Environment and Social Due Diligence Report

February 2015

IND: Accelerating Infrastructure Investment Facility in India –Kiratpur Ner Chowk Expressway Ltd.

Prepared by

India Infrastructure Finance Company Limited for the Asian Development Bank

INDIA INFRASTRUCTURE FINANCE COMPANY LIMITED

ENVIRONMENTAL & SOCIAL SAFEGUARDS DUE DILIGENCE REPORT

Of

KIRATPUR NER CHOWK EXPRESSWAY LTD.

THE SUB PROJECT: **FOUR LANING OF KIRATPUR TO NER CHOWK SECTION OF NH-21 FROM EXISTING KM. 73.200 TO KM. 186.500 (NEW DESIGN LENGTH APPROX. 84.38 KM.) ON DESIGN, BUILD, FINANCE, OPERATE AND TRANSFER (DBFOT) BASIS IN THE STATES OF PUNJAB & HIMACHAL PRADESH AS BOT (TOLL) UNDER NHDP PHASE-III.**

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Environmental and Social Safeguards Due Diligence Report

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ABBREVIATIONS

ADB	:	Asian Development Bank
BOT	:	Built Operate and Transfer
CA	:	Concession Agreement
CoI	:	Corridor of Impact
CSR	:	Corporate Social Responsibility
DBFOT	:	Design, Built, Finance Operate and Transfer
EC	:	Environmental Clearance
EIA	:	Environmental Impact Assessment
EMP	:	Environmental Management Plan
EPC	:	Engineering Procurement and Construction
ESDDR	:	Environmental and Social Due Diligence Report
IIFCL	:	India Infrastructure Finance Company Limited
GoI	:	Government of India
IE	:	Independent Engineer
IL&FS	:	Infrastructure Leasing & Financial Services Limited
ITENL	:	IL&FS Transportation Networks Ltd. (ITNL)
KNCEL	:	Kiratpur Ner Chowk Expressway Ltd.
LAO	:	Land Acquisition Officer
LHS	:	Left Hand Side
LIE	:	Lenders Independent Engineers'
MoEF	:	Ministry of Environment and Forests
NGO	:	Non-Governmental Organization
NH	:	National Highway

NHDP	:	National Highways Development Plan
NOC	:	No Objection Certificate
PD	:	Project Director
PPP	:	Public Private Partnership
RHS	:	Right Hand Sight
RO	:	Regional Office
RoW	:	Right of Way
SDDR	:	Social Due Diligence Report
TDP	:	Tribal Development Plan

Project Background

1. PURPOSE OF THE REPORT:

1. This Environmental and Social Due Diligence Report (ESDDR) has been prepared by India Infrastructure Finance Company Limited (IIFCL) in consultation with the Concessionaire, Kiratpur Ner Chowk Expressway Ltd. (KNCEL) to know the adequacy of the project with the applicable National Safeguard status. The report has been prepared as per the documents/information received from the concessionaire and the site visit observations. In order to be eligible for funding from the ADB, IIFCL has prepared the Environmental and Social Due Diligence Report (ESDDR) for the sub-project on behalf of the concessionaire KNCEL. The information given in the ESDDR as agreed and confirmed by the Concessionaires (KNCEL). The sub-project has been prepared by NHAI as per its own funding requirement and not in anticipation to ADB's operations.

2. SUBPROJECT TITLE

2. The subproject: four laning of Kiratpur to Ner-Chowk section of NH-21 from km. 73.200 to km. 186.500 (Designed length is approx. 84.38 km.) on Design, Build, Finance, Operate and Transfer (DBFOT) basis in the states of Punjab & Himachal Pradesh as BOT (Toll) under NHDP phase-III.

3. SUBPROJECT SCOPE

3. The scope of work broadly includes widening of the existing alignment from Km. 73.200 to Km. 86.00, Km. 159.070 to Km. 167.473 and Km. 179.582 to 184. 323. The remaining alignment is proposed as new four lane divided highway configuration. The proposed entire road portion shall be four lane including the bridges and structures except tunnel portion which is of two lane configuration of NH-21. Moreover, construction/ strengthening of service road, bypasses, realignments, construction and /or rehabilitation of major bridges, minor bridges, cattle under passes, culverts, culverts, truck/bus lay bay, road intersections, interchanges, drains, etc., and operation of toll plaza, wayside amenities and maintenance thereof by the concessionaire. The project has allotted to the concessionaire KNCEL for the concession period of 28 years (including the construction period of 1095 days) from the date of appointment.

4. SUBPROJECT DESCRIPTION:

4. The National Highways Authority of India has awarded the Concession to Kiratpur Ner Chowk Expressway Ltd. (KNCEL), a Special Purpose Vehicle, promoted by IL&FS Transportation Networks Ltd. (ITNL) on 16th day of March 2012 to undertake four laning of Kiratpur to Ner-Chowk section of NH-21 from km. 73.200 to km. 186.500 (Design length is approx. 84.380 km.) on Design, Build, Finance, Operate and Transfer (DBFOT) basis in the states of Punjab & Himachal Pradesh as BOT (Toll) under NHDP phase-III., through public, private partnership (PPP).

5. The Project road starts from Kiratpur bypass (at Km. 73.200) and ends at Ner Chowk bypass (at Km. 186.500) with an existing length of 113. 300 Km. and the redesign length of approx. 84.380 Kms. The sub project KNCEL of NH-21 is passing through two States of India namely Punjab and Himachal Pradesh and divided into two Sections: Section-I (Kiratpur to Bilaspur) and Section-II (Bilaspur to Ner Chowk) and two separate Environmental Clearances (EC) have been obtained for the subproject are attached in **Appendix-I**

- **Section-I (Kiratpur to Bilaspur):** The proposed road starts from Km. 73.200 at Kiratpur in District Roopnagar in the state of Punjab and ends at Km. 134.500 in Bharadi village near Bilaspur town in Bilaspur District in the state of Himachal Pradesh.

- **Section-II (Bilaspur to Ner Chowk):** The proposed road starts from Km.134.500 at Nauni Chowk and ends at Km. 186.500 at Ner Chowk in Himachal Pradesh.

6. The present carriageway of proposed project road is 2-lane with earthen shoulder on both sides, varies from 5m to 7m with paved shoulder (0.3m to 0.9m) and existing RoW varies from 11m to 42m. The existing land use along the project corridor is predominantly hilly in the stretch of Himachal Pradesh and plain in Punjab Section.

7. The proposed RoW width is 45m except at the existing widening of NH-21 with 24m-30m and link connectivity and tunnels with 20m. There are five numbers of tunnels (Three in Kiratpur to Bilaspur section and two in Bilaspur to Ner Chowk section)proposed to be constructed. The proposed new alignment will result in reducing of approx., 29 Km along the project stretch. The project highway passes through Rupnagar district of Punjab and Bilaspur & Mandi districts of Himachal Pradesh. The important places and settlements along and around the existing alignment are Kiratpur Sahib, Swarghat, Nauni, Bilaspur, Ghagas, Barmana, Sunder Nagar and Ner Chowk The detailed project stretch is given in **Figure:-1**.

8. The proposed road section with 4-lane divide carriageway with 1.50 m wide paved shoulder and 1.5 m wide earthen shoulder on either side of the road. The pavement type along the highway is Flexible Pavement and Rigid Pavement at Toll Plaza locations and Tunnel Section. The paved carriageway shall be 17.50 meters wide (excluding the median) with shoulders in plain/rolling terrain and in hilly/mountain terrain the carriageway shall be 14.00 m wide excluding the median with shoulders. In tunnels the carriageway shall be two Lane Bi-Directional. The details of project road alignment and the alignment of Tunnels are given in **Table-:1** and **Table-:2,** respectively.

Table-1: Details of Project Road Alignment

Sl. No.	Location (Design Chainage)		Length (Kms)
	From (Kms).	To (Kms).	
Kiratpur-Bilaspur Section			
1.	0.00	12.732	12.732 (4-lane along existing road)
2.	12.732	26.462	13.730 (4-lane New Alignment)
3.	126.500	129.500	3.000 (4-lane New Alignment)
4.	129.500	159.070	29.570 (4-lane New Alignment)
5.	159.070	167.473	8.403 (4-lane along existing road)
Sudernagar Bypass			
6.	167.473	179.582	5.678 (2- lane New Alignment)
Widening of Existing Road			
7.	179.582	184.323	4.741 (4-lane along existing road)
Ner Chowk Bypass			

8.	184.323	188.874	4.550 (4-lane New Alignment)
Connection of Barmana Cement Factory to New Alignment			
9.	0.000	1.971	1.971 (2-lane New Alignment)
Total Length			**84.375**

Source: Concession Agreement

Table-2: Details of Tunnel Alignment

Sl.No.	Description	Chainage (Kms)		Length (m)
1.	Tunnel 1	12.732	14.482	1,750 (With Parallel Escape Tunnel)
2.	Tunnel 2	15.810	16.460	650
3.	Tunnel 3	23. 700	24.100	400
4.	Tunnel 4	148.580	149.990	1410
5.	Tunnel 5	157. 800	158.660	860
Total Length				**5070**

Source: Concession Agreement

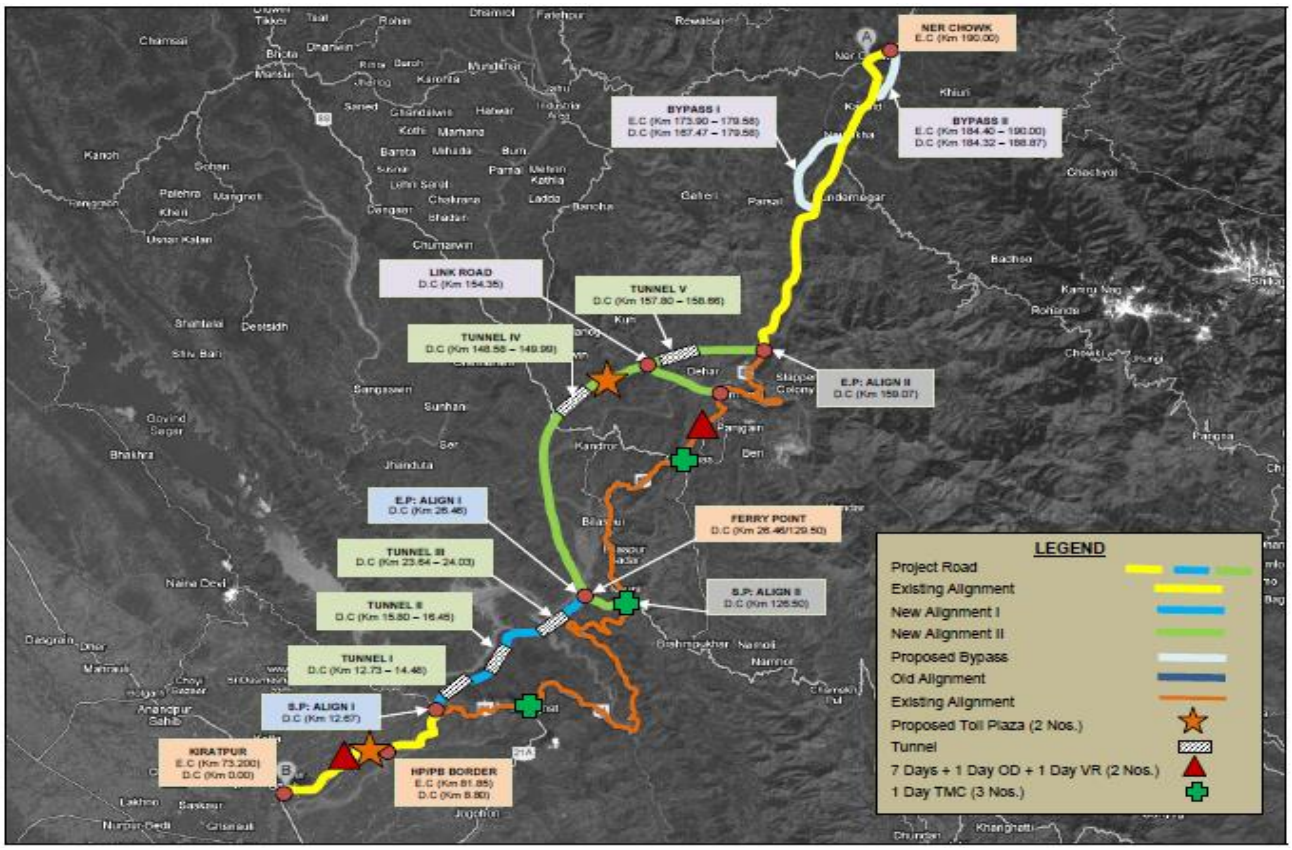


Figure-1: Project Location: Kiratpur Ner Chowk Expressway Ltd.

