l)	<0.001	0.001	No Relaxation
30	Arsenic as As (mg/l)	<0.01	0.01	No Relaxation
31	Coliforms (MPN/100 ml)	Not Detected	Shall not be detected	
32	E. Coli/100 ml	Absent	Absent	

*Samples were collected in September, 2019.

The characteristics of the ground water and surface water samples were found to be well within the standard limits specified for the water quality characteristic for the desirable limits as specified in BIS10500: 2012 except a few deviations for the surface water and ground water.

4.2.4 Land Environment

Land and soil constitute the basic components of the physical environment. The alignment of a road may cause changes in land, land use, soil and denudation processes in different intensities.

4.2.4.1 Geology and Soils

Geology and Soil Types of the Area:

Major soil types that are scattered throughout the state are described here. Alluvial soils and Brown Podzoic soils variety is found in Sirmour and Shimla district (Project influence area).

4.2.4.2 Soil Analysis

For the assessment of the base line soil quality, soil samples were collected at 2 locations from near the proposed alignment of the project road. Details of the soil sampling locations are presented in **Table 4-11**. Soil samples were collected for 15 cm and 100 cm depth for each location.

Table 4-11 Location Details of Soil Samples

Sample Code	Location of Sample	Depth	Land Use
Gumma to Fediz Section of NH-707			
SQHP-01	Gumma	15 cm	Agricultural Field
SQHP-02	Fediz	100cm	Agricultural Field

The characteristics of the soil along the proposed project road are presented in **Table 4-12**.



Table 4-12 Soil Characteristics of along the Project *

S. No.	Parameter	Unit	SQHP-01	SQHP-02
1	pH (1:2.5)	-	7.11	7.68
2	Electrical Conductivity of Saturation Extract (1:2)	umhos/cm	510	498
3	Soil Moisture Content	%	56.48	49.85
4	Soil Texture	-	Sandy clay	Sandy clay
5	Organic Matter	%	1.48	0.98
6	Lead (pb)	mg/kg	0.11	BDL
7	Permeability	mm/hr	53.24	52.61

*Samples were collected in September, 2019.

Note: BDL - Below Detection Limit Meq - milli Equivalent

4.3 ECOLOGICAL RESOURCES

Ecological resources are among the most important resources impacted by the proposed bypass. In this section baseline details of the flora and fauna are presented.

4.3.1 Flora

The natural vegetation follows a climatic altitudinal zonation. In the altitude range of 300-900m, as in Rajban, the vegetation is tropical and subtropical in character. 'Sal' is the main species of the broad leaved hill forest. Some patches on the hill slopes are clad in dense forests which are 'reserved'. The important species of plants found in the project study area are:- *Shorea robusta* : (Sal), *Quercus intone* : (Oak), *Alnus glutinosa*: (Alder), *Albizzia Lebbek* : (Seris), *Dalbergia sissoo*: (Shisham), *Adinacard folia*: (Holdu), *Bachanania latifolia* : (Bhilova), *Condia mysea* : (Lasors), *Eugenia jambolana* : (Jamun), *Ruododenron arboreum*, *Terminata tomentos* : (Asin).

Among the shrubs there are Vitex, Munj, Ber, Dodenea, Bamboo etc and among grasses Vetiver, Sanchrus, Munj are common.

Road side vegetation is likely to be impacted due to proposed road widening project. The major trees to be affected/ cut are Pine, Khadig, Deodar, Gular, Saal and Kachnar. The tree removal will take place from Corridor of Impact of project road.

4.3.2 Protected Areas and Fauna

The existing network of protected areas (PA's) in Himachal Pradesh has 32 Wildlife sanctuaries (5664 sq.km) and two National parks (1440sqkm) covering a total geographical area of 7,104 sq.km. However, No wild life sanctuary/National Park is located within 10 km aerial distance from the alignment of project road or none of the same has their Eco-sensitive zone in the project study area. Survey was carried out in 10km of the proposed road project. The ground studies along the alignment, together with Forest Department and stakeholder consultation have revealed that there are some wild mammalian species such as Sloth bear,



Sambhar deer and Leopard found near the study area occasionally, while livestock of local people i.e. goat, sheep, cow etc. and common animals as field mouse, Squirrel, flare, dog, cat, bats, monkeys etc. are significantly using the area.

There are many river channels present in the buffer zone of study area which are the major attraction sites for avifauna. Birds like Himalayan Bulbul, Red Vented bulbuls, Purple Sunbird, Rufous Tree Pie, White Capped Water Redstart, Whistling Thrush, Red Jungle Fowl, Parakeet, and Common Myna are found common in occurrence.

Due to diversified forest lying along and across the riverbed, the area is equally important for butterfly diversity. Butterflies form important part of the food chain components for the birds, reptiles, spiders and other predatory insects making them inevitable part of present ecosystem.

The information of important animal groups such as Birds, Reptiles, Fishes and Mammals were collected by trekking inhabiting area, along the river banks, adjoining forest on the slopes, nallahs, hill top and agricultural fields present in the project influence area.

4.3.3 Biodiversity and Endangered Fauna

4.3.3.1 Reptiles

Out of the species of reptiles recorded (Table 3.13), two species of lizard i.e. Monitor Lizard and Common Garden Lizard are reported common in occurrence. Among reptiles, three species of snake such as Russells Viper and Rat Snake recorded in study area also, which are listed in Schedule II, Part II of the Indian Wildlife (Protection) Act 1972. None of the reptile species is present in the IUCN Red List of Threatened Animals (2007).

Table 4-13 List of Species of Reptiles Recorded in the Study Area

S. No.	Zoological Name	Common Name	Conservation Status as per IUCN
1	<i>Daboia russelii</i>	Russell's Viper	LC
2	<i>Bungarus caeruleus</i>	Indian Krait	LC
3	<i>Varanus spp.</i>	Monitor Lizard	VU
4	<i>Calotes versicolor</i>	Indian Garden Lizard	LC
5	<i>Pi Pas mucosa</i>	Rat Snake	LC

Source: CEA sunoeto, LC=Least Concern, VU= Vulnerable

4.3.3.2 Birds

Many species of birds are found in the study area (Table 3.14). Most of the species of birds are protected as their respective families have been listed under Schedule IV of Indian Wildlife (Protection) Act 1972 and none under IUCN red listed endangered, threatened and vulnerable species of birds are recorded in the study area.

Table 4-14 Species of Birds Found in the Study Area

S. No.	Zoological Name	Common name
1	<i>Psittacula himzalarana</i>	Slaty-headed Parakeet
2	<i>Columba Livia</i>	Blue Rock Pigeon
3	<i>Streptopelia chinensis</i>	Spotted Dove
4	<i>Streptopelia senegalensis</i>	Laughing Dove
5	<i>Dicrurus macrocercus</i>	Black Drongo
6	<i>Acridotheres tristis</i>	Common Myna
7	<i>Hr psipetes leucocephalus</i>	Black Bulbul
8	<i>Pyconotus leucogenys</i>	Himalayan Bulbul
9	<i>Pvcononotus cafer</i>	Red-vented Bulbul
10	<i>Passer domesticus</i>	I louse Sparrow

Source: CEA, survey

4.3.3.3 Mammals

Area is not rich in wild mammals, but many domesticated mammal species are reported from buffer zone during the field survey. Common grazing animals like buffalo, cow, goat etc. can be noticed in open grass fields. Small mammals like Indian palm squirrel (*Funambulus palmarum*) and field mouse (*Apodemus sylvaticus*) are noticed in vicinity of village. Inquiry from village people regarding wild animals reveals that Rhesus macaque (*Macaca mulatta*), Indian hare (*Lepus nigricollis*), fruits bat (*Pteropus conspicillatus*), etc. are often seen in the area. As per discussed with Rajban Forest Range officials it was found that Sloth bear (*Melursus ursinus*), Sambhar (*Rusa unicolor*) and Leopard (*Panthera pardus*) are seen occasionally in the upper reaches of the project study area.

Table 4-15 List of important Mammal species recorded in the study area

S. No	Zoological Name	Common Name	Conservation Status
1	<i>Macaca mtdatto</i>	Rhesus Macaque	LC
2	<i>Semnopithecus entellus</i>	Common Langur	NT
3	<i>Lepus nigricollis</i>	Indian Hare	LC
4	<i>Funambulus pennanti</i>	Five-striped Palm Squirrel	LC
5	<i>Pteropus giganteus</i>	Indian Flying Fox Bat	LC
6	<i>Apodemus sylvaticus</i>	Field Mouse	LC
7	<i>Melursus ursinus</i>	Sloth bear	VU
8	<i>Rusa unicolor</i>	Sambhar	VU
9	<i>Panthera pardus</i>	Leopard	VU

Source: CEA survey, LC=Least Concern. VU= Vulnerable, AT=near threatened

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4.3.3.4 Fishes

During survey some fish species were identified from the Giri, Tons and Yamuna rivers. Most common and predominant fish present in the catch was endemic golden mahseer (*Tor* spp) followed by other fishes including *Schizothorax* spp., *Barilius* spp., *Channa* spp., *Glyptothorax* spp, *Bagarius* spp, *Puntius* spp. None of the fish species recorded from the study area are listed in various schedules of the Indian Wildlife (Protection) Act 1972 or listed in the IUCN Red List as Threatened Animals (2006).