9. To avoid the resettlement and to minimize rehabilitation impact on the existing structures as well as the affected people, two numbers of bypasses at Sundar Nagar and Ner Chowk and fourteen number of realignments have been proposed in different locations. The chainage wise details of bypasses and the project salient features are given in **Table:-3** and **Table-4,** respectively.

Table-3: Chainage Wise Bypasses

Sl.No.	Bypasses	Design Chainage (Kms)		Total Length (Kms)	Side
		From	To		
1	Sundar Nagar	173.904	179.582	5.678	LHS
2	Ner Chowk	184.323	188.874	4.551	RHS
Total Length of Bypasses				**10.229**	

Table-4: Project Salient Features

Sl.No.	Parameter	Information
1	Concessionaire	Kiratpur Ner Chowk Expressway Ltd. (KNCEL)
2	Concessioning Authority	National Highways Authority of India (NHAI)
3	Sub Projects	Four laning of Kiratpur to Ner-Chowk section of NH-21 from km. 73.200 to km. 186.500 (Design length is approx. 84.38 km.) on Design, Build, Finance, Operate and Transfer (DBFOT) basis in the states of Punjab & Himachal Pradesh as BOT (Toll) under NHDP phase-III.
4	Location	Kiratpur to Ner-Chowk section of NH-21
5	Chainage	Km 73.200 to Km. 186.500
6	Total Term Loan	Rs. 1474.86 Cr.
7	Length (in Kms.)	Approx. 84. 380 Km.
8	Tunnel	Five Nos.
9	By pass	Two Nos (Lengths of Sundar Nagar and Ner Chowk bypasses are 5.678 Kms and 4.551 Kms, respectively.)
10	Right of Way (RoW)	The present RoW varies between 11 m to 24 m. The proposed RoW width is 45m except at the existing widening of NH-21 with 24m-30m and link connectivity and tunnels with 20m.
11	Service Road	4. 84 Kms. (At Naulakha- Dadour Section)
12	Toll Plaza	Two Nos. (At Km. 81.620 & Km. 151.735)

13	Major Bridges	Forty Four Nos. (23 in LHS & 21 IN RHS)
14	Minor Bridges	Thirty Six Nos. (18 in LHS & 18 in RHS)
15	Flyover	One Nos.
16	Pedestrian /Vehicular Under Pass	Eight Nos. (4 in LHS & 4 in RHS)
17	Slab Culverts	396 Nos. (198 in LHS & 198 IN RHS)
18	Pipe Culverts	128 Nos. (64 in LHS & 64 in RHS)
19	Truck Lay Bay	Three Nos. (At Km 7.840 RHS, 152.135 RHS & 178.735 LHS)
20	Bus Lay Bay	Fifty Nos.

Source: LI's Monthly Progress Report (November 2014).

5. PROJECT ADMINISTRATIVE DETAILS:

10. The administrative and financial details of the project as follows in the below **Table-5**:

Table-5: Administrative Details of the Project

Sl. No.	Description	Project Data
1	Concessioning Authority	National Highways Authority of India
2	Project Cost	Rs. 2291.00 Cr
3	EPC Contractor	IL&FS Transportation Networks Ltd. (ITNL)
4	EPC Cost	Rs. 1934.17 Cr.
5	Independent Consultant	M/s Getinsia Ingeniers S.L., Spain in association with Segmental Consulting and Infrastructure Advisory Pvt. Ltd.
6	Design Consultants	i. Highway Design & Development Unit: ITNL; ii. Structure: BSEC& CDS; iii. Proof Check of Structures: NAXCOM; iv. Tunnel: Elsamex Portugal Engineering and Management Systems in association with Grusamar Ingenieria Consulting;
7	Date of Concession Agreement	16th March 2012
8	Appointed Date	14th November 2013
9	Concession Period	28 Years including 3 years of construction period
10	Construction Period	1095 days from the appointed date
11	Lenders Independent Engineer	M/s Frischmann Prabhu

Source: LIE Report: November 2014

6. ALTERNATINVE ANALYSIS

11. The analysis of alternatives has been carried out on the basis of with project and without project scenarios in terms of socio-economic and environmental consequences. The project offers some environmental as well as social alternatives in order to facilitate the decision making process. 'With' and 'Without' project scenarios analysis has been carried out to justify the proposal of a widening alternative to no widening alternative. The "with" project scenarios will, however, only occur if the recommendations provided for the construction stage are followed and all construction activities are carried out according to principles of Environment Friendly Road Construction.

12. **Without Project Scenario**: The existing project road is 2 lanes highway. The capacity of the existing 2 lanes highway is insufficient for handling large number of vehicles which needs immediate improvements. The present highway passes through urban settlements which hamper the smooth flow of traffic. This is further compounded by the rapid increase in the number of tourists visiting the Manali area. It is only road connecting Chandigarh to Manali and Kullu, popular tourist places. There is no rail transport facility available in the area. This road also serves a connecting link with Ladakh which is also very important from tourist as well as defence point of view. There are lime stone mines and three operating cement plants (one under construction) in the area. Increasing commercial, mining and industrial activities (mainly cement plants) will further exacerbate the situation.

13. The existing road is not capable to cater for increasing traffic needs due to increase of traffic. There has been an increase in the movement of heavy vehicles transporting minerals (mainly lime stone) and goods (including cement). The existing unsafe conditions and slow traffic movement, the prevailing environmental quality along the highway will continue to deteriorate in the absence of proposed strengthening/widening of the highway. It will also impede the economic development of the region. Total about 123 ha of forest land (involved in this proposed project) will not be affected in case of without project scenario.

14. **With Project Scenario**: This scenario includes the 4-laning of existing 2-lane national highway sections of NH-21 stretch between Kiratpur (Punjab) and Ner-Chowk (Himachal Pradesh) as envisaged in the project objectives. The "with project scenario", has been assessed to be economically viable and will alleviate the existing conditions. It will, therefore, contribute to the development goals envisaged by the Government of India, and enhance the growth potential of the region. This is one of the only highways for effective connectivity to Kullu, Manali and Ladakh.

15. To avoid the large scale acquisition of land and properties, the project envisages the four laning of the highway. Two by passes have been proposed at Sunder Nagar and Ner-Chowk to minimize the impact on the existing settlements in the town area. With the improvement of road surface and proposed by passes, five tunnels and bridges, the traffic congestion due to obstructed movement of vehicles will be minimized and will reduce emission of pollutants from the vehicles. Distance between Kiratpur and Ner-Chowk is about 113 km (existing) which will be reduced to about 84 km due to prosed alignment.

16. Widening of the road and construction of proposed facilities will improve traffic flow, overall safety and drainage along the road.

17. On the basis of above analysis it is concluded that "with" project scenario will be more beneficial as compared to "without" project scenario. The proposed project will instigate faster and comfortable movement of people and transportation of goods. Therefore, proposed road widening project with minor reversible impacts is justified.

7. PUBLIC HEARINGS

18. In order to obtain environmental clearance as required under EIA Notification 2006 and No Objection Certificate (NOC) from both the State Pollution Control Boards (SPCBs) of Punjab and Himachal Pradesh. Public Hearings were conducted on 29/06/2012, 23/04/2012 & 24/04/2012 at Roopnagar District of Punjab, Bilaspur, (HP) and Mandi District of Himachal Pradesh, respectively. The Public Hearings related communication between State Pollution Control Boards and the District Administration and minutes of meeting are given in **Appendix-II** for both the sections.

8. ROAD FURNITURE AND FACILITIES:

19. As per the Concession Agreement the Concessionaire has to provide various project facilities as mentioned below:

- Toll Plaza, Roadside Furniture, Street Lighting;
- Tunnels and bypasses;
- Pedestrian facilities;
- Landscaping & tree plantation;
- Rest Areas and truck lay-bays;
- Bus bayes and Bus shelters;
- Development of site for wayside amenities;
- Traffic Aid Post;
- Medical Aid Posts;
- Vehicle rescue posts;
- Telecom System;
- Highway traffic management system
- Ambulances/Cranes at toll plaza locations;
- Administration, Operation and Maintenance of Base Camp;
- Junction Improvements;
- Highway patrolling, ambulance measures during operation;
- Road Safety Signboards;
- Drainage System for Storm Water wherever applicable.

9. DEBT COMPONENT OF THE PROJECT:

20. The debt[1]allocation to various banks and IIFCL for the proposed project is being financed by a syndication of loan. KNCEL, has signed a Common Rupee Loan Agreement with consortium of Lenders comprises of Indian Bank as a Lead Bank, Yes Bank, Central Bank of India, Oriental Bank of Commerce, Allahabad Bank, Tamilnad Mercantile Bank Ltd., Corporation Bank, India Infrastructure Finance Company Limited (IIFCL), and Life Insurance Corporation. The total cost of the project is Rs. 2291.00 Cr. out of which IIFCL has sanctioned Rs. 279. 86 Cr.

10. CONCESSIONAIRE:

NHAI has appointed M/s Kiratpur Ner Chowk Expressway Ltd. (KNCEL) as the concessionaire for this sub-project. The Concession Agreement signed on 16th March 2012 between NHAI and KNCEL. The Concession period for the project is 28 Years including the construction period of 3 years (1095 days) from the Appointed Date of 12th September 2012.

11. EPC CONTRACTOR:

21. The EPC contractor, M/s IL&FS Transportation Networks Ltd. (ITNL) has signed the Engineering Procurement and Construction Contract (EPC) agreement with M/s Kiratpur Ner Chowk Expressway Ltd. on 25th day of July 2013 and the EPC cost is INR Rs. 1934.17 Cr.

12. LENDER'S ENGINEER:

22. M/s. Frischmann Prabhu has appointed as Lender's Engineer (LE) for the project M/s Kiratpur Ner Chowk Expressway Ltd. As per the Lender's Engineer report for the month of August 2014, the physical progress is 18.45% and financial progress is about 27.24%.

13. INDEPENDENT CONSULTANTS

23. NHAI has appointed M/s Getinsia Ingeniera S.L., Spain in association with Segmental Consulting and Infrastructure as Independent Consultant to monitor the subproject periodically and submitting the periodic compliance monitoring report, in every six-month to NHAI for the subproject which also includes the status of land acquisition, compensation, any disputes, utility shifting, and religious structures affected.

[1] The loan sanctioned (Rupees in Crores) by various banks which include: Yes Bank: Rs.250.00 Cr., Indian Bank: Rs. 350 Cr., Central Bank of India: Rs. 45.00 Cr., Oriental Bank of Commerce: Rs.100.00 Cr., Allahabad Bank: Rs. 100.00 Cr., Tamilnad Mercantile Bank Ltd.: Rs. 75.00 Cr., Corporation Bank: Rs. 150.00 Cr., IIFCL: 279. 86 Cr. & Life Insurance Corporation: Rs. 125.00Cr.

ENVIRONMENTAL SAFEGUARS

ENVIRONMENTAL SAFEGUARD DUE DILIGENCE

14. AVAILABILITY OF EIA/EMP REPORTS:

24. The environmental impact assessment (EIA) studies were carried out in accordance with requirements of Ministry of Environment and Forests (MOEF), GOI, guidelines for highway projects. The proposed road project is passing through one district of Punjab (Km 73.200 to Km 134.500) and two districts of Himachal Pradesh (Km 134.5 to Km 186.5). For both states separate EIA/EMP reports were prepared and district wise public hearings were conducted. The proposals were examined in the Ministry of Environment and Forests and environmental clearances were accorded vide letters F. No. 10-118/2011-IA.III dated 21st March, 2013 (Section of Project Road in Punjab) and F No. 10-52/2011-IA.III dated 21 March, 2013 (Section of Project Road in Himachal Pradesh) under Environment Impact Assessment Notification, 2006. Copies of the EIA/EMP reports and environmental clearances letter are attached as **Appendix-II1** and **Appendix-I,** respectively.

15. ENVIRONMENTAL SENSITIVITY AND DUE DILIGENCE:

25. The project site was visited by the Environmental Safeguard Specialist of IIFCL along with the concessionaire's and EPC contractor's officials during 02 to 04 January, 2015 for field verification of environmental safeguards.

- The Project Highway starts from the Kiratpur in District Roopnagar in the State of Punjab at km 73.200 of NH-21 and ends at Ner Chowk in Mandi District in the State of Himachal Pradesh at km 186.500;
- The important places and settlements along and around the existing alignment are Kiratpur Sahib, Swarghat, Nauni, Bilaspur, Ghagas, Barmana, Sunder Nagar and Ner Chowk.;
- Kiratpur Sahib, famous for Gurdwara Patal Puri, is a very important town on NH-21 (Project Highway);
- Urban stretches with multiple land uses act as bottlenecks in the free flow of traffic because of intermixing of local and through traffic as well as the movement of pedestrians. Sundar Nagar and Ner Chowk are highly congested;
- The existing road is a 2-lane carriageway with earthen shoulder and runs through a combination of plain/rolling and predominantly through the mountainous terrain;
- To avoid the congestion and smooth traffic flow two by passes, Sundar Nagar Bypass (between km 173.904 to km 179.582) and Ner Chowk Bypass (from km 184.323 to km 188.874), have been proposed;
- Five tunnels are also proposed to be constructed between chainage km 12.732 and km 14.482, km 15.800 and km 16.460, km 23.700 and km 24.100, km 148.580 and 149.990, km 157.800 and 158.660. The proposed realignment of the existing highway (proposed project highway stretch) will reduce Highway length by about 29 kms;
- The Govind Sagar Wildlife Sanctuary has been de-notified as per decision of the Hon'ble Supreme Court (**Appendix V** Denotification of Govind Wildlife Sanctuary). As per Divisional Forest Officer, Suket letter No. 1822 dated 06 June, 2013 written to the Nodal Officer-cum-APCCF

(FCA), O/O Pr.CCF H.P. Shimla, "the proposed area for four laning under the jurisdiction of Suket Forest Division, Sundernagar from Bhatehar to Dadour is away from Bandli eco-sensitive zone (**Appendix V** Eco Sensitive Zone of Bandli Wildlife Sanctuarty). The proposed project road is not passing through any National Park and Sanctuary area;

- Forest clearances (Stages I and II) as has been obtained from MOEF for the diversion of 119.8843 ha of forest land. For the construction of Sunder Nagar bypass 3.34 ha forest land is required for which developer has already initiated the process to obtain the forest clearance.
- There are no known rare or endangered flora and fauna species reported in the area close to the corridor of impact (CoI) of the project road;
- There are no archaeological monuments of national importance within corridor of impact of the project;
- Elaborate environmental management and monitoring activities are being conducted;
- Proper signage have been installed at appropriate locations for the safe traffic movement;
- Longitudinal drains will be provided along the project road to ensure proper drainage;
- The concessionaire has undertaken implementation of environment management measures as per agreed EMP during the construction stage of the project.
- As part of EMP implementation, a budgetary provision of INR 9.45 Cr. (approx.) has been earmarked.

16. CATEGORIZATION OF SUB-PROJECT:

26. The sub-project (Widening and improvement of existing two lanes NH-2) classified as Category 'B' project based upon the Asian Development Bank's policies on environment. This classification is based on the review of EIA/EMP and other available documents provided by the Concessionaire with respect to the environmental sensitivity due to project activities.

17. STATUS OF REGULATORY CLEARANCES:

27. The sub-project meets the requirements of appropriate National and State legislations by considering appropriate obligations and guidelines of Regulatory Authorities. The sub project has necessary national and local environmental clearances as well as permits and approvals for project implementation and suitable environmental management. The statutory clearances required as part of the proposed widening and strengthening of the sub-project has been assessed and current status of such clearances are provided in **Table-6.**

Table- 6: Status of Regulatory Clearances Obtained

Sl. No.	Clearances Required	Statutory Authority	Current Status of Clearance
1.	Environmental Clearance	Ministry of Environment and Forests, GoI, New Delhi	Environmental clearances have been accorded by MOEF vide letters F. No. 10-118/2011-IA.III dated 21st March, 2013 (Section of Project Road in Punjab) and F No. 10-52/2011-IA.III dated 21 March, 2013 (Section of Project Road in Himachal

			Pradesh) **(Appendix-I)**.
2.	Forest Clearance	Ministry of Environment and Forests, Government of India, New Delhi	Final approval for diversion of 74.7875 ha of forest land (Km 8/700 to km26/500 and km 126/500 to km 152/100) in Himachal Pradesh and 29.5169 ha of forest land in Punjab have been granted by **(Appendix-IV)** MOEF (FC Division), GOI vide letters F.No. 8-25/2013-FC, dated 01 October, 2013 and F No. 8-44/2013-FC dated 06 May, 2014, respectively. Final approval for diversion of 15.5799 ha of forest land (from km 151/100 to Km 189/000) within the jurisdiction of Suket and Mandi Forest Divisions, of Himachal Pradesh has been granted by MOEF (FC Division), GOI vide F No. 8-25/2013-FC (Vol-I), dated 16 December, 2013 **(Appendix-IV).** Forest clearance process has been initiated for 3.34 ha forest land..
4.	Water Drawing Permission	Bhakra Beas Management Board, Chandigarh	Permission to use water from Govind Sagar Reservoir and Satluj for construction has been obtained (**Appendix-V**).
5.	Permission to Install & Operate	State Pollution Control Board	NOCs have been obtained for the installation and operation of Stone Crusher, Hot Mix Plant, DG sets, etc. **(Appendix-V).**
6.	Tree Cutting Permission	State Government	Trees are being cut by Forest Department **(Appendix-V).**
7.	Explosive Permission	Dy CCF, Chandigarh and District Administration, Bilaspur.	Permissions have been obtained **(Appendix-V).**

Source: Concessionaire and Field Observation

18. ENVIRONMENT AND SAFETY CLAUSES IN CONCESSION AGREEMENT

28. The NHAI has signed concession agreement with Kiratpur Ner Chowk Expressway Limited, Mumbai on 16th March, 2012. Copy of the Concession Agreement (CA) is attached as **Appendix VI.** The Concessionaire shall ensure safe conditions for users and in the event of unsafe conditions, lane closures, diversions, vehicles breakdowns and accidents, it will follow the relevant operating procedures including the setting up temporary traffic cones and lights and removal of obstruction and debris without delay. Such procedures shall conform to the provisions of the agreement, applicable laws, permits and good industry practices.

29. Safety requirements are given under Article 18 in which it is specified that the Concessionaire shall comply with the provisions of agreement, applicable laws and applicable permits and conform to good industry practices for securing the safety of the users. In particular, the Concessionaire shall develop,

implement and administer a surveillance and safety programme for providing a safe environment on or about the project roads and shall comply with the safety requirements set forth in Schedule L.

30. As per Concessionaire Agreement all costs and expenses arising out of or relating to safety requirements shall be borne by the Concessionaire to the extent such costs and expenses form part of the works and services included in the scope of the project, and works and services, if any, not forming part of the Scope of the Project shall be undertaken in accordance with the provisions of Article 16.

19. ENVIRONMENT AND SAFETY CLAUSES IN EPC CONTRACT

31. M/s Kiratpur Ner Chowk Expressway Limited (KNCEL) has awarded the EPC works for this project to IL & FS Transportation Networks Limited (ITNL). Copy of the EPC Contract for this project has been attached as **Appendix-VII.** As per EPC Contract ITNL agrees to conduct its activities in connection with the contract in such a manner so as to comply with environmental management plan (EMP).

32. ITNL shall make its own arrangements for quarrying and disposal of surplus materials and fulfil the environmental and other requirements under the applicable laws and permits at its (ITNL) own cost and expense;

33. Compliance with all applicable permits and laws in its performance of ITNL's obligations under the contract including those being performed by any of the sub-contractors;

34. ITNL will be responsible to remove all surplus construction machinery and materials including rubbish and other materials. ITNL shall keep the project highway in a neat and clean condition and conformity with the applicable laws and permits

20. EMP IMPLEMENTATION BUDGET:

35. As part of the project, detailed EMP measures have been undertaken including a budget of INR 9.45 Cr. (Approx.) for implementing the same. The EMP budget exclusively includes the following measures:

- Safeguard measures towards maintaining of air, noise and water quality as per norms;
- Monitoring of environmental parameters and preparation of compliance report;
- Sprinkling of water during construction to minimize the fugitive emission;
- Tree-cutting and plantation of new saplings;
- Health & safety;
- Training and awareness on health, safety and environment.

21. ENVIRONMENT MANAGEMENT PLAN (EMP) IMPLEMENTATION:

36. The environmental management plan(EMP) as appeared in the EIA is provided at **Appendix-III**. The EMP consists of a set of mitigation, monitoring and institutional measures to be taken during the design, construction and operational phases of the project to eliminate adverse environmental impacts, to offset them, or to reduce them to acceptable levels. The main aim of the EMP is to ensure that the various adverse impacts are mitigated and the positive impacts are enhanced. The EMP has proposed mitigation

measures which are being adopted during the pre-construction and construction phases of the project. The EMP also elaborates on environmental monitoring program. The mitigation measures adopted during construction and operations shall include the ambient air quality management; control of water pollution including treatment and water conservation; spill prevention and control; noise quality management from plant, machineries vehicles and solid waste management, etc.

37. Slew of environmental management and safety measures are being taken for construction of proposed five tunnels. Two International experts for tunnel construction have been posted at construction site. All drilling, blasting and excavation are being carried out under the supervision of experts;

38. Safety sign boards are provided at various places including tunnels. Adequate ventilation and lighting facilities are provided in the tunnels being constructed;

39. To provide the rock support Swellex Rock Bolts are being provided. The salient features of these bolts are easy wire mesh installation, insensitive to vibration, cover wide range of rock and high anchorage;

40. To get an accurate determination of distribution, magnitude, rate and acceleration of deformation in the rock mass intersected by the drill holes extensometers are provided. Extensometers are usually installed at the collar drill hole and one or more in-hole anchors, each of which is fixed in place at a known depth in the borehole;

41. To get the data on how the ground is moving during construction of tunnels against the initial pre-construction curves inclinometers are being provided.

42. The muck which are not utilized at present and being stacked in the earmarked dumping sites for further utilization. Muck dumping yards have been identified in Bilaspur and Mandi districts. The total capacities of all dumping yards are 2324213 cum and 34487 cum in Bilaspur and Mundi district, respectively**.** Till 16 December, 2014, the quantities of muck dumped in Bilaspur and Mandi districts dumping yards are 480069 cum and 1800 cum, respectively.

43. The stacked muck at dumping yards will be reutilized, after construction of retaining wall/ gabion wall/approaches of bridges for filling purpose and construction of embankment. Muck generation, dumping and utilization details are provided in **Table-7.**

Table-7: Details of Muck Generation/Management*

District	Quantity of Muck (cum)		
	Generated	Used	Dumped at Dumping Yard
Bilaspur	1245815	765746	480069
Mandi	246056	244256	1800

* *Till 16 December, 2014*

22. CONCESSIONAIRE AND EPC CONTRACTOR'S HSE PLAN

44. ITNL shall be responsible for the adequacy, stability and safety of the works and all project site operations and for all methods, design, construction, operation and maintenance of existing road and project facilities.