The common fishes of the study area are as follows (Table 4-16):

Table 4-16 Resident Fish Species Recorded in Study Area

Fish Species	Local	Common Life Stage		Dwelling	Feeding	Breeding
	Name	Name	encountered	habits	habits	period
Family: Cyprinidae						
<i>Tor puNlora</i> (Hamilton)	Mahseer chiniaru	Golden mahseer	Fingerlings and Adults	Column and mid water dweller scavenger	Column Ormnivorous: green matters, insects and their larvae, phyto benthos, Zoo benthos.	Monsoon months
<i>Sclrlborax richardsoii</i> (Gray)	Sal	Himalayan trout	Fingerlings and Adults	Midwater dweller	Herbivorous: green matters, algae attached on stones, phytobenthos etc.	August to October
<i>Labeo deco</i> (Hamilton)	Gid	Sairu	Fingerlings and Adults	Midwater dweller scraper	Herbiomnivorous: macrophytes, Insects, Phytobenthos, Zoobenthos	March to June
<i>Barilius</i> spp. i. B. bendelesis ii. B. barila iii.B. vagra	i.Patha ii.----- iii. Lohari	Hillstream carp	Juveniles, fingerlings and Adults	Column of side waters/ ditches on the bank of small tributaries	Omnivorous: small insects, phytoplankton, zooplankton	February to June *Found in Sep- Nov.



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Puntius spp. i. P. ticto ticto ii. P. sarana	ii. Khangni	Minnows	Adults	Shallow pools and riffles	Column feeder, Planktonic feeder	-
Family: Siluroidie						
Bagarius bagarius	Goonch	Hillstrear catfish	Adult	Bottom dweller beneath stones	Scavengers: Feed upon animal flash, Insects	-
Family: Sisroidie						
Glyptothorax spp.	catfish	Hillstream	Adults	Bottom dweller beneath stones	Scavangers: Feed upon animal flash, Insects	-
Family: Channidae						
Channa orientalis	Dauli	Snake head	Adults	Shallow pools and muddy water	Carnivores, small insects and zoo benthos	-

*None of the Fish is in IUCN Red List

Source: CEA, surrey

4.4 SOCIO-CULTURAL ENVIRONMENT

4.4.1 Demographic Features

Gumma to Fediz Section of NH-707: Project road falls in two districts of Himachal Pradesh state. Demographic and socioeconomic details of Himachal state and both districts namely Shimla and Sirmaur are given below:

4.4.2 Socio-economic Profile of Project Affected People

The majority of the potentially affected / benefited persons living in the project Influence zone frequently travel down the existing roads or proposed alignment of the project. Their purpose of visit brings them generally to the prominent market places by the roadside or transport boarding points alongside the road. Other beneficiaries also pass through the important junctions of the feeder roads connecting the project roads / proposed alignment. There are administrative offices, places of worship, community structures, in the major settlements within the project impact zone.

Table 4-17 Socio Economic Profile

State/District	Himachal		Shimla		Sirmaur	
Population	2001	2011	2001	2011	2001	2011
Persons	60,77,900	68,56,509	7,22,502	8,13,384	4,58,593	4,72,926
Male	3087940	34,73,892	38,0,996	4,24,486	2,41,299	2,46,599
Female	2989960	33,82,617	3,41,506	3,88,898	2,17,294	2,26,327
Population Density per Sq. km	109	123	141	159	162	188

Literacy Rate %						
Male	86.02	90.83	87.72	90.73	63.2	79.73
Female	68.08	76.6	70.68	77.8	38.45	60.93
Sex ratio	970	988	898	916	897	901
Human Development Index	0.518		0.409		0.433	

Source: District Statistical office. Nahan, Dist.

4.4.3 Agriculture

The agricultural sector of the Himachal Pradesh Economy contributes over 45% to the net state domestic product and nearly the entire population of the state depends directly upon agriculture.

Gumma to Fediz road section of Himachal located in the Plains & Rolling and Hilly both terrains. There is paddy, maize, sugar cane etc., cultivated intermittently. Since there is no water scarcity along this alignment, the area is used for cultivation. Around 17% of project area population are doing agriculture related works.

Himachal Pradesh is known as the Apple State of India. However, apples are grown in upper parts of the project highway as Rohru, Jubbal and Chaupal and transported through the project road.

5. PUBLIC CONSULTATION

5.1 INTRODUCTION

The **Gumma to Fediz Section of NH-707** project will bring overall benefits to the people in the area as well as to those living close to the corridor. However, a few are likely to experience negative impacts, which can be overcome through proper mitigation measures. Throughout the process of consultation, the focus was on understanding community impacts and to obtain their feedback to effectively establish appropriate road design and implementation.

5.2 METHODOLOGY ADOPTED FOR PUBLIC CONSULTATIONS

5.2.1 Levels of Public Consultations and Profile of Stakeholders

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

Local level:

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

- Disseminating information and requesting villagers to attend the public consultation meetings through village Sarpanch and field staff.
- Sharing the opinions and identify the local environmental issues.
- Involving the PAPs to avoid/mitigate the impacts.

Institutional level:

- Institutional level consultations were held with Himachal Pradesh Forest Department and Himachal Pradesh State Pollution Control Board.

5.3 CONSULTATION PROGRAMME

Focus Group Discussions (FGDs) were held at two (2) locations along the **Gumma to Fediz Section of NH-707 project road**. During the FGD, interaction/discussion was held with the general public and the village Sarpanch. The public consultations in the project area were mainly conducted at the local level i.e. at village level

The details of the stakeholder consultations including the date, location, participants, the issues discussed and the outcome / mitigation measures (design) is summarized in table below:

Detailed Attendance sheets of these consultations are presented in [Annexure –I](#).

Table 5-1 Summary of Local level Consultations at Gumma to Fediz Section of NH-707

Project Corridor	Location	Chainage	No. of participants	Typical Issues	Remarks
Gumma to Fediz Section of NH-707	Antroli Village	98+300	18	<ul style="list-style-type: none"> • Drainage problem • Road Safety • Bus Stop • Dust suppression measures should be adopted • Provision of speed breaker • Relocation of Structures • Junction Improvement 	Issues considered in design
	Near Starting Point Gumma Village	95/000	16		

5.4 DETAILED ISSUES RAISED

Some of the general issues raised during the different consultation sessions can be summed up as follows.

Loss of Income Restoration Options

This issue was raised by most villagers as loss of fertile land will deteriorate their income sources. Instead of lump sum money they were more interested in limited regular income.

Road Safety

Safety issues were paramount in all the consultation sessions i.e. curve improvement, Traffic calming measures etc. Woman participants raised the issue of their children's safety.

Drainage

Water logging and divide of agricultural land in two parts are one of the important concerns of public.

Higher Level of Pollutants due to Increase in Traffic

People were concerned about pollution levels in the area after construction of the project road. Some of the participants were also concerned about noise pollution after construction. Vegetative noise barrier are proposed to minimize the noise pollution at several locations as specified in above table.

5.5 REDRESS OF ISSUES

The project has tried to address all the issues raised during consultations under the constraints of suitability from engineering point of view. A table of general issues that arose during public consultations and their redress has been presented in Table 5-2.

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Table 5-2 Address of General Issues and Concerns under the Project

Issue/Concern	Redress Under the Project
Loss of Income Restoration Option	People will be compensated as per R&R framework (The detail is provided in RAP document prepared by HPSPCB).
Road Safety	Traffic calming measures (at all intersections), crossing points have been proposed for the safety of local people. Hazard markers, RRPM, road marking etc. have also been provided. Crash barrier has also been proposed throughout the alignment
Land Acquisition and Mode of Compensation	Compensation will be made as per RAP
Flood Problem	Total 38 nos. culverts have been provided at various locations
Drainage	Drainage has been provided throughout the alignment
Loss of Trees	Compensatory forestation would be done at the ratio of two trees for each tree to be cut. Local species of trees have been selected for plantation.
Impact on Health	Further study has been suggested to study the impact of bypass on community's health. Roadside plantation has been proposed to screen emissions from the traffic reaching the settlement areas.
Utilities and Basic Infrastructure	All the utilities and basic infrastructures to be impacted will be relocated under the project cost.
Employment During Construction	The locals will be given preference for employment during construction provided they meet job requirements.