45. Five tunnels are being constructed for this project. Tunnel specific HSE manual **(Appendix VIII)** has been prepared to ensure a safe and healthy working environment for all employees and workers working for the construction of the tunnels. It addresses good industry practices with regard to worker safety and accident/hazard prevention at work site. Major objectives of developing such plan is to assess the risk associated with worker's health, safety and to suggest best precautionary measures to avoid accidents; integrate safety with work practices; create safety awareness amongst every individual associated with the project.

23. ENVIRONMENTAL MONITORING:

46. Monitoring of environmental quality during construction and operation reflects the success of implementation of the mitigation measures and it also provides a chance to review the suggested measures and improve upon the measures. The environmental monitoring is primarily the responsibility of the EPC contractor Presently, International Testing Centre, Panchkula (Haryana) is carrying out the monitoring work. Environmental quality monitoring should be carried out as described in the EIA/EMP report .

24. INSTITUTIONAL FRAMEWORK FOR EMP IMPLEMENTATION:

47. Concessionaire is responsible for ensuring overall compliance with the EMP and setting up of environmental policies by EPC contractor engaged for execution of the project work. The project institutional framework as given in the project EMP **(Appendix- III)** indicates that the overall implementation responsibility of the EMP lies with contracting company. The arrangement made for implementation of project including quality assurance and environmental aspects is provided as **Appendix-III.**

48. The muck which are not utilized at present and being stacked in the earmarked dumping sites. The total capacities of all dumping yards are 2324213 cum and 34487 cum in Bilaspur and Mundi district, respectively**.** Till 16 December, 2014, the quantities of muck dumped in Bilaspur and Mandi districts dumping yards are 480069 cum and 1800 cum, respectively.

25. SITE VISIT:

49. A site visit was undertaken by IIFCL's Environmental and Social Safeguard Specialists along with the concessionaire and EPC contractor's officials during 2nd to 4th January, 2015. The concessionaire has appointed EPC contractor for execution of construction work. EPC contractor/subcontractor has mobilized sufficient number of staffs for construction, survey and quality testing work together with plant, machinery and equipment. QA/QC Lab, stores, machinery, fabrication yard and work shop. During the site visit it has been observed that:

- Camp offices including toilets and mess facilities are well maintained. Good sanitation and proper hygiene are being maintained regularly. Monitoring is being done daily/weekly;
- Contractor has mobilized a safety management team to ensure proper traffic and safety management along the entire stretch of the project road especially at locations where the work is in progress;
- First aid facilities and ambulances are provided to camp offices;
- Cautionary boards and other applicable sign boards are provided at regular intervals to avoid the accidents;
- Adequate measures have been taken to prevent the rock fall and landslide. Mesh has been provided to prevent the rock falling at required places;

- Adequate lighting and ventilation facilities are being provided at the tunnels construction sites. Ambulance facility is also provided at site to meet any emergency requirement;
- Trees are being cut by Forest Department;
- Water sprinkling facilities have been provided and being practiced during site visit for suppression of dust at fugitive dust generating sources;
- At construction plant sites, crushers have been provided with wind breaking walls and water sprinkler system to control the air pollution;
- The muck generated from the alignment of four laning project are either being utilized for construction of embankment or dumped/stacked at dumping yards/sites and not thrown anywhere else.
- Proper traffic diversions and appropriate signages are being provided at appropriate locations at the construction site for the convenience of road traffic;
- Workers are being provided with the required safety gears to be worn during execution of work;
- Necessary barricading and safety precautions are being ensured. Work safety signages have been provided in places where the construction work has begun;
- Retro reflective safety signs for work zone, men at work, go slow and cautionary signs are provided;
- Periodic environmental quality monitoring is being carried out by International Testing Centre, Panchkula, and Haryana.
- Training and awareness to the workers on potential hazard.

26. PROJECT IMPLEMENTATION STRUCTURE:

50. For the purpose of providing project management and carrying out routine maintenances, the company has executed a development contract with ITNL as developer for the implementation of the project. The Company proposes to form a Project Management team to supervise the construction of the Project Highway. The implementation framework is provided in **Figure 2**.

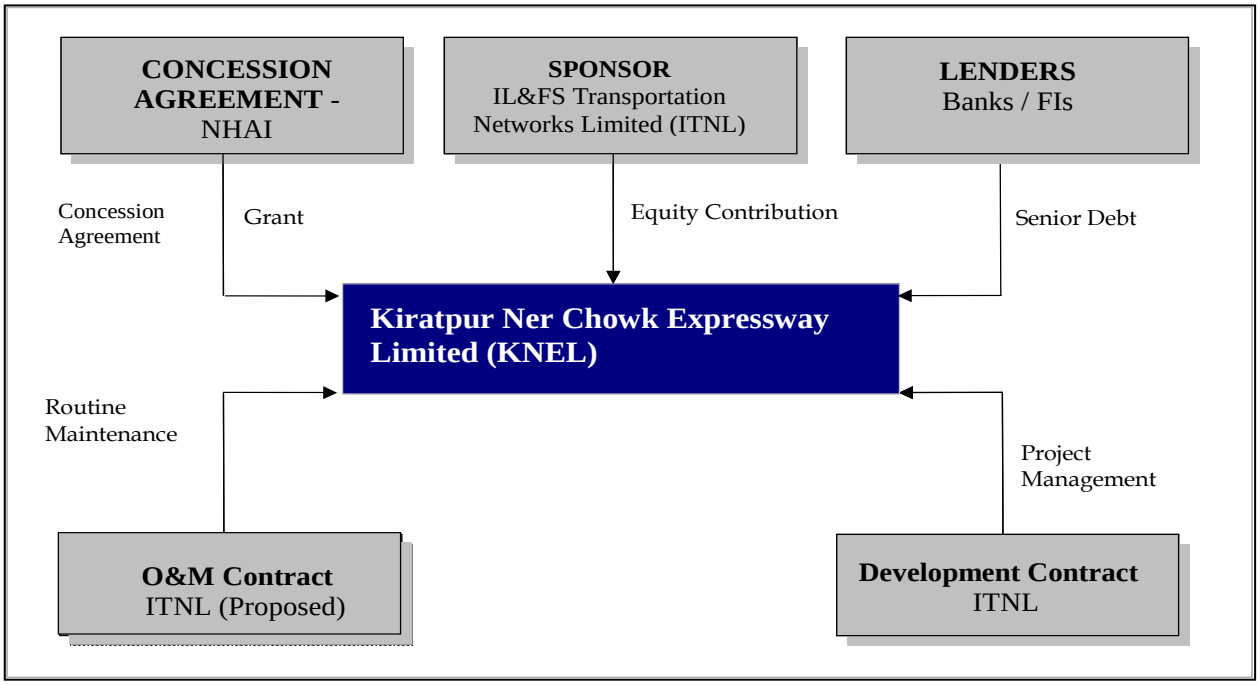


Figure-2: Project Implementation Structure

27. CONCLUSIONS AND RECOMMENDATION:

51. Based upon the available documents and site visit, it is concluded that the concessionaire through their EPC contractor has undertaken environmental safeguard measures. Safety-in-charge is posted at site, is responsible for the safety and environmental aspects of the project. He reports directly to the Project In charge. The sub-project has made sound progress. The conclusion for the sub-projects is given below:

- The project has been prepared by NHAI as per its own funding requirement and not in anticipation to Asian Development Bank's operation;
- Necessary permits/approvals, environmental clearances and forestry clearances (Stages I and II for 119.8843 ha forest land) for project implementation have been undertaken by the concessionaire. Forest clearance for 3.34 ha land is expected shortly. No construction work should be carried out on forest land (3.34 ha) without obtaining forest clearance;
- The proposed project does not affect any eco-sensitive zones as declared by MoEF. Also the project does not pass through any national park or wildlife sanctuary. No historical or archaeologically important monuments are affected due to this sub-project;
- Trees are being cut by Forest Department. Plantation and afforestation work will be carried out as per the requirement of MOEF;
- Institutional arrangement is also being done for regular environmental management. EPC Contractor has engaged International Testing Centre, Panchkula (Haryana) for carrying out the environmental parameters monitoring work;
- The proposed project may also has a positive GHG emission reduction due to less fuel consumption for the same traffic density and reduced highway length (about 29 km) between Kiratpur and Ner Chowk;

- For road safety suitable measures such as construction of installation of barricades along both sides of the road, sign boards, speed breakers, etc. will be provided;

- The solid waste (muck) generated should be used to the extent possible to meet the road construction requirements and remaining muck should be used to treat and level the borrow pits and other scars created during the road construction;

- Based on the due diligence findings, it can be deduced that the sub-projects have no significant environmental safeguard issues;

- Monitoring of environmental parameters should be carried out as described in the EIA reports and six monthly compliance reports should be submitted to regional office of MOEF and other applicable regulatory authorities. Monitoring as well as compliance and project status reports should also be submitted to IIFCL, New Delhi;

- Greenbelt should be developed as outlined in the EIA report, as per guidelines of forest department and Central Pollution Control Board;

- The Sub-projects, therefore, do not appear to involve any kind of reputational risk to IIFCL and the Asian Development Bank funding on environmental safeguards and is recommended for funding under the proposed head.

SOCIAL SAFEGUARDS

SOCIAL SAFEGUARD DUE DILIGENCE REPORT (SSDDR)

28. METHODOLOGY FOLLOWED DURING SSDDR:

52. The Social Safeguards Due Diligence Report (SSDDR) for the subproject was prepared by IIFCL to understand the salient features of the project and various social and resettlement concerns during construction period of the project. This report has been prepared by IIFCL on behalf of the sub-project developer with the information and documents received from the concessionaire Kiratpur Ner Chowk Expressway Ltd. (KNCEL). The methodology followed during the preparation of Social Due Diligence Report (SDDR) is as follows:

- Discussion with the subproject developer regarding the implementation status and progress of the project before as well as during the site visit;

- During the preparation of SSDDR the relevant documents have been reviewed e.g. Detail Project Report (DPR), Environmental Impact Assessment (EIA) Report, Gazette Notifications for Land Acquisitions, Concession Agreement (CA), Engineering Procurement & Construction (EPC) Contract, Project Information Memorandum (PIM) of the project, Lenders Independent Engineers (LIE) and applicable clearances/permits/No Objection Certificates (NOCs) as applicable for the project implementation.

29. PUBLIC CONSULTATION:

53. During project planning and preparation stage, Public Consultations were carried out with the different stakeholders along the project road, villages, shopkeepers, project affected people and the people of the different section of the society. Public Consultations have been conducted by the project proponent in different locations to appraise the stake holders about the project as indicated below.

a. Auhar Village on 03-02-2010;

b. Barmana Village on 14-05-2010;

c. Sundar Nagar Temple on 18-05-2010

d. Panoh Main Market on 12-10-2010

e. Dehar Main Market on 16/10/2010

54. The village wise some of the issues as raised by the local people during the consultation were depicted :

29.1 Meeting at Auhar Village :

- Alignment Plan
- Minimizaiton of Demolition of Structures
- Compensation Package
- Safety Measures

29.2 Meeting at Barmana Village

- Willingness in relocation of historical temple.
- Provision of Service lanes on both sides of the existing road.
- Provision of Compensation at Market rate.

- Provision for drainage system in village as water logging is a major problem during the rainy season.
- Provision for the Safe access to reach and cross the existing road like Zebra crossings etc. for pedestrians, school going children and women, shall be considered during designing.
- Wayside facilities such as parks, toilet,

29.3 Meeting at Sundar Nagar Temple:

- Provision of alternative alignment, that is bypass
- Limited Widening of existing road
- Wayside facilities such as parks, toilet,
- No proper Drainage system along the roadside due to this they faced water logging during rainy season.
- Provision to be made to avoid any negative impact on the religious structures.

29.4 Meeting at Panoh Main Market

- Alignment Plan
- Minimization of demolition of structures.
- Compensation Package.
- Safety Measures.
- Basic amenities for the local people

29.5 Dehar Main Market

- Alignment Plan
- Minimization of demolition of structures.
- Compensation Package.
- Safety Measures.
- Basic amenities for the local people

30. SOCIAL SAFEGUARDS COMPLIANCE REVIEW:

30.1 Magnitude of Impact on Project Affected People

55. During the project planning and preparation stage, it was observed that 6671 numbers of persons will be affected in 61 villages under 3 districts. The subproject which consists of 3178 project affected persons in Mandi District, 3118 number of persons in Billaspur District and 375 numbers of persons in Punjab District. The detail Districts and villages wise distribution of affected persons is given in **Appendix-XV**. Moreover, due to construction of bypasses about 2540 affected structures are avoided, in addition to affected structures 48 temples are also avoided.

30.2 Impact on Schedule Tribe population

56. Kiratpur Ner Chowk Expressway Ltd. section of NH-21 is falling under the states of Punjab and Himachal Pradesh (HP). The project road is passing through Rupnagar district of Punjab and Bilaspur & Mandi districts of Himachal Pradesh, which is not a part of the notified Fifth Schedule Area[2], hence, the

[2] The Web link of the state wise list of "The Scheduled Areas": http://www.tribal.gov.in/Content/StatewiseListofScheduleAreasProfiles.aspx

project does not disturb any tribal settlement and does not have any adverse impact or create any threat to the survival of any tribal community along the alignment. Hence no Tribal Development Plan (TDP) is required to be prepared for this sub-project.

30.3 Social Requirements

57. To acquire the land /structures for the project, the Gazette Notifications published and land properties are acquired as per the NHAI Act-1956. It is confirmed by the developer that there is no litigation case related to land acquisition and compensation. Moreover, this report has been prepared by NHAI, for its own funding as well as the requirements of the National Policy where involuntary resettlement takes place. During our site visit on dated on 2nd to 4th of January 2015, it appears that the project is in compliance with the applicable National Policy and in comprehensiveness with the RAP/SIA which is a part of the DPR report. On behalf of lender the Lenders Independent Engineer (LIE), M/s Frischmann Prabhu, (November 2014) is also monitoring on monthly basis the status of land acquisition, utility shifting, financial progress as well as physical progress of the project.

30.4 Information Disclosure

58. The project was disclosed to the project affected people through Gazette Notifications, which were published dated 21st of April 202 (under subsection (1) of section 3A of the National Highway Act 1956) in the Gazette of India. The notifications for land acquisition have also been published in the Vernacular language in the regional daily as well as in the English Daily Newspapers in "The Tribune" (English) and "Amar Ujala" (Hindi) both dated 22nd May 2012 and "The Times of India (English) and Divya Himachal (Hindi) both dated 17th September 2014. A sample copy of the Gazette Notification is attached as **Appendix- IX.**

59. **Gazette Notifications for Land Acquisitions:-**The Gazette of India is a public journal and an authorized legal document of the Government of India published weekly by the Department of Publication, Ministry of Urban Development. It is authentic in content, accurate and strictly in accordance with the Government policies and decisions. Through the Gazette Notifications for land acquisitions, the Central Government declared its intention to acquire the land for widening, maintenance, management and operation of National Highway No.-21(NH-21), falling within the stretch from 73.200 to Km. 186.500, in the state of Punjab and Himachal Pradesh under sub-section (3) of section 3A of the said NHAI Act 1956.

30.5 Minimization of social impacts

60. Efforts have been taken during the project planning and design stage to minimize the resettlement impact and land acquisition. During finalizing the alignment, bypasses, realignment, symmetrical widening and side widening have been proposed to minimize the social impact. Alternatives have been adopted keeping in mind the prime objective of reducing the displacement of the people and disruption of livelihoods as well as social, environmental and cost considerations. To avoid displacement of structure and disruption of life along the cities, following efforts have been undertaken to minimize negative social impact:

30.5.1 Bypass

61. To offer better connectivity and to run smooth traffic in the congested area and towns to avoid acquisition of structures, house and displacement of existing population residing in the villages two number of bypasses (Sunder Nagar Bypass which accounts 5.678 Km. of length & Ner Chowk Bypass which accounts 4.550 Km. of length) of total length of 10. 228 Km. have been proposed. The chainage wise details of bypass have given in Table-3.

30.5.2 Realignments

62. To minimize the social impact, and to improve better connectivity and for smooth traffic along the project stretch most of the alignment has been realigned which was about 51.057 Km. long realignment/geometric improvements have also been proposed in the existing project stretch.

31. LAND ACQUISITION IN THE PROJECT

63. The existing RoW all along the project corridor is around 11 to 24 m. The proposed RoW is 45m, except at the link connectivity (24m-30m) and tunnels with 20m. Land acquisition is being done by NHAI with the help of the district administration. As per Lenders Engineers' Report, August 2014 the total land required for the widening and strengthening of the existing 2-lane road carriageway section of NH-21 by 4 laning is 374.2076 Ha out of which the existing RoW is 44.05 Ha., private land is 183.6367 Ha. and forest land is 121.8834 Ha. The total land acquisition for the subproject is given **Table:-8**.

Table-8: Total Land Required for the Project

Sl No	Ownership of Land	Required Land in Ha.	Land Already Acquired Ha.	Remaining land to be Acquired Ha.	Remarks
1	Forest Land	121.8834	119.8834	3.3400	• Stage-II Forest Clearance for 119.8834 Ha has taken. • 3.34 Ha of forest land under Sundernagar Bypass is in process of Notifications (3A published).
3	Private Land	208.2742	183.6367	24.6375	3A Published.
4	Within Existing RoW	44.0500	44.0500	0	
Total		**374.2076**	**347.5701**	**27.9775**	RoW of entire length except Sunder Nagar Bypass is available with the Concessionaire.

Source: LIE, November 2014

64. During the discussion it was informed by the concessionaire that the land acquisition is being carried out by the Concessioning Authority i.e. NHAI after the official Gazette Notification was published dated 21st of April 202 (under subsection (1) of section 3A of the National Highway Act 1956) in the Gazette of India. The notifications for land acquisition have also been published in the Vernacular language in the regional daily as well as in the English Daily Newspapers in "The Tribune" (English) and "Amar Ujala" (Hindi) both dated 22nd May 2012 and "The Times of India (English) and Divya Himachal (Hindi) both dated 17th September 2014. A sample copy of the Gazette Notification for land acquisition is attached as **Appendix- IX.**

65. As per the Concession Agreement subject to provision of Section 10.2.2 and Schedule-B of Concession Agreement, the Concessioning Authority has handed over encroachment free and free from all encumbrance Right of Way (RoW) has handed over to the subproject developer. The RoW hand over letter from NHAI to the Concessionaire, the KNCEL.by NHAI for the sub-project is given in **Appendix- X.**

66. During the site visit and discussion with the concessionaire it was told that, major part of land acquisition was completed and land was already available with the concessionaire except at Sunder Nagar bypass. It was also informed that there is no outstanding grievance/issue with respect to the land acquisition and compensation.

32. COMPENSATION AND ENTITLEMENT:

67. Land acquisition is being done by NHAI as per the applicable policy of NHAI Act-1956. The compensation for the loss of land and structures has been decided by competent authority. The payment of compensation is being paid by NHAI through RTGES/NEFT. A sample copy of funds transfer through RTGES/NEFT relating to payment for compensation is attached as **Appendix-XI.**

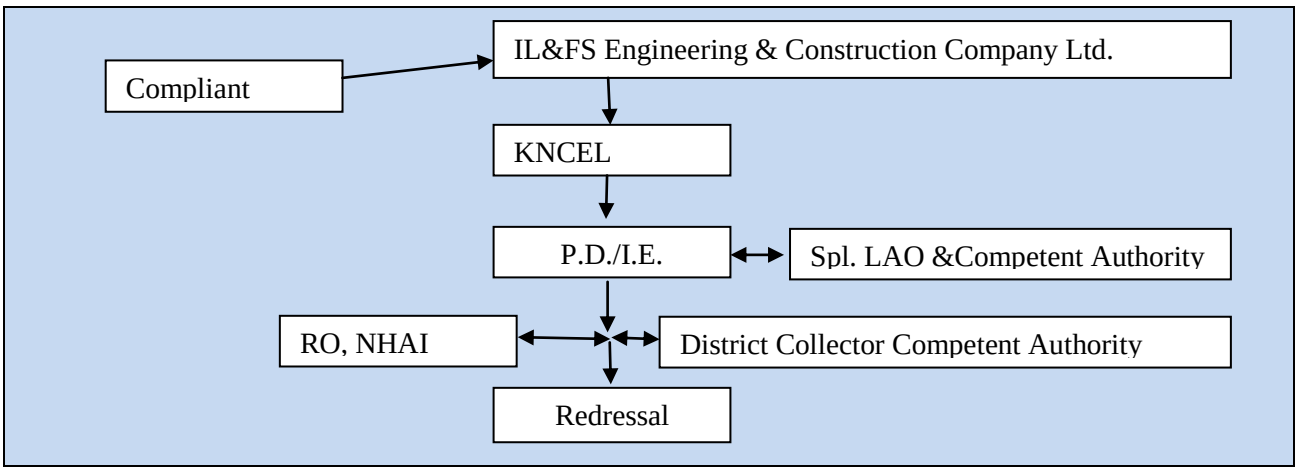
68. NHAI has prepared this project for its own funding requirement and not in anticipation to ADB's operation, thus the land acquisition is being done by NHAI and the compensation is being paid for loss of properties as determined by the Competent Authority for Land Acquisition is the district administration.

33. GRIEVANCE REDRESSAL MECHANISM

69. KNCEL has formed their own grievance redressal mechanism to deal with the land acquisition and resettlement issues in the project area. Whenever any complaints receives in writing from any project affected person, at first the complaint will forward to the IL&FS Engineering & Construction Company Ltd., to resolve the issue/matter at project level. If the site in-charge is unable to resolve the issue and the gravity of the issues is not within his purview, then the matter will be forwarded to KNCEL, if the matter required to forward to NHAI then it may be forwarded to the Project Director or Independent Engineer to resolve the issue amicably. Regional Officer (RO), NHAI will try to resolve the issue, if required he will take the help of the competent authority.

70. For early resolution of any issue and on time completion of project, the project authority has formed their own institutional arrangements to deal with the land acquisition and resettlement issues in the project area. The flow chart showing the grievance redressal mechanism is provided in **Figure- 3.**

Figure-3: Grievance Redressal Mechanism



71. As information provided by the concessionaire, there is no pending litigation cases related to land acquisition and compensation**.**

34. RESETTLEMENT IMPACT IN THE SUB-PROJECT

72. During the site visit it was observed that the project corridor passes through mostly, private and forest lands on along project corridor, during the project planning and preparation stage the Concessioning Authority has taken due care and consideration not to disturb any major settlement areas two numbers of bypasses have been proposed to avoid the major resettlement. During the site visit, it was also observed

that most of the major cities/habitation area have been avoided by providing bypasses and to minimize the impact of resettlement and rehabilitation two number of bypasses has been proposed.

73. As informed by the subproject developer as well as in the LIE Report November 2014, the major portion of land acquisition was completed except in the Sunder Nagar Bypass. It is also informed that no substantial resettlement and rehabilitation was involved in this project but some impact on private structures like; residential, commercial, residential cum commercial structures are being affected due to the 4 laning of the sub-project. However, the affected people are compensated before handing over the land to the concessionaire. The details of affected structures along the project are given in **Table-9**.

Table-9: Type of Structures Affected

Sl. No.	Type of Structures Affected	Number of Structures Affected
1	Pucca	750
2	Semi Pucca	202
3	Kutcha	158
Total		**1110**

Source: Sub Project Developer

34.1 Impact on Religious properties

74. It was observed during the site visit that the alignment has been so designed in a manner that there are negligible numbers of properties are affected. As informed by the subproject developer that if required, few number of affected properties may be shifted from the RoW, since the physical progress is only 18. 45%, the number of structures avoided/ displaced will be provided during Annual Audit. The religious structures are basically small temples or structures and if relocation of religious structures required then it will be done with prior discussion with the local people. Moreover it was also assured that, considering the sentiments of the local people all new structures will be constructed in a place agreed by local people. Further, it was also told by the project authority that all new structures will be better than the existing one.