5.6 PHOTOGRAPHS

LOCATION: VILLAGE-ANTROLI (98+300)



LOCATION: NEAR STARTING POINT GUMMA VILLAGE (96/200)



6. ANALYSIS OF ALTERNATIVES

6.1 GENERAL

The mandate of the current project is to widen the existing road to 2 lanes with provision of paved shoulder in the build-up sections and hence there is no alternative site involved. However, the chapter discusses on the "With" and "Without" project scenarios. The methodology that has been adopted for the evaluation of the alternate alignment route for construction of Project Road and the selection is based on engineering, economic, environmental and social considerations have been highlighted. The minimization of environmental impacts by considering design alternatives determines the extent of mainstreaming of the environmental component. This chapter looks at the decisions made during the project when alternatives were available and describes the rationale behind each decision. The EIA study with EMP and without EMP has also been discussed in the context of Gumma to Fediz project.

6.2 WITH AND WITHOUT PROJECT ALTERNATIVES

Keeping in view the site conditions and the scope of development of the area, the 'with' and 'without' project scenarios have been compared as given in **Table 6-1**.

By looking at the table it can be concluded that "With" project scenario positive/beneficial impacts will improve the environment and enhance social and economic development of the region compared to the "Without" project scenario, which will further deteriorate the present environmental setup and quality of life. Hence the "With" project scenario with minor reversible impacts is an acceptable option than the "Without" project scenario. The implementation of the project therefore will be definitely advantageous to achieve the all - round development of the economy and progress of the region.

Impacts on vegetation are expected during construction phase. Little increase in the pollution levels of the air is possible. Dust and particulate matter during construction will affect the air quality on a short-term basis. However, an important benefit which is not represented in this assessment will be major reduction in the Particulate Matter (PM 10 and PM2.5) levels from vehicles using a surfaced road (with project scenario) in the build condition, compared to a continued use of dusty unsurfaced/tracks (without project scenarios). The minor impacts due to air; noise, vegetative cover and soil erosion will be remunerated by adopting appropriate mitigated measures such as roadside plantation, arboriculture and landscaping, compensatory afforestation, and providing underpasses and bio-engineering measures with retaining structures.

Table 6-1 'With' and 'Without' Project Scenario

Component	'Without' Project Scenario	'With' Project Scenario
Connectivity and development	<p>Without' Project Scenario</p> <p>The connectivity between the other National and State Highways is not good. Existing connectivity with Delhi, Haryana and Uttarakhand need to be improved. Pavement conditions are in poor condition resulting in high travel time, bad vehicle conditions, and more pollution. Poor pavement conditions restricting people's access to local market, Medical facilities, education centers, work zones etc.</p>	<p>It will improve inter-connectivity between other National Highways (NH-707, NH-124 and various PMGSY roads). Connectivity with Haryana, Delhi and Uttarakhand will improve. Travel time will be reduced due to improved pavement conditions and road geometry and hence Pollution levels will be reduced as well. Trade of local produce like dairy products, agriculture products, and small scale industrial product will also be increased.</p>
Flora	<p>There will not be any impact on existing terrestrial ecology.</p>	<p>With project scenario involves felling of 186 trees due to proposed widening. As per the Forest Conservation Act (1980), Compensatory Afforestation will be done through Forest Department in 1:3 ratio. Avenue Plantation will be done as 558 roadside trees will be planted.</p>
Social and Cultural Environment	<p>There will not be any impact on existing social and cultural environment.</p>	<p>03 structures (Encroachments) including and none of the common property resources will be affected due to proposed widening. Necessary R&R plan has been developed to reduce the socio economic impact due to the proposed project.</p>
Carriageway	<p>2 lane/ intermediate / earthen shoulder</p>	<p>2 lane with paved shoulder has been proposed to improve the road condition</p>

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Drainage/ Water logging	Water logging issues are observed along the road side specially settlement area due to absence/non-functional drains.	Will be improved by reconstruction of culverts/ bridges with adequate hydraulic (details are provided in Chapter-2 Project Description) New cross drainage structures and drains are also provided to address the flooding and water logging issues.
Financial Implications	Without project scenario does not involve any capital cost, but there will be recurring maintenance cost to maintain the smooth flow of traffic.	The environmental cost as per environment assessment will be about 24,94,16,431/- crore.

Therefore, "With" project scenario, with its minor adverse impacts is more acceptable than the "Without" project scenario which would mean an aggravation of the existing problems. The potential benefits of the proposed road improvements are substantial and far-reaching both in terms of the geographical spread and time. Hence, it is clear that the implementation of the project will be a definite advantage to State of Himachal Pradesh in order to achieve all-round development of its economy and progress of its people.

The project will have multiple benefits. The project will release the potential of the area and fast connectivity between Himachal Pradesh Uttarakhand and Haryana. Being improved limestone linkage from Sataun, there is further scope of installation of 17 Nos. new factories at Gumma, which is under active consideration of Government of Himachal Pradesh.

Further, there is vast scope for many pharmaceutical industries and limestone industries after up-gradation of NH707. This project will also reduce the travel time substantially. In addition this project road will provide further other benefits like:

- Fast and safe connectivity resulting in saving in fuel, travel time and Total Transportation cost to the society;
- Employment opportunities to local people during road construction;
- Development of local industries, agriculture and handicrafts;
- Development of tourism and pilgrimage;
- Transporting, processing and marketing of agricultural products; Reduction in accidents;
- Reduction in pollution;
- Opening of opportunities for new occupations;
- Better approach to medical & educational services and quick transportation of perishable goods like fruits, vegetables and dairy products; and
- Improved quality of life for people and so on

However, there would be an increase in the vehicular pollution-air and noise, in the vicinity of the



highway. This road construction will result in loss of private properties and loss of living.

If the project is not implemented, there is likelihood that the roads presently carrying the traffic between Paonta Sahib and Gumma will deteriorate further and rampant traffic disruptions will hinder the free flow of the traffic. Increased air pollution, due to slow moving traffic and congestion, will follow suit. Noise levels in built up portions will rise due to deterioration of the pavement as well as increased honking.

SAFETY ASPECTS

While assessing the impacts, safety of the road users and the roadside communities has been found to be a major concern. A number of measures have been proposed to reduce the risk of traffic accidents. In some places, these safety measures are co-terminus with the project's impact minimization measures. Horizontal profile correction and intersection improvement has been suggested for betterment of the project corridor. Other safety measures taken are:

- Improvement of existing curves,
- Improvement of existing Curve at bridge approaches.
- Provision of adequate traffic signage,
- Widening of bridge with footpath in built-up location,
- Embankment protection in approaches to bridge
- Foot path and pedestrian guard rails in built up zone,
- Improvement of existing highway junction
- Retro-reflective painting on roadside plantations.

6.3 EIA WITHOUT EMP

The Environment Impact Assessment (EIA) without Environment Management Plan (EMP) will not be complete. The Coverage for project will be limited to establishment of baseline scenario and extent of impact due to project implementation. Without EMP the project implementation will be difficult, as inconvenience to local public will increase. This will result in resistance of local public to the project.

Environmental Management Plan suggests the environmental treasures to monitor, mitigate and manage the adverse impacts of the project on the components of valued ecosystem. If a project is implemented without EMP it will be environmentally disastrous.

6.4 EIA WITH EMP

The EIA with EMP will be more fruitful as it will have detailed mitigation measures, budget and monitoring plan for the project - for pre-construction, construction and operation phases. The EMP will help to mitigate adverse impacts of project, a plan for monitoring to check the efficacy of mitigation measures is also laid out in the design of EMP. The implementation of EMP will also reduce inconvenience to local public during construction and the project will become environmentally sustainable and human friendly.

6.5 CONCLUSION

The analysis indicates little choice of alignment alternatives for the Gumma to Fediz Project. Socioeconomic and Environmental considerations have been given due weightage in the finalization of

the alignment.

The minor adverse impacts are manageable to an acceptable level by implementing Environmental Management Plan and the unavoidable loses will be compensated as per the applicable R&R guiding principles.

7. ENVIRONMENTAL IMPACTS

7.1 GENERAL

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

The impacts on the natural, biological and social environment can be direct or indirect. Areas of pollution generated include the Corridor of Impact and Operational Facilities of the Contractor. Environmental Impacts due to the project are summarized in **Table 7-1**.

Table 7-1 Environmental Impact Summary

Sr. No.	Parameter	Gumma to Fediz Section of NH-707
I. Negative Impacts		
1	Hand Hand Pumps/Tube \ Relocation (Nos.)	2
2	Pond Area (sq. m)	0
3	Relocation of Religious properties	0
4	Transfer of Agricultural land (ha.)	0
5	Borrow Earth (Cum)	Nil
6	Quarry Material (Cum)	130879
7	Water (cum)	107675
8	No. of trees to be felled	186
II. Positive Impacts		
1	Enhancement sites	
A	Cultural/Religious Properties	0
B	Surface water body	River tons
C	Educational Institute	0
D	Safe Access to educational institution	0
E	Enhancement of Bus bays/Bus shelter	1
F	Vegetative Screen Barrier	0
G	Tree Saving (Nos.)	-
1	Proposed Plantation – Bamboo plantation	5700 sqm
2	Road safety Measures - "W" : Metal Beam Crash Barrier on valley side	
A	Major junction improvement (nos.)	1
B	Proposal for Rotary Junctions (nos.)	0
C	Bus Shelter (nos.)	5
D	City Lights/ solar light in buildup area	26
	ELECTRIC LIGHTS single arm	10

7.2 IMPACTS ON PHYSICAL ENVIRONMENT

7.2.1 Impact on Soil

Loss of Productive Soil

Top soil will not be used in the road construction work.