34.2 Local employment Generated by the Concessionaire

75. As informed by the concessionaire, the subproject provides employment opportunities to about 1000 local people during the construction stage of the sub-project as skilled, semi-skilled and unskilled labour. Moreover, all the local people are employed in the camp sites, project offices in the subproject. During the discussion with the concessionaire, it was also informed that the EPC contractor has employed few local people as security guards, driver, cook, administrative assistants, cleaning, sweeping and maintenance of the existing road etc. Also, few vehicles from the locality have been taken on hire basis for project works and movement. The local labour employed by the concessionaire in the project is given in **Table-10.**

Table-10: Employment Generated During Construction Stage of the Project

Component	Local Labour employed
Skilled	91
Semi-Skilled	195
Unskilled	680

Local Engineer	64
Total	**1030**

Source: Sub Project Developer

34.3 Impact on Health, Safety, Hygiene on Construction Workers

76. The EPC Contractor has obtained the Labour license No. 57 (R-23)/2013/ACH (HP) for the subproject KNCEL granted by Ministry of Labour & Employment: Govt. Of India with a separate EPF Code No. RO/SML/Comp/Cov/HP-8048/7645 covered under Employees Provident Fund (EPF) for administrative convenience and to facilitate compliance in respect of all locally recruited employees/ workers with effect from 01/05/2013. The detail of EPF Code obtained by the company is given under **Appendix-XII.**

77. The company has hired skilled and unskilled workers belonging to the project region. As per the Certificate of Registration given by the Ministry of Labour & Employment, Office of the Deputy Chief Labour Commissioner, (Central), Chandigarh the maximum number of building workers to be employed on any day by the employer for the execution of contract job engaging contract labourer not exceeding 100 (one hundred).

78. During the site visit it was noticed that, the workers have been provided with adequate safety measures such as safety helmets, safety shoes, Highway jackets and gloves. Facilities like onsite accommodation with basic amenities like drinking water, toilets, transportation to work site and safety gears. Construction workers have also been provided with ready access to on- or off-site health care check-up facilities and for any minor injuries first aid tool box has been provided in base camp as well as with site offices. The detail of Labour license is given under **Appendix-XIII.**

34.4 Details of Corporate Social Responsibility (CSR) Activity

79. Under Corporate Social Responsibility the subproject developer, KNCEL has proactively engaged themselves by identifying various the welfare activities like; Education, Health, Employment and Livelihood facility for the people in the project affected area. After identifying the immediate requirements of the project affected people through the base line survey, the subproject developer has engaged four numbers of NGOs to provide different type of support to the project affected people.

80. The subproject developer has hired four Non-Government Organization (NGOs) i) Institutional Development Society, Dehradun for Agricultural Cultivation support to the villagers ii) Magic Bus, to motivate the children to increase the enrolment and to minimize the school dropout in Primary and Secondary schools iii) Samridhi, for Agricultural Processing iv) Smile Foundation for Medical Mobile Unit support in the village. The details of community development activity under Corporate Social Responsibility (CSR) has taken by the subproject developer is given in **Appendix-XIV.**

81. As part of goodwill gesture and responsibility towards the affected community, some of the welfare activities have been listed by the subproject developer under CSR activities. While addressing the needs of the local community, the project authorities have earmarked some of the activities for the local people's development, which are as follows:

Health/Medical Facility:

- Eye check-up camp has been organized in 23 villages, 472 villager have been screened, out of which 48 Cataract patients were operated at Maranda Hospital of Harlog villge;

- Second Eye check-up camp has been organized in another 25 villages, 450 villager have been screened, out of which 35 Cataract patients were operated at Jhanduta villge;

- Medical Mobile Unit with emergency contact number has been provided in the village area for smooth and easy transportation of patients to the nearby medical through Smile Foundation.

Education Facility:

- To improve the quality of education and awareness some programme in Govt. Schools through Magic Bus intervention is being conducted;

- To minimize the school dropout and to encourage the literacy in village level, National Sports Day/Children Day/ District Level Tournament/Sports/Game activity has been organized;

Awareness Camp:

- Snake bite awareness programme with the help of trained people has been organized in 42 villages;

- Life Saving Skills Programme through Sports/Games with the help of a NGO Magic Bus.

Income Generation:

- Thirty four youths have been inducted in advance wielders training programme at IETS Skills in Ropar, linked with placement, out of which Elevens are got placement and rest are self-employed;

- Ten youths have been inducted in Hospitality Training Programe at IIS Nahan linked with placement in Hotel Industry, out of which seven are got placement in Rajasthan and three are self-employed.

Livelihood:

- The concessionaire has earmarked few of the identified programme through the need of the local people with the help of Samridhi, which includes vegetable cultivation, fruit processing and agricultural products marketing through clusters;

- Piloting of medium term spice cultivation with 16 farmers in Maura of Punjab, for which land has been identified, 11 farmers are growing the nursery of onion. They had involved the KVK Punjab who will be providing technical support for the farmers;

- Samridhi is in process to processing the raw material gandyali, galgal & amla (for candy) through SHG's and also organized training programmes. After processing the gandyali, galgal & amla, pickle would be sold by brand name of Samridhi co-operative Women Society-Palampur

- Production & marketing of processed agri-produce through 7 women groups (total 50 women) of 4 villages in Auhar Cluster.

35. DISCLOSURE:

82. The final ESDDR report will be accepted and owned by the Concessionaire and endorsed by IIFCL. After getting the No Objection Certificate (NOC) from the ADB, the report will be uploaded for public disclosure in IIFCL's website, Project developer's website as well as ADB's website.

36. MONITORING:

83. On behalf of NHAI the appointed Independent Engineer M/s Getinsia Ingeniers S.L., Spain in association with Segmental Consulting and Infrastructure Advisory Pvt. Ltd. is being monitored periodically and submitting the periodic compliance monitoring report to NHAI for the subproject which also includes the status of land acquisition, compensation, any disputes and utility shifting.

84. On behalf of Lenders the Lenders Independent Engineer (LIE) M/s. Frischmann Prabhu is monitoring the financial as well as physical progress of the project and submitting the Quarterly Progress Report to the lenders which captures status of tunnels, bypasses land acquisition, status of tree cutting, utility shifting, maintenance and applicable permits.

37. SITE VISIT OBSERVATIONS

85. Site visit was undertaken by the ESMU team of IIFCL on 2nd to 4th of January 2015 to understand the project and safeguard procedures adopted by the subproject developer. During the site visit it was observed that:

- As informed by the subproject developer during the site visit that more than 1000 numbers of local labours are being engaged in the construction activities for skilled semi-skilled and unskilled activities;
- During the discussion with the developer , it was observed that few of the vehicles are hired from local for support of the project;
- Within the camp site it was observed that the EPC contractor has maintained proper sanitation facilities of drainage, sewerage, hygiene in mess, for drinking water they have established RO plant for workers;
- Construction workers are provided with ready access to on- or off-site health care check-up facilities and are being provided with first aid for minor injuries;
- Proper traffic diversions and appropriate signages are being provided at the site to prevent any disruption of life and the highway traffic.

38. CONCLUSION AND RECOMMENDATIONS

86. Based upon the available documents and site visits it appears that the subproject developer has undertaken social safeguard measures for better and on time implementation of the sub-project. The key observations on due diligence on the social impacts are summarised as follows:

- The sub-project was prepared by NHAI as per its own funding requirement and not in anticipation to ADB's operations;
- The project corridor passes through mostly on hilly terrain and forest lands on either side of the road;
- It was observed that 6671 numbers of persons will be affected in 61 villages under 3 districts.
- The existing length of the project is 113. 300 Km. and the design length of the project are approx. 84.380 Kms;

- For smooth flow of traffic in the hilly terrain, to avoid congestion in the city areas as well as to minimize rehabilitation and resettlement of project affected people, two number of bypass have been provided as a result the proposed project alignment is saving approx. 29 Km of length;

- Due to construction of bypasses about 2540 affected structures are avoided, in addition to affected structures 48 temples are also avoided;

- The project was disclosed to the project affected people through Gazette Notifications;

- Public Consultations were carried out with the different stakeholders along the project road, villages, shopkeepers, project affected people and the people of the different section of the society in six number of places along the project road;

- The developer confirmed that the Civil Works commence only after the Forest Clearance in the relevant stretch.

- Thirty four youths have been inducted in advance wielders training programme at IETS Skills in Ropar, linked with placement, out of which Elevens are got placement and rest are self-employed;

- Ten youths have been inducted in Hospitality Training Programe at IIS Nahan linked with placement in Hotel Industry, out of which seven are got placement in Rajasthan and three are self-employed.

- As per information provided by subproject developer no Schedule Caste/Schedule Tribe people get affected due to proposed project;

- Considering the socio-economic profile of the sub-project areas, it may be noted that the sub-project will improve the quality of life of the people;

- The sub-project is connecting to Leah and Ladkha region of India by connecting through State and National Highways;

- Concessionaire has undertaken various community development activities to benefit the local people which were documented in the subsection 33.4 of this report;

- The widening of the existing road will provide better transportation facility for tourists visiting Manali-Rohtang Pass from different parts of India and abroad;

- The widening of the existing road will provide better connectivity to Kulu-Manali, which is an important tourist destination in India;

- Local labourers are being hired from the locality for day to day activity and construction purposes. These labourers go back to their own houses in the evening after completing day's work;

- Based on the site visits observations and desk review, it appears that the sub-project have no negative significant social safeguard issue.

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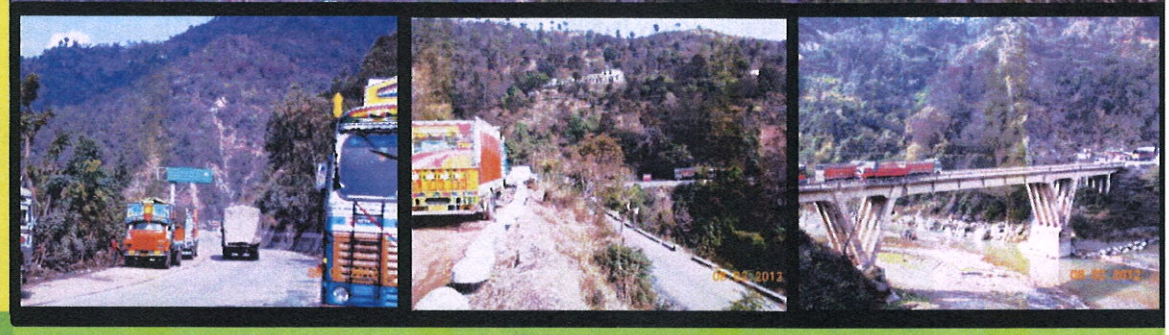
F.No. 10-118/2011-IA-III

National Highways Authority of India

(Ministry Of Road Transport & Highways)
Government of India



ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Widening and Improvement of Existing 2 Lane with Paved Shoulder to 4 Lane with Paved Shoulder of Kiratpur to Bilaspur section of NH-21 from Km. 73.200 to 134.500 in the State of Punjab and Himachal Pradesh

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September, 2012

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1. *Project Description and Scope of EIA*

This chapter presents a brief description of the project, also presents briefly the proposed project interventions and resource requirements.

1.1 PROJECT BACKGROUND

The Government of India (GoI) has acknowledged the importance of better road infrastructure and launched several programs and initiatives to extend and improve India's highway network. Road development is pivotal to sustain the country's economic growth. This is further reflected in the Ministry of Road Transport and Highways (MORTH) Road Development Plan: Vision 2021. As part of the Government's initiatives to further road development, certain existing stretches/ corridors of State Highways in the state of Himachal Pradesh/Punjab have been considered for widening to two/four lanes with paved shoulders.

Concerned by the seriousness of continuing pollution, the Ministry of Environment and Forests, GOI issued an Environment Impact Assessment (EIA) Notification on 14th September, 2006 with subsequent amendments on 1st December 2009 under which highway projects like new National Highways and expansion of National Highways greater than 30 km involving additional Right of Way (RoW) greater than 20m, involving land acquisition and passing through more than one state fall under the purview of Environment Clearance process through submission of an EIA Report.

As the proposed project is an expansion of N.H. 21, it will come under the scope of EIA Notification, falling under Category A item 7(f) of the schedule. Accordingly, EIA study of the project is required as per the guidelines of MoEF.

The present study would help the project proponent to obtain Environmental Clearance (EC) from MoEF as per the above-mentioned EIA notification.

1.2 PROJECT CORRIDOR

The project road is a new four lane alignment and a two lane widening of existing NH-21 highway section which starts from Kiratpur (existing Km 73.200) and ends near Bilaspur (Km 134.500) with paved shoulders configuration except at the tunnel which is of a two lane capacity. The improvement proposals for NH-21 are as under:

- Widening of the existing road section between Kiratpur and ends at Kainchi More (**Km. 0+000 to Km. 12+732**) and
- New alignment starts from Kainchi More and end at Bharadi village (**Km. 12+732 to Km. 26.462**). This alignment consists of 3 tunnels they are at Km. 12.732 to Km. 14.482, Km. 15.800 to Km. 16.450 and Km. 23.636 to Km. 24.030.

1.3 NEED AND OBJECTIVE

Improved road connectivity can reduce travel times and lower the costs of vehicle use. The ultimate aim of the proposed project is to promote societal welfare of Kiratpur to Bilaspur area of Punjab and Himachal Pradesh State. The developments of above widening project will play a significant role in changing the socio-economic condition of people living in this region through dynamic externalities that such development often generates.

A capacity analysis for project road section has been carried out to define the level of service offered by road under the prevailing roadway and traffic condition. Given the prevailing traffic levels, bottlenecks (terrain/R&R) on the existing road alignment and also the strategic importance

of the project road, it is expected to take off with the opening of the Rohtang Pass Tunnel, hence, recommended to build a 4 lane road on new alignment. Moreover, Kulu-Manali is an important tourist destination in India. This road construction will provide better transportation facility for tourists visiting Manali-Rohtang Pass from different parts of India and abroad. Details of proposed road widening are given in **Table 1.1.**

Table 1.1: Proposed Re-alignment & Widening of NH-21

S. No.	Chainage		Description	Remarks
	From	To		
1.	0+000	12+732	Existing widening from Kiratpur to Kainchi More	Existing 2-Lane widened to 4-Lane Road
2.	12+732	14+482	Proposed Tunnel 1 on New Alignment	2-Lane New Construction
3.	14+482	15+810	New Alignment	4-Lane New Construction
4.	15+810	16+460	Proposed Tunnel 2 on New Alignment	4-Lane New Construction
5.	16+460	23+700	New Alignment	4-Lane New Construction
6.	23+700	24+100	Proposed Tunnel 3 on New Alignment	4-Lane New Construction
7.	24+100	26+462	New Alignment ends at Nauni	4-Lane New Construction

The proposed improvement will aim at improving riding quality and journey speed and reducing traffic congestion on the highway. However, land acquisition will be required through entire stretch as it is a new alignment and the proposed ROW various from 30m to 45m.

1.4 LOCATION

The Project Corridor road starts from km 73.200 at Kiratpur (31°11'2.21"N & 76°34'16.29"E) in District Ropar in the State of Punjab and ends at km 134.500 near Bilaspur (31°16'58.44"N & 76°44'15.23"E) in Bilaspur District in the State of Himachal Pradesh. The road starts at an elevation of 289 m above MSL and ends at 521 m above MSL. It traverses through many settlements i.e., Kiratpur, Kainchi More, Swarghat and Nauni. Apart from these settlements the road also passes through a lot of small settlements at many places. Settlements details have given in (Table 1.4). Fig. 1.1 shows the location of project road on Himachal Pradesh state map. The Index Map showing the project road is at Fig 1.2. The following index map is showing the project alignment and geomorphology of the area. The elevation variation is too high. To reduce the risk tunnels are proposed on project corridor.

1.5 PROPOSED IMPROVMENTS *UPGRADING*

- Widening of existing carriageway form 2 to 4 lane.
- Change of the vertical and horizontal alingnment
- Construction new two/four lane bridges and culverts in section.
- Reconstruction of some pavement section, which are considered weak and /low laying.

1.6 UPGRADING AND REHABILITAITON

- Providing profile corrective course
- Construction of closed concrete drains in urban area and earthen drain in rural areas.
- Reconstruction of damaged culverts
- Junction improvements particularly at crossing with major road and highways.
- Providing of signage and road markig for additional safety and convenience to the road users.

Fig 1.1: Location Map

Fig 1.2: Index Map Showing the Project Road

1.6.1 Existing RoW

The existing RoW is 20-42 mtr along the project road. Major impacts on residential and commercial structures are less likely and existing RoW is adequate enough for the proposed road development except in the locations with deficient geometry. The available right of Way over the project corridor area as follow:

Table 1.2: Available ROW

S. No.	Existing Chainage (From 2 lane to 4 lane with Paved Shoulder)		ROW	Required Wirth
	From (Km)	To (Km)	(in metres)	(in metres)
1.	73.000	74.000	45.00	0
2.	74.000	75.000	45.00	0
3.	75.000	76.000	39.00	6
4.	76.000	77.000	36.00	9
5.	77.000	78.000	36.00	9.00
6.	78.000	79.000	34.00	11.00
7.	79.000	80.000	34.00	11.00
8.	80.000	81.000	26.00	19.00
9.	81.000	82.000	26.00	19.00
10.	82.000	83.000	29.00	16.00
11.	83.000	84.000	29.00	16.00
12.	84.000	85.000	27.00	18.00
13.	85.000	86.000	27.00	45.00
14.	86.000	86.938/12.732	29.00	45.00

Table 1.3: PROW in Bypass / Realignment Section

S. No.	Proposed Chainage		ROW	Required Wirth
	From (Km)	To (Km)	(in metres)	(in metres)
1.	12.732	13.000	0.00	45.00
2.	13.000	14.000	0.00	45.00
3.	14.000	15.000	0.00	45.00
4.	15.000	16.000	0.00	45.00
5.	16.000	17.000	0.00	45.00
6.	17.000	18.000	0.00	45.00
7.	18.000	19.000	0.00	45.00
8.	19.000	20.000	0.00	45.00
9.	20.000	21.000	0.00	45.00
10.	21.000	22.000	0.00	45.00
11.	22.000	23.000	0.00	45.00
12.	23.000	24.000	0.00	45.00
13.	24.000	25.000	0.00	45.00
14.	26.000	26.462	0.00	45.00

1.6.2 Major Settlements En route

The project corridor takes off from with a new four lane alignment and a two lane widening of existing NH-21 highway. It starts from Kiratpur and ends near Bilaspur (Km 134.500) with paved shoulders configuration except at the tunnel which is of a two lane capacity. There are twenty eight villages along project corridor as follows:

Table 1.4: List of Villages along the project road

S. No	State	District	Tehsil	Village	From	To	Gram Panchyat
1	Punjab	Roopnagar	Anandpur Sahib	Kalyanpur	0+000	0+658	Kalyanpur
2				Dabur	0+658	2+000	Dabur
3				Baruwal	2+000	2+548	Baruwal
4				Masewal	2+548	3+799	Masewal
5				Dahini	3+799	5+246	Dahini
6				Chamdauli	5+246	7+818	Maura
7				Maura	7+818	10+657	Maura
8	Himachal Pradesh	Bilaspur	Naina Devi Ji	Gara	8+895	9+792	Swhan
9				Ree	9+792	10+607	Ree
10				Buhai	10+607	14+427	Swhan
11				Chambujan	14+427	14+82	Ree
12				Mehla	14+82	16+995	Kutehla
13				Jangal Dadnal	16+995	17+107	Kutehla
14				Tirli	17+107	17+658	Tirli
15				Thapna	17+658	18+641	Kutehla
16				Samletu	18+641	20+038	Kutehla
17				Jabbal	20+038	20+959	Kutehla
18				Sunhan	20+959	22+32	Tali
19				Kyariya	22+32	22+828	Kutehla
20				Jungal Ftehpur	22+828	23+472	Kutehla
21				Bhated	23+472	24+627	Tali
22				Tali	24+627	24+788	Tali

S. No	State	District	Tehsil	Village	From	To	Gram Panchyat
23			Bilaspur - Sadar	Tunnu	24+788	25+282	Kaller
24				Jool	25+282	25+362	Kaller
25				Dalyar	25+362	25+495	Kaller
26				Patta	25+495	26+257	Kaller
27				Bharadi	26+257	26+462	Raghunathpura

1.6.3 Project Intervention

The new 4 lane alignment will aim at improving riding quality and journey speed and reducing traffic congestion on the highway. The proposed engineering aspects are summarized in Table 1.5.

Table 1.5: Project Interventions

S. No	Description	Proposed
1	Length of new alignment proposed	26.462 Kms
2	Length of existing alignment proposed to be strengthened / widened	61.200 Kms (as per Contract)
3	RoW width of the existing alignment	20 m to 40 m
4	RoW width of proposed alignment after widening	30 m to 45 m
5	Total length of the alignment (Kilometers)	26.462 Km (Including Realignment)
6	No. of Tunnels with Length	3 Tunnels with Length of 1.75 Km, 0.650 Km & 0.394 Km.
7	Major Bridges	05 in number
8	Minor Bridges	17 in number
9	Cross Drainage structures	77 in number
10	Type of Terrain	Plain in Punjab and Rolling & Hilly in Himachal Pradesh
11	Realignment	01 (From Kainchi More to Nauni Chowk)
12	Toll Plaza	01
13	Truck layby	01
14	Pedestrian /Cattle crossing	03
15	Bus bays and bus shelters	26

1.6.4 Realignment

The section of existing project corridor does not have sufficient ROW for developing 4-lane facility. So, one Bypass from Kainchi More to Nauni Chowk i.e. of 13.730 Km (Km.12.732 to Km.26.462) has been proposed to enhance safety in vehicle movement. General realignment and improvement details have been shown in Table 1.6.

Table 1.6: The section details of the new alignment are as under

S. No	Section Detail	From	To	Length
1	Kiratpur to Kainchi More: improvement of existing alignment to 4-lanes	0.000	12.732	12.732 Km
2	Kainchi More to Nauni Chwok Realignment section	12.732	26.462	13.730 Km
			Total Length	**26.462 Km**

1.6.5 Tunnels

As described below, in order to traverse the intervening hill sections along the new alignment three tunnels have been proposed as indicated below:

Table 1.7: Two lane vehicular tunnels at following locations are proposed

S. No	Proposed Chainage		Length	Lanes
	From	To		
1.	12.732	14.482	1.750	2 Lane with Escape tunnel
2.	15.800	16.450	0.650	2 Lane
3.	23.636	24.030	0.394	2 Lane
	Total Length		**2.794**	

The tunnels shall be designed as per IRC:SP:91-2010 as two lane bi-directional Traffic Tunnels. Escape Tunnel of 1905.00 m shall be provide parallel to the main tunnel: 1. Cross-sections of Main tunnel and two alternate cross-sections of Escape Tunnel are enclosed to choose from at the time of designing the tunnel.

Table 1.8: The section details of the New Alignment

S. No	Design Chainage		Length	Remarks
	From	To		
1.	12.732	14.482	1.750	With Escape Tunnel
2.	15.800	16.450	0.650	2 Lane
3.	23.236	24.030	3.940	2 Lane

1.6.6 Proposed Right-of-Way (ROW)

The proposed right of way (RoW) of the project corridor is 35-45 m. the details of the proposed RoW are as under:

Table 1.9: Proposed ROW

S. No	Design Chainage		Proposed ROW In Meters	Remarks
	From	To		
1.	0.000	0.450	35.0	
2.	0.450	7.680	45.0	
3.	7.680	8.000	54.5	Truck Lay Bye
4.	8.000	8.100	45.0	
5.	8.100	8.775	150.0	Toll Plaza
6.	8.775	12.732	45.0	
7.	14.500	26.462	45.0	

1.6.7 Bridges & Culverts:

There are 2 major bridges exist on the project road, 17 are minor bridges and remaining 77 are cross drainage structure.