Soil Erosion

Construction Stage

Slopes of the project road are relatively stable as the embankment of the road is not high compared to the adjacent lands.

Operation Stage

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

Compaction of soil

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

Contamination of Soil during the Construction Stage

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

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

Table 7-2 gives the details of debris generated and reused. From the table it can be observed that all excavated material can be used for embankment fill. The remaining quantity of earth will be procured from approved borrow areas.

Table 7-2 Details of the Quantities of Debris and Spoil

Excavated Material	Qty. likely to be generated (Cum)	Qty. Required for Embankment Fill (Cum)	Debris Unused/ disposal qty. (Cum)
Scarified Bituminous	4745.183	74439.64	298178.722
Concrete	4861.179		
Spoils/earth/other debris	363012		
Total	372618.362	74439.64	298178.722

7.2.2 Impact on Water Resources

Due to the proposed project there will be some impacts on the water resources. The impacts are due to relocation of hand pumps, use of water for the construction and construction facility operations and accident spills during operation stage.

Details of the water resources affected due to the project are presented in **Table 7-3**.

Table 7-3 Affected Hand Pumps and Wells

Hand Pumps (Nos.)	Bore Wells (Nos.)
2	-

Increased surface run-off

Due to the construction of new pavement and construction of the paved shoulder, the surface runoff may marginally increase as the increased paved surface area reduces the infiltration of water into the ground. There will not be a significant impact on the ground water levels.

Impacts on Water Quality

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

- Water flow from scarified bitumen materials.
- Oil spills from the Maintenance of the machinery and operation of the diesel generator sets on site.
- Oil Spill from the operation of the mechanical workshops, diesel pumps and diesel storage, transportation and transfer, parking places, and diesel generators.
- Operation of the emulsion sprayer and laying of hot mix.
- Operation of the residential facilities for the labour and officers and offices.
- Storage and stock yards of bitumen and emulsion.
- Degradation of water quality is also possible due to accidental discharges into watercourses from drainage of workers camps and from spillages from vehicle parking and/or fuel and lubricant storage areas.

Water requirements for construction

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

1. 8-10% of weight of soil for the embankment construction.
2. 7-8% of weight of soil for sub grade construction
3. 5-6% of weight of GSB materials for GSB and WMM
4. 150 liters/ cum for concrete

Domestic requirement of 100 liters per worker/day has been assumed. For this project about 50 resident workers have been considered. Details of the water requirement assessed for the project is presented in **Table 7-4**.

Table 7-4 Requirement of Water for Proposed Construction Works

Sr. No.	Purpose	Qty. (Cum)
1	Permanent works (Total quantity in cum)	15
2	Dust Suppression at work zone in (cum/day)	30
3	Curing (cum/day)	15
4	Laboratory (cum/day)	10
5	Haul Roads (cum/day)	20.5
6	Crusher (cum/day)	22
7	Plant Cleaning and workshop washing in (cum/day)	15
8	Domestic Purpose in (cum/day)	20
Total Requirement(cum/day)		147.5

Daily water requirement for the permanent works has been calculated based on the total working days (i.e. 730 days).

7.2.3 Impact on Air Environment

In addition to the direct impacts during the preconstruction, construction and operation phases, the ribbon development adds to the pollution load along the road and will increase the closeness of the receptors.

The Air pollution sources and types has been described in **Table 7-5**.

Table 7-5 Summary of Air Pollution during different stages

Stage	Likely Impacts	Reasons/Activities for Impacts	Remarks
1. Pre-Construction Stage	<ul style="list-style-type: none"> • Dust Generation 	<ul style="list-style-type: none"> • Site clearance/Grubbing • Cutting of Trees/Shrubs • Transportation of Man and Material • Construction of Stock Yard and office buildings • Installation of Construction plants • Activities performed in Dry 	<ul style="list-style-type: none"> • The impacts are temporary and location specific. • The width of impact is limited.

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Weather			
2. Construction Stage	<ul style="list-style-type: none"> Increases the level of PM10 and PM2.5. Increases the Gases Pollutant level (i.e. CO, SOx and NOx) Carbon based emission from HMP Impact on agricultural land having crops, vegetation etc. 	<ul style="list-style-type: none"> Clearing and grubbing, material dumping, drying of material etc. Movement of vehicles in Construction camp, Transportation of quarries/aggregate and soil from borrow area. Operation of HMP, WMM and Batching Plant. Emission of fine dust/rejected material from bag filters of HMP. Material Storage and handling (loading and uploading). Construction machinery and vehicle uses. 	<ul style="list-style-type: none"> The impact area is particularly near working zones, plant sites.
3. Operation Stage	<ul style="list-style-type: none"> Dust generation Emission from vehicular tyres. Increase the gases pollutant from diesel vehicles (i.e. trucks, buses, cars, utilities etc.) 	<ul style="list-style-type: none"> Increases the Vehicle moment in rural area. Presently the area is agricultural land and does not have commercial vehicle moments. Abrasive action of tyres on bypass road. 	<ul style="list-style-type: none"> The impact is permanent

7.2.4 Noise Environment

The impacts of noise due to the project will be of temporary significance locally in the construction phase and slight increase may occur during the operation stages. However as the present noise levels are already high the impact will be relatively low. The impact is tabulated in **Table 7-6**.

Table 7-6 Summary of Noise Impacts at different stages

Stage	Likely Impacts	Reasons/Activities for Impacts	Remarks
1. Pre-Construction Stage	<ul style="list-style-type: none"> Noise level/exposure will increases for the local communities as the proposed road will passes through agricultural and residential rural area. 	<ul style="list-style-type: none"> Use of heavy Machinery and Equipment for Site Clearance/Grubbing. Transportation of Man and Material Construction of plant sites. 	<ul style="list-style-type: none"> The impacts are temporary and location specific. The width of impact is limited and not significant.

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2. Construction Stage	<ul style="list-style-type: none"> The impacts of noise exposure will be on the community residing near to the work zones. The activities of plants (i.e. HMP, WMM etc.) and DG sets shall produce significantly high noise level. 	<ul style="list-style-type: none"> The use of machinery involved in the construction operation i.e. dozer, roller, grader, paver, tractors, brooms/rotary brushing, tippers, generators, excavators etc. Operation of HMP, WMM, Batching Plant and DG sets. 	<ul style="list-style-type: none"> The impact area is particularly near work sites, plant sites and will also vary for different receptors. The impact will be quite significant but will be localized to the plant sites.
3. Operation Stage	<ul style="list-style-type: none"> Possibly Higher Ambient Noise level on Day and Night time in agricultural and rural residential area near to proposed bypass. 	<ul style="list-style-type: none"> Uninterrupted movement of heavy and light vehicle on high speed. 	<ul style="list-style-type: none"> The impact is permanent

The impact on village noise pollution may be significant caused by traffic. Therefore, measures are required to reduce noise from traffic passing through project area.

7.3 NATURAL ENVIRONMENT IMPACT ON ROAD SIDE TREE

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

Pre-Construction Stage

There will be a significant, direct impact on cutting of the roadside trees during the pre-construction stage. A total of about 186 trees are required to be cut for the proposed project. The major trees to be affected/cut are Pine, Khadig, Deodar, Gular, Saal, Kachnar etc. The detail is given in **Table 7-7**. Girth wise details of Trees are given in [Annexure-II](#).

Table 7-7 Details of Diverted Protected Forest Area and Trees to be cut within ROW

Name of the Corridor	Forest Area (within ROW) to Be Diverted (ha.)	Number of trees to be cut along the road up to proposed toe line		
		LHS	RHS	Total
Gumma to Fediz Section of NH-707	14.412 Ha	86	100	186

Cutting of trees for fuel by workers, especially near their camps is of major concern. Therefore adequate training of the workers and availability of their fuel requirements are to be ensured by the Contractor.

Operation Stage

Trees and shrubs will be planted along the project corridor; aesthetic view of the corridor will be improved.

Under the proposed project the road aesthetics will be improved by the way of tree plantation, landscaping of embankment slopes, improving the road cross sections providing more bus bays, foot paths, medians and drains. The aesthetics may be reduced during the pre-construction and construction stage and will be improved during the operation phase.

Construction Stage

During construction, the initial visual impacts will be associated with the removal of encroachments from Corridor of Impact and structures from the acquired land, removal of cultural properties, clearing of mature trees and vegetation for the construction activities. These activities create significant differences in the local aesthetics of which some are negative and some are positive. Some activities pose positive impacts such as creation of clearer views along roads or from roadside houses and other buildings that were previously blocked by encroachments. Changes in the aesthetics during the construction stage are generally temporary negative impacts.

7.4 IMPACT ON SOCIO-CULTURAL ENVIRONMENT

7.4.1 Economic Impacts

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

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

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

7.4.2 Impact on Religious and Historic Sites

Along the proposed Road no cultural, heritage and religious structures of National and State importance are present.

7.5 IMPACT ON SAFETY AND PUBLIC HEALTH

7.5.1 Impact on Safety

Construction stage

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



Operation stage

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

7.5.2 Impact on Public Health

Pre-Construction and Construction Stage

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

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

Operation stage

After the completion of the project there will be both positive and negative impacts on the public health. The positive impacts include increased speed of accessibility to local and regional health centers and other community support facilities.

Health impacts due to vehicular pollution: Health impacts associated with road projects in operation stage are long-term impacts. General health impacts will be respiratory infections and lung infections. Respirable Particulate Matter (RPM) i.e., particulates of size less than $10\mu\text{m}$ are a major cause of the infections and allergies. They enter human body through inhalation. These particulates are more in the emissions of heavy diesel vehicles. Hence, higher volumes of heavy vehicles increase the pollution load and consequent health impacts. Hydrocarbons from exhaust emissions are carcinogenic at high concentrations. Though impacts due to higher emissions exist, such severe impacts shall be at concentrations higher than those generated by the project. However, there will be the potential for adverse impacts on public health related to increases in noise, especially as traffic volumes increase. Impacts associated with noise are also long term and restricted to the direct area of influence.

8. AVOIDANCE, MITIGATION AND ENHANCEMENT MEASURES

8.1 OVERVIEW

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

The main impacts identified have been addressed during design wherever possible and will be further mitigated by the construction procedures and specific measures provided in the contract drawings and specifications. These are summarized in **Table 8-1**.

Table 8-1 Key Environmental Impacts and Management in the Project

Issue	Addressed in design	Addressed in Implementation	Operation
Flooding/ Drainage	Total 38 nos. culverts have been provided at various locations and Drainage has been provided throughout the alignment	Keep channels clear prior to monsoon period.	Maintain culvert channels
Tree removal	Tree cutting largely unavoidable. Minimize by alignment selection for proposed ROW.	Control tree cutting operations for minimize the possibility of damage to nearest plants/ shrubs during construction stage Implement afforestation Programme in 1:3 ratio.	Monitor plantation Programme and check survival rates
Erosion	Identification of erodible soils. Treatment of embankment slopes and stream inlet and outlet.	Close control of timing of embankment treatment after earthwork operations.	Monitor and maintenance.
Borrow Areas	Minimized borrow requirements with reuse of the excavated material /earth in embankment formation.	Select suitable sites with land owners and cultivators Rehabilitate with topsoil	No action required
Road Safety	Provided median for all section to avoid head on collision.	Provide safe traffic management methods as specified in	Monitor Accidents



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	Provided traffic calming measures near junctions and village area. Provided pedestrian crossings. Crash barriers has been proposed throughout the alignment. Provide high standard of road signs, RRPM, hazard marker and markings as per IRC codes	documents.	
Air Pollution	Wider road with paved shoulders will reduce use of unpaved shoulders.	Siting of work areas/camp site etc. away from sensitive receptors. Modern well maintained construction equipment with PUC certificates. Dust suppression measures on plant i.e. maximum paved area, sprinkling of water etc., diversions and haul roads.	National Motor Vehicle emission controls.
Noise Pollution	Impossible for project to lower existing high noise levels. Selected flexible pavement. Vegetation barrier for noise reduction at source	Siting of work areas away from sensitive receptors. Use of well-maintained construction equipment and machinery. Acoustic enclosures for DG sets.	No action required
Aggregate / Sand	Use only controlled renewable resources	Conform to regulations	No action required
Debris disposal	Minimized the debris generation.	Use scarified material and spoils in embankment fill as filling is required for the project.	No action Required
Land	Provide shortest alignment for corridor where social disruption outweighs loss of agricultural land.	Reinstate site working areas on completion of works	No action Required

8.2 PHYSICAL ENVIRONMENT

8.2.1 Environmental Management at Quarries

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

8.2.2 Soil

Soil Erosion Control Measures

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

Surface erosion is prevented and controlled by adopting following methods:

A. Hedge Brush Layer-

This shall be provided in the landslide zone or places having soft rock/ soil to protect the hill slope from crumbling/weathering. This shall be provided over the embankment on valley side throughout the project road (except the stretches in built-up area, Bridges and Culverts) to prevent the compacted material from sliding into the valley.



Figure 8-1 Hedge Brush Layer

Hedge brush layer method is proposed from 97+750 to 99+200 total length is 640 RM. The detail is given below:

Table 8-2 Details of Proposed Hedge Brush Layer

Chainage		Side	Length of Treatment (in RM)
From	To		
97+750	97+950	LHS	200
98+160	98+350	LHS	190
98+450	98+500	LHS	50
99+200	99+400	LHS	200

B. Bamboo Net Plantation

This shall be provided in the proposed dumping sites to check sliding of dumped material. Bamboo for the said technique may be procured from the low lying parts of the state. A National Bamboo Mission (NBM) under Centrally Sponsored Scheme-Mission for Integrated Development of Horticulture (MIDH) is being implemented in Himachal Pradesh since 2006-07.



Figure 8-2 Bamboo Net Plantation

Bamboo Plantation method is proposed from 97+550 to 103+550 total length is 1900 RM. The detail is given below:

Table 8-3 Details of Proposed Bamboo Plantation

Chainage		Side	Length of Treatment (in RM)
From	To		
97+550	97+950	LHS	400
97+900	98+000	LHS	100
99+200	99+400	LHS	200
99+650	99+800	LHS	150
101+700	102+150	LHS	450
102+950	103+550	LHS	600

C. Hydroseeding

Hydroseeding is a method of seeding that consists of applying a mixture of water, seed, wood fiber, and soil stabilizer (if used) with hydroseeding equipment.

INSTALLATION/CONSTRUCTION PROCEDURES Hydroseeding will be done immediately after completion of a phase of grading. Hydroseeding can be accomplished using a multiple-step or one-step process. The multiple-step process ensures maximum direct contact of the seeds to soil. When the one-step process is used to apply the mixture of seed, fiber, etc., the seed rate shall be increased to compensate for all seeds not having direct contact with the soil. Follow-up applications shall be made as needed to cover weak spots. Avoid overspray on existing vegetation, waterways, sidewalks, and roadways. Straw or other mulch should be applied to reduce the erosive capacity of storm water and keep soil and seed in place.



Figure 8-3 Hydroseeding

Hydroseeding method is proposed from 95+520 to 102+690 total length is 1740 RM. The detail is given below:

Table 8-4 Details of Proposed Hydroseeding

Chainage		Side	Length of Treatment (in RM)
From	To		
95+520	95+570	LHS	50
95+900	95+930	LHS	30
96+520	96+570	LHS	50
98+800	98+850	LHS	50
101+170	101+270	LHS	100
101+370	101+470	LHS	100
101+690	101+740	LHS	50
102+630	102+690	LHS	60
96+050	96+100	LHS	50
95+50	95+700	LHS	150
96+600	96+700	LHS	100
98+500	98+650	LHS	150
99+200	99+400	LHS	200
99+500	99+700	LHS	200
101+050	101+250	LHS	200
101+400	101+600	LHS	200

D. Rock Anchoring

In mountainous areas where there are numerous rock-fall hazards that may result in a significant cost to the operator of the transportation system, a stabilization program is often justified.

Rock anchors or rock bolts, as they are commonly known as, are important structural tools used in stabilizing rocky slopes.

Rock and soil anchoring technique is a technique that we people uses the rock bolt (cable) to reinforce the rock or soil mass. Rock anchors or rock bolts is a long anchor bolt, for stabilizing rock excavations, which may be used in tunnels or rock cuts. It transfers load from unstable exteriors to the confined interior of the rock mass.



Figure 8-4 Rock Anchoring

Rock Anchoring method is proposed from 95+520 to 102+690 total length is 3020 RM. The detail is given below:

Table 8-5 Details of Proposed Rock Anchoring

Chainage		Side	Length of Treatment (in RM)
From	To		
94850	97030	LHS	2180
99370	99920	LHS	550
103260	103550	LHS	290

Soil Contamination

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

Construction Stage

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

Operation Stage

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

Loss of Productive Top Soil

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

The following mitigation measures will be adopted:

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

Borrow Areas Management:

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

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

8.2.3 Water Environment

Relocation of Ground Water Supply Sources

- Total 2 nos. of ground water source i.e. Hand pumps will be relocated before the construction of work, with the consent of private owner and local gram Panchayat.
- The relocation site will be identified with the consent of the local community for whom the water source is intended.

Minimize the use of natural water resources

The water required for construction will be extracted in such a manner that there will be very little disruption to the local community. The total quantity required for the Project is about 30.5 cum/day.

Mitigation for water quality degradation:

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

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

For each construction camp one oil interceptor will be constructed. Wastewater contaminated with oils and waste oils and grease will be treated in the oil interceptor to remove all oil and grease spills before discharging appropriately. As far as possible the ground will be leveled in such manner that the wastewater will flow in one direction. The wastewater channels will be constructed with a slope of 1: 150 to ensure that



wastewater flows into the interceptor before discharge. Oil and grease of the oil interceptors will be cleaned once in a fortnight from outside by skimming of oil film over the surface. Figure 8-4 provides the details of the arrangement for the oil interceptor for the removal of oil and grease.

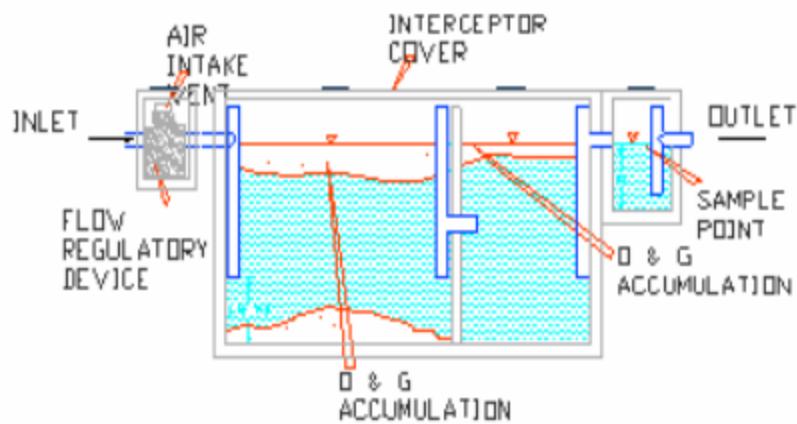


Figure 8-5 Oil Interceptor

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

8.2.4 Air Environment

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

Details of the mitigation measures proposed are detailed below.

The specific mitigation measures for working zone include:

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

Mitigation Measures for Plant Sites:

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

8.2.5 Noise Environment

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

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

Construction Stage

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

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

8.2.6 Construction Camp

8.2.6.1 Layout of Construction Camp

The construction camps for labour accommodation, offices and construction plant sites shall be identified based on the RPCB guidelines and World Bank Guideline for Setting out of Construction Camp. Detailed guidelines are given in EMP.

8.2.6.2 Facilities at Workers Camps

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

Sanitation Facilities: Construction camps shall be provided with sanitary latrines and urinals. Closed drainage systems and the proper treatment systems according to the local conditions should be constructed for the proper flow and effective treatment. The sewage system built for the camp will be operated properly to avoid health hazard, ground water and soil pollution. Compost pits will be constructed for the disposal of the garbage and other biodegradable wastes generated from the camps. Proper collection, transportation and disposal of the wastes will be ensured.

Shelter at Workplace: At such workplaces where the duration of the works will prevail for more than one month some form of shelters will be provided for meals, resting, change of clothes and for keeping the tools of the work and personal protective equipment. The height of shelter shall not be less than 3m from floor level to lowest part of the roof. Sheds shall be kept clean and the space provided shall be on the basis of at least 1m² per head.

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

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

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

8.3 NATURAL ENVIRONMENT

The environment along the project road shall be enhanced, principally through plantation of various types of shade and ornamental trees along with shrubs and grasses. Tree plantations have manifold benefits. During the construction stage, all precautions will be taken to ensure that the trees outside the Col or those not marked will not be removed. To compensate for the tree cutting, two times of the diverted protected forest area will be afforested in accordance with the Forest (Conservation) Act, 1980.

8.3.1 Landscaping Strategy for Project Corridor

Landscape strategy has been developed to enhance the visual quality and safety concern at intersection of proposed corridor.

The following improvements are incorporated in Design:

a. Plantation Scheme

Shrubs will be planted at road as part of the compensatory afforestation. Shrubs will be planted at median as antiglares for the road users and increase the aesthetic value of the road. With due importance to aesthetic value and comfort along a new road, 25 % of the species selected should be flowering species and the rest will be shade providing and fruit bearing species.

8.4 SOCIO-CULTURAL ENVIRONMENT

Relocation of the CPR affected by the Project is detailed in the Resettlement Action Plan. Relocation process will be monitored to ensure that all the structures totally affected will be relocated as desired by the local community requirements.

8.5 ENHANCEMENT MEASURES

For the proposed corridor alignment no enhancement is involved except the necessary inherently enhancements i.e. landscaping, traffic calming etc.

8.6 SAFETY MEASURES

8.6.1 Health/Safety Measures for Labors

First Aid Boxes will be placed at all work places and in the Construction Camp. Some of the workers should have received First Aid training to respond to the emergencies at the working zones and at auxiliary sites. Arrangements with nearby health centers and local doctors should be made for treating injuries. During the construction phase, workers should be provided personal protective equipment's based on the nature of the work. Details of the personal protective equipment which are to be given to the workers are presented in **Table 8-6**.

Table 8-6 List of Personal Protective Equipment

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

8.6.2 Traffic Safety Plans

Design Stage

Safety of pedestrians as well as vehicles on the road will be of highest importance and adequate measures have been incorporated in the design of the Project. For the safety and convenience of the local people, traffic calming measures, traffic control systems and unpaved shoulders for pedestrians in the village areas has been incorporated. The details of traffic calming measures adopted along the project corridors are presented in **Table 8-7**.

Table 8-7 Locations of Traffic/Road Safety Measures at Junctions

Section	Chainage	Type of Measures
J 01	94+900	Traffic Calming & Junction Improvement
J 02	95+250	Traffic Calming , Junction Improvement & Pedestrian Crossing
J 03	97+960	Traffic Calming & Junction Improvement
J 04	98+350	Traffic Calming & Pedestrian Crossing
J 05	102+750	Traffic Calming & Pedestrian Crossing

Construction Stage

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

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

Components of the Construction Zone



- **Construction Zone** is the area of the road which is affected by the works and which affects traffic flow resulting in a conflict between the road users and the construction activities.
 - **WorkZone** is the area where workmen are working i.e. excavation, overlaying improvements etc.
 - **Working Space** is the space around the work area that allows the workmen to move around to do the job and will include space required for storing excavated material, plant and equipment and clear space required for swinging of equipment and excavation arms.
 - **Safety Zone** is provided to protect the workmen from the moving traffic. This includes providing lateral and longitudinal buffer zones.

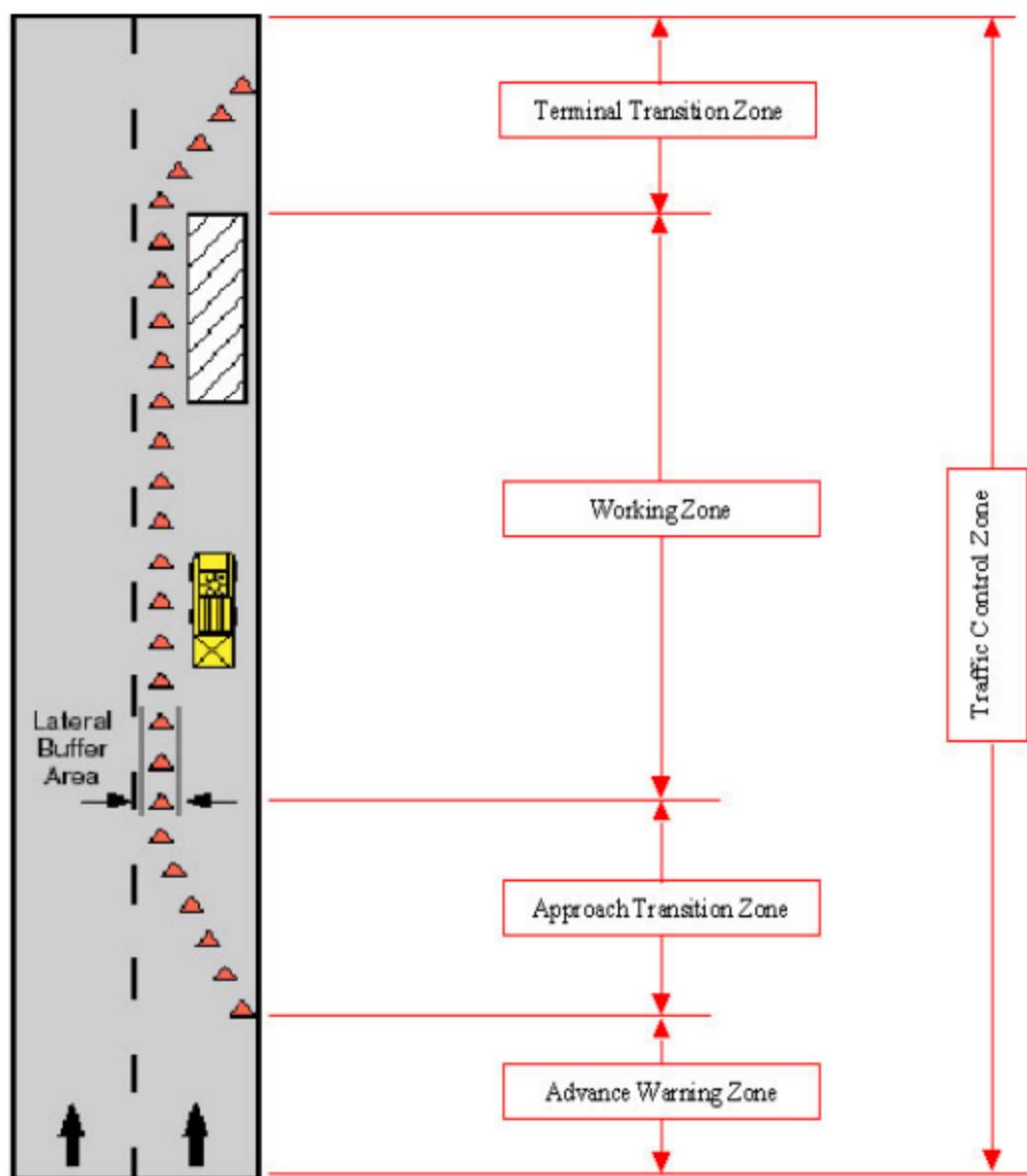


Figure 8-6 Traffic Control Zone

- **Traffic Control Zone** includes those areas in advance of the actual work site that are required for advance working as well as safety zones, the transition zones and the working zones itself.
- For providing all required safety precautions specific traffic management plans will be prepared and implemented during construction in accordance with the IRC: SP: 55:2014 (Guidelines on Safety in Road Construction Zones). Some guiding drawings for the general safety measures are provided below:

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

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

Figures 8-7 and 8-8 below shows the basic layout that would permit two-way working of traffic past the working zone.

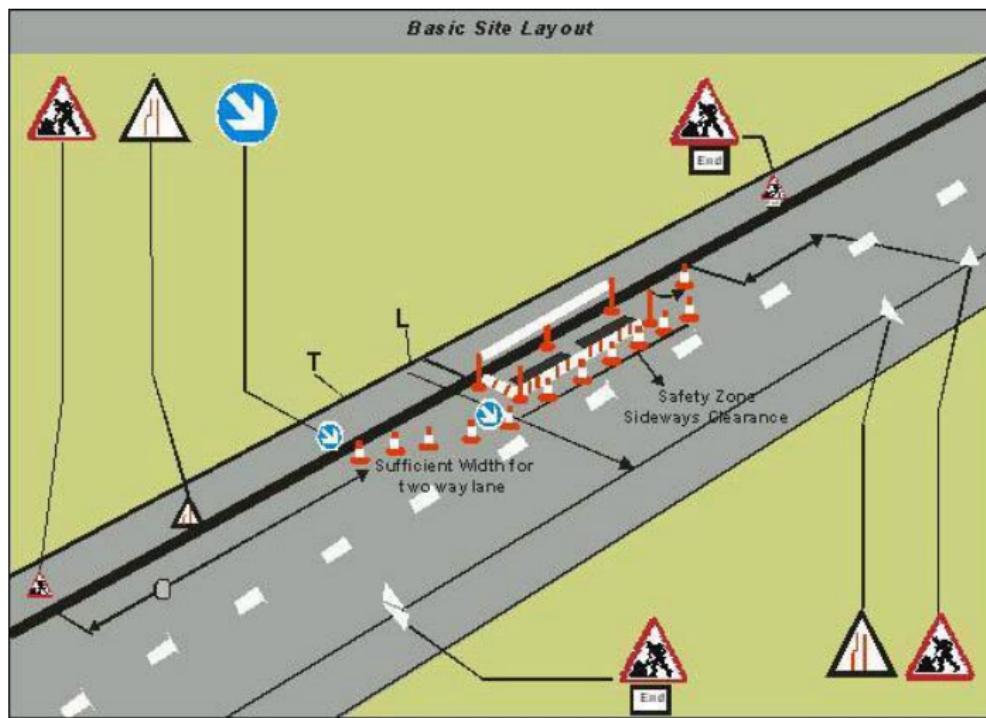


Figure 8-7 Basic Layout for Signs at a Road Works Site, Including Work Space and a Safety Zone.

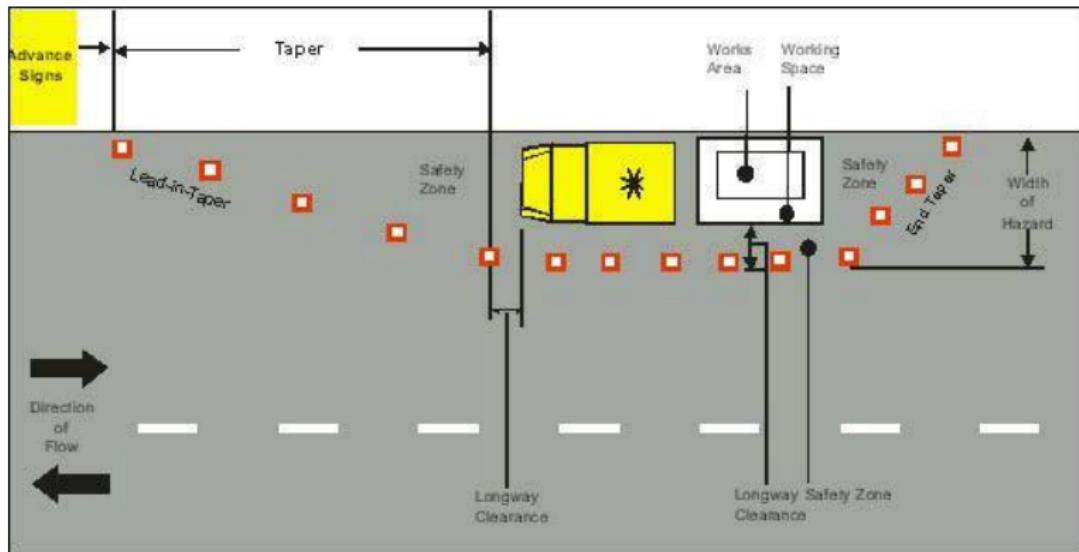


Figure 8-8 Basic Layout with Works Vehicle



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8.7 HANDLING OF PETROLEUM PRODUCTS

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

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

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

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

8.8 HANDLING OF PETROLEUM PRODUCTS

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

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

8.9 ENVIRONMENTAL MANAGEMENT PLAN

Environmental Management Plan (EMP) has been prepared for corridor project and will be part of the contract document between the Contractor and HP PWD. It is expected that implementation of all the environmental measures proposed in the EMP are adopted. The implementation actions, responsibilities and timeframes have been specified for each component and adverse impact anticipated. The following sections details the monitoring plan, a comprehensive monitoring system and budgetary estimate.

8.9.1 Monitoring Plans

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

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

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

The monitoring plans during construction and operation stages have been described in detail in the EMP documents and summary of monitoring plan and locations are presented in **Table 8-8 & Table 8-9**. For each of the environmental components, the monitoring plan specifies the parameters to be monitored; location of monitoring sites; frequency and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising responsibilities.

Table 8-8 Environmental Monitoring Plan

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation	Monitoring/Supervision
Air	Construction	CO, NOx, SPM, RPM, and SO2	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) Rules, CPCB, 1994	Quarterly	24 hours Sampling	Ref. Table No. 8.6	Contractor	HP PWD
Water	Construction	All essential characteristics and some of desirable characteristics as decided by the PRBDB	Grab sample collected from source and analyse as per Standard Methods for Examination of Water and Wastewater	Indian Standards for Inland Surface Waters (IS: 2296, 1982) and for Drinking Water (IS : 10500 - 1991)	Quarterly	Grab Sampling	Ref. Table No. 8.6	Contractor	HP PWD



Noise	Construction	Noise levels on dB (A) scale	Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement	MoEF Noise Rules, 2000	Quarterly	Leq. in dB(A) of day time and night time	Ref. Table No. 8.6	Contractor	HP PWD
Soil	Construction	Monitoring of Pb, SAR and Oil & Grease	Sample of soil collected to acidified and analysed using absorption spectrophotometer	Threshold for each contaminant set by IRIS database of USEPA until national standards are promulgated	Once in Six Months	Grab Sampling	Ref. Table No. 8.6	Contractor	HP PWD
Borrow area	Construction	As per Guidelines	Visual Observation	-	Once in a Month	-	Borrow area location	Contractor	CMU/ HP PWD
Tree plantation	Operation stage	As per Rehabilitation			Quarterly	-	Areas where	-	CMU/ HP PWD



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Table 8-9 Environmental Monitoring Locations

Environmental Component	S. N.	Location	Remarks
Air Quality	1.	Upstream of proposed Gumma Fediz Section of NH-707	Rural Residential/ Commercial
	2.	Middle of proposed Gumma Fediz Section of NH-707 near village Antroli	Residential/Commercial
	3.	Near End of Gumma Fediz Section of NH-707	Rural Residential/Commercial
	4	HMP Camp Site	Residential/Commercial
Water quality	1.	HMP Camp Site	Surface water / Ground water
	2.	Hand Pump at village Gumma	Ground water
	3	Hand Pump at Village Antroli	Ground water
	4	Giri River near disposal site -1	Surface water
	5	Giri River near disposal site -2	Surface water
	6	Giri River at Nearest point to HMP Camp Site	Surface water
Noise Monitoring	1.	Upstream of proposed Gumma Fediz Section of NH-707	Residential/Commercial
	2.	Middle of proposed Gumma Fediz Section of NH-707 near village Antroli	Rural Residential
	3.	Near End of Gumma Fediz Section of NH-707	Rural Residential
	4.	HMP Camp Site	Residential/Commercial
Soil quality	1.	Random Location at Completed section of Gumma to Fediz section of NH-707	Agricultural
	2	Near Construction Site	Agricultural
	3.	HMP Plant site	Agricultural

8.9.2 Reporting System

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

8.9.3 Environmental Budget

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

A summary of the environmental budget is presented in **Table 8-10**.

Table 8-10 Environmental Budget

S.N.	Component	Description	Unit Rate (Rs.)	Quantity	Amount (Rs.)
1.	Forest Clearances	Cutting of trees, diversion of forest land and compensatory afforestation Ha.)	-	14.412	1400000/-
Total (A)					14,000,00/-
2.	Mitigation Measures				
2.1	Air Pollution	Dust Management measures, Covers for vehicles transportation of construction material etc.	Lump sum	-	400000
2.2	Oil Inceptor	Provision at workshop in construction camp site	200000	1 Nos.	200000
2.3	Top Soil Preservation	Stripping of Top Soil, Staking and reuse	200	15000	3000000
2.4	Soil Erosion Control Measures	A. Hedge Brush Layer B. Hydroseeding C. Bamboo Plantation D. Rock Anchoring	AS per BOQ	AS per BOQ	195935000
Total (B)					19,95,35,000/-
3.	Enhancement Measures				
3.1	Landscaping	Landscaping at all intersections, median with fine grass and shrubs including maintenance for one year	Lump sum	-	500000
Total (C)					5,000,00/-
4.	Road Safety Measures				



Environmental Impact Assessment (EIA) for Rehabilitation and Up-gradation to Intermediate lane of Paonta Sahib Rajban Shillai Meenus Hatkoti road portion between Km 97+000 to 106+120 (Gumma to Fediz)(Design RD 94+900 to 103+550) of NH 707 in the state of Himachal Pradesh

4.1	Junction Improvement	Traffic Calming measures, Pedestrians crossing facilities	AS per BOQ	AS per BOQ	2612481
4.2	Road Safety Furniture	Road Safety signs/boards, hazard markers, RRPM, delineators, Solar Blinker, High mast Light, safety cones etc.	AS per BOQ	AS per BOQ	6848647
4.3	Road Safety Item	Crash Barrier	AS per BOQ	AS per BOQ	26339330
Total (D)					35,80,0458/-
5.	Environmental Monitoring Cost				
5.1	Air	Sampling, monitoring & analysis of ambient air quality and gaseous pollutant.	10000	24 Nos.	240000
5.2	Water	Sampling, monitoring & analysis of surface & drinking quality.	10000	36 Nos.	360000
5.3	Noise	Sampling, monitoring & analysis of ambient noise quality.	5000	24 Nos.	120000
5.4	Soil	Sampling, monitoring & analysis of Soil quality.	7000	12 Nos.	84000
Total (E)					8,04,000/-
6	Miscellaneous Cost				
6.1	Logistics and Administrative	Uses of vehicle for environmental cell , data processing, administrative support, stationary, remuneration of Environment Expert etc.	Lump sum	-	2400000
Total (F)					24,00,00/-
Total Environmental Budget (A+B+C+D+E+F)					23,61,39,458/-
Contingency @ 5 % on Total Environmental Budget					1,18,76,973/-
GRAND TOTAL					24,94,16,431/-



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Annexures

Annexure-I

Attendance Sheets of

Consultations at Antroli and

Gumma Village

PUBLIC/STAKEHOLDER'S CONSULTATION MEETING ATTENDANCE SHEET

Project - Gumma-Fediz section (NH 707)
District - Chhattisgarh - Parahyati - Dantewada.

Project	Gumma-Fediz section (NH 707)	District	Taluka	Block/ward No	GP/MC
Settlement	PS/Thana	PS/Thana	Chainage/km	Venue	
Date	Time	Total No. of participants	Male	Female	Total

S. No	Name	Age	Gender	Contact Details	Occupation	Caste	Signature
1.	Virender Singh	32		9805267773			<i>Virender Singh</i>
2.	Anil Kumar	30		9894380899			<i>Anil Kumar</i>
3.	Kewal Ram	33		9805163066			<i>Kewal Ram</i>
4.	Bhagwan	40		9805730780			<i>Bhagwan</i>
5.	Deepa Singh	36		8895123889			<i>Deepa Singh</i>
6.	Parveen Singh	35		9816719060			<i>Parveen Singh</i>
7.	Peeche Chawla	41		9805080690			<i>Peeche Chawla</i>
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22/9/19

PUBLIC/STAKEHOLDER'S CONSULTATION MEETING ATTENDANCE SHEET

Antoli - Danchigat Patti

Project Gumma-Fediz section (NH 707)

District Bellary

Settlement Antoli

Date 22-09-2019

Taluka PS/Thana

Time

Block/ward No

Chainage/km

Total No. of participants

Male

Female

Total

GP/MC

Venue

S. No	Name	Age	Gender	Contact Details	Occupation	Caste	Signature
1.	Shivappa	60		9816640730	Chattan		
2.							
3.							
4.							
5.							
6.	Shankar	60		9805089493	Chattan		
7.	Chattan	41		9805089493			
8.	Chattan	30		9862482744			
9.	Chattan	35	M.	X			
10.	Chattan	36	F	9816575960			
11.	Gupta Devi						
12.	Padmanabha P. Patel	40					
13.							
14.	Mani Ram Sharma	SSB		8894801372			
15.							
16.							
17.	Seeta Ram	43		9816511247			
18.							
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22/09/19

PUBLIC/STAKEHOLDER'S CONSULTATION MEETING ATTENDANCE SHEET

Project	Gumma-Fediz section (NH 707)			Block/ward No	GP/MC	venue	Gumma - Market
District	Taluka	PS/Thana	Chainage/km	9450	Total	Female	Total
Settlement				14	No. of participants		
Date	21/09/2019	Time					
S. No	Name	Age	Gender	Contact Details	Occupation	Caste	Signature / Issue raised
1.	Ajje Singh Bhanwari	65	M.	9816182437	Freelancer	SC/ST	SC/ST
2.	Ismail	28	M	9885458410	Finance Officer	SC/ST	Team of Friends
3.	Lakhwinder	48		9816321811	Customer	SC/ST	Friends
4.	Rajender Singh	39	Male	8219499947	Businessman	Rajput	Business
5.	Cham Singh	47	Male	9805517500	Businessman	Rajput	Business
6.	Parveen	45	M.	8694114505	Student	Gen.	Self
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21/09/2019
21/09/2019

PUBUC/STAKEHOLDER'S CONSULTATION MEETING ATTENDANCE SHEET

Project	Gumma-Fediz section (NH 707)		Taluka PS/Thana		Block/ward No Chainage/km		GP/MC Venue		Gumma - Mudukut Total	
Settlement	Date	Time	Total No. of participants	Male	Female					
	21/09/2019	5:00PM								
S. No	Name	Age	Gender	Contact Details		Occupation		Caste	Signature	
1.	Rotti Ram.	59	M.	018664 84 858		Brahmin				
2.	Ratan Lal	33	M	9219224679		Brahmin				
3.	Gumma	33	M	9816503474		Brahmin				
4.	Sunder Kumar	35	M	8878877191		Brahmin				
5.	Grayanath	42	M	859615486668		Brahmin				
6.	Gaurav	47	M	9805267181		Brahmin				
7.	Lingam	60	M	9805878895		Brahmin				
8.	ATENDER SINGH	81	M	8819833143		Brahmin				
9.	SARLA Joshi			9805926333		Brahmin				
10.	Kiran									
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संसदीय पंचायत समिति द्वारा
प्रभाग - गुम्मा
दरवाजा कार्यालय, गुम्मा, दूर्घाट, गुम्मा.
21/09/2019

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दरवाजा कार्यालय, गुम्मा, दूर्घाट, गुम्मा.
21/09/2019

Annexure- II
Girth Wise details of Tress