Cross Drainage Structures

The road includes cross over river, canals, seasonal drains and streams. The terrain of the project area is sloping, rolling and mountainous. The bridges and culverts are important from environmental point of view since they will minimize disturbance of the natural drainage pattern which would otherwise lead to stagnation and water logging especially near settlements. Details of the cross drainage structure of the project corridor are presented in Table 1.10.

Table 1.10: Details of the Cross Drainage structures of the project road

S. No	Bridge	Major Bridges	Minor Bridges	Culverts
1.	Existing	2	4	41
2.	Proposed	5	17	77

The details of the proposed improvements for the cross drainage structures are -

- Replacement of existing structures with new structures with two locations
- New structures to fit the proposed widening of the road with twenty location.

- Reconstruction or repairing of parapet walls
- Pitching of slopes for the control of soil erosion.
- Proposed of new culverts or upgradation of exiting culverts

Table 1.11: Existing Major Bridges and Proposed Improvements (From Km. 0.000 to 12.732)

S. No.	Existing Chainage	Span Arrangement	Length	Proposal for Structures	Type of Superstructure	Type of Foundation
1	73.654	5 x 8	40	2-L New Proposed	Solid Slab	Open Foundation
2	79.322	3 x 9.45	28.35	2-L New Proposed	Solid Slab	Open Foundation

Table 1.12: Proposed Major Bridges after Kainchi Morh (From Km 12.732 to Km 26.462)

S. No.	Location	Span	Length	Lane	Type of Super-Structure	Type of Foundation
1.	14.700	1 x 13.0	13	4-Lane	RCC-T Beam	Open Foundation
2.	14.870	1 x 13.0	13	4-Lane	RCC-T Beam	Open Foundation
3.	15.060	1 x 18.0	18	4-Lane	RCC-T Beam	Open Foundation
4.	15.108	1 x 18.0	18	4-Lane	RCC-T Beam	Open Foundation
5.	15.734	1 x 45.0	45	4-Lane	BOX Girder	Open Foundation
6.	16.635	1 x 35.0	35	4-Lane	PSC-T Beam	Open Foundation
7.	16.800	1 x 13.0	13	4-Lane	RCC-T Beam	Open Foundation
8.	18.958	1 x 25.0	25	4-Lane	PSC-T Beam	Open Foundation
9	17.525	1 x 18.0	18	4-Lane	RCC-T Beam	Open Foundation
10.	17.636	1 x 35.0	35	4-Lane	PSC-T Beam	Open Foundation
11.	18.265	1 x 40.0	40	4-Lane	BOX Girder	Open Foundation
12.	19.400	2 x 40.0	80	4-Lane	BOX Girder	Open Foundation
13.	20.535	1 x 45.0	45	4-Lane	BOX Girder	Open Foundation
14.	21.000	40+70+40	150	4-Lane	BOX Girder	Open Foundation
15.	21.550	2 x 30	60	4-Lane	BOX Girder	Open Foundation
16.	23.100	App. 400	400	4-Lane	BOX Girder	Open Foundation
17.	24.925	2 x 45	90	4-Lane	BOX Girder	Open Foundation
18.	25.175	1 x 25.0	25	4-Lane	PSC-T Beam	Open Foundation
19.	25.250	1 x 13.0	13	4-Lane	RCC-T Beam	Open Foundation
20.	26.100	App. 300	300	4-Lane	RCC-T Beam	Open Foundation

1.6.8 Culverts

There are total three types of culverts i.e. Slab, Hume pipe and others. There are total 18 no of slab culverts exist within project stretch. Total number of 22 hume pipe culvers are identified within project road and one detorirated culvert is exist. Inventory has been recorded as per guidelines of IRC: SP: 19-2001.

Table 1.13: List of Existing Culvert

S. No	Type of Culvert	Number of Culverts	Remarks
1.	Slab	18	
2.	Hume Pipe	22	
3.	Others	1	Deteriorated

Proposal

The list of the existing culverts on the project stretch of NH-21(From Km 0.000 to Km 12.732) is given in Table 1.14.

Table 1.14: List of proposed culvert on the existing alignment

Sl. No.	Chainage	CD No.	Size	Culvert Type	Remarks
1	0.163	1/1	1 X 2m	Slab	Reconstruction With Slab
2	0.407	1/2	1 X 2m	Slab	Reconstruction With Slab
3	0.828	1/3	1 X 2m	Pipe	New Construction With Pipe
4	1.240	2/1	1 x 1.5m	Pipe	New Construction With Pipe

Sl. No.	Chainage	CD No.	Size	Culvert Type	Remarks
5	2.349	3/1	1 x 1.5m	Slab	Reconstruction With Slab
6	2.857	3/2	1 X 1.5m	Slab	Reconstruction With Slab
7	3.002	4/1	1 X 1.2m	Slab	Reconstruction With Slab
8	3.510	4/2	1 X 1.2m	Slab	Reconstruction With Slab
9	3.859	4/3	1 X 1.5m	Slab	Reconstruction With Slab
10	5.507	6/1	1 X 1.8m	Slab	Reconstruction With Slab
11	5.903	6/2	1 X 3.5m	Slab	Reconstruction With Slab
12	6.596	7/1	1 X 3.5m	Slab	Reconstruction With Slab
13	7.387	8/1	1 X 3.5m	Slab	Reconstruction With Slab
14	7.511	8/2	1 X 3.5m	Slab	Reconstruction With Slab
15	7.632	8/3	1 X 1.2 m	Slab	Reconstruction With Slab
16	8.862	9/1	1 X 1.2 m	Slab	Reconstruction With Slab
17	8.975	9/2	1 X 1.2 m	Pipe	New Construction With Pipe
18	9.100	10/1	1 X 1.2m	Pipe	New Construction With Pipe
19	9.225	10/2	1 X 1.2m	Pipe	New Construction With Pipe
20	9.350	10/3	1 X 1.2m	Pipe	New Construction With Pipe
21	9.540	10/4	1 X 1.2m	Pipe	New Construction With Pipe
22	9.675	10/5	1 X 1.2m	Pipe	New Construction With Pipe
23	9.816	10/6	1 X 1.2m	Pipe	New Construction With Pipe
24	10.154	11/1	1 X 1.2m	Pipe	New Construction With Pipe
25	10.325	11/2	1 X 1.2m	Pipe	New Construction With Pipe
26	10.350	11/3	1 X 1.2m	Pipe	New Construction With Pipe
27	10.416	11/4	1 X 1.2m	Pipe	New Construction With Pipe
28	10.591	11/5	1 X 1.2m	Pipe	New Construction With Pipe
29	10.842	11/6	1 X 1.2m	Pipe	New Construction With Pipe
30	10.992	11/7	1 X 1.2m	Pipe	New Construction With Pipe
31	11.186	12/1	1 X 1.2m	Pipe	New Construction With Pipe
32	11.298	12/2	1 X 1.2m	Pipe	New Construction With Pipe
33	11.450	12/3	1 X 1.2m	Pipe	New Construction With Pipe
34	11.734	12/4	1 X 1.2m	Pipe	New Construction With Pipe
35	11.820	12/5	1 X 1.2m	Pipe	New Construction With Pipe
36	11.955	12/6	1 X 1.2 m	Slab	New Construction With Slab
37	12.180	13/1	1 X 1.2m	Pipe	New Construction With Pipe
38	12.315	13/2	1 X 1.2 m	Slab	New Construction With Slab
39	12.400	13/3	1 X 1.2 m	Slab	New Construction With Slab
40	12.550	13/4	1 X 1.2 m	Slab	New Construction With Slab
41	12.718	13/5	2 x 3.0 m	Pipe	New Construction With Pipe

The list the proposal for the culverts on the proposed alignment is given in following table.

Table 1.15: List of culvert on the proposed alignment

Structure	Design Chainage	Type of Structure	Proposed Span Arrangement
1.	14+912	Box	3 x 3m
2.	15+400	Box	3 x 3m
3.	15+525	Pipe	1 x 1.2m
4.	16+400	Slab	1 x 2.0m
5.	17+086	Pipe	1 x 1.2m
6.	17+267	Slab	1 x 3.0m
7.	17+466	Slab	1 x 3.0m
8.	17+679	Slab	1 x 3.0m
9.	17+880	Slab	1 x 5.0m
10.	18+115	Pipe	1 x 1.5m
11.	18+458	Box	2 x 2.0m
12.	18+738	Slab	1 x 4.0m
13.	18+892	Box	2 x 2.0m
14.	19+075	Box	2 x 2.0m

Structure	Design Chainage	Type of Structure	Proposed Span Arrangement
15.	19+266	Slab	1 x 3.0m
16.	19+656	Slab	1 x 3.0m
17.	19+856	Pipe	1 x 1.5m
18.	20+106	Box	2 x 2.0m
19.	20+236	Slab	1 x 6.0m
20.	20+366	Pipe	1 x 1.5m
21.	20+666	Pipe	1 x 1.2m
22.	20+865	Slab	1 x 5.0m
23.	21+236	Slab	1 x 3.0m
24.	21+443	Slab	1 x 4.0m
25.	21+653	Pipe	1 x 1.2m
26.	21+832	Box	2 x 2.0m
27.	22+194	Box	2 x 2.0m
28.	22+353	Slab	1 x 1.2m
29.	22+713	Slab	1 x 1.2m
30.	24+142	Pipe	1 x 1.2m
31.	24+464	Slab	1 x 2.0m
32.	24+713	Slab	1 x 4.0m
33.	25+040	Box	3 x 2.5m
34.	25+450	Pipe	1 x 1.2m
35.	25+600	Slab	1 x 2.0m
36.	25+800	Box	2 x 2.0m

1.6.9 Intersections

There are number of intersections along the project corridor with various categories of roads. There are 5 major intersections of primary importance of roads. These areas as follows:

Table 1.16: List of Intersections on the Proposed Alignment

S. No.	Existing Chainage (km)	Design Chainage (km)	Side (Left / Right)	Carriageway Width (m)	Category of Road
1.	73+200	0.000	Kiratpur	-	Link road
2.	80+017	6.825	Dehni	Nalagarh	Link road
3.	86+000	12.732	Naina Devi	-	Link road
4.	Realignment	17.225	Bhag-chal	Manjed	Link road
5.	Realignment	26.462	Ferry Ghat	Bharadi	Link road

Others Proposed project corridor has three pedestrian cum cattle underpass, one toll plaza, one truck lay by and 26 bus bays cum bus shelters.

a) Parapet Walls on High Embankment Areas
As a measure of safety, parapet walls on high embankment areas have been provided

b) Provision of Grade Separation (Flyover)
There is no major crossing between the New Alignment and existing way so grade separator has proposed.

c) Provision of Breast Wall on the Hill Side and Retaining Wall on the Valley Side
The provision of breast wall to retain the excavated soils along the hill side and also the provision of retaining wall to retain soil towards the valley side has been made.

1.7 CONSTRUCTION MATERIAL

The major construction material required for the project are soil, sand, aggregates, bitumen, steel and cement, soil required for the project will be procured from local borrow areas, which are located mainly in agricultural fields where topsoil has been removed. The gravel material will be excavated from the riverbed of the river originating in the hills and deposited at the foot hills will be used as Granular Sub Base.

1.7.1 Borrow Area Soil

Extensive survey was conducted to locate the potential sources of borrow area soils required for the construction of embankment and subgrade. A total of 6 borrow areas located on both sides along the project road were identified. The locations, lead, owner and tentative area of borrow soil available are given in Annexure 1.1. The excavated material from borrow pits will be compensated with waste material from locations where excavation for widening is carried out. Details and Lead Chart for Borrow areas are given in Annexure 1.2.

1.7.2 Quarry Materials

(I) Stone Metal: Four (4) stone quarries were identified as the potential sources of coarse aggregates required for road construction which is mentioned below. Lead distances of these quarries from the project road are found in the range of 10 km to 35 km. Lead Chart for Quarry areas are placed are given in the table below:

1. Ch. 73.000 R/S, HSD Stone Crusher, Lead 46 Km (Village Chararu On Mubarakpur road)
2. Ch. 73.000 L/S, Jai Bhole Shankar Stone Crusher, Lead 46 Km (Samtana Village, near Ukhli, 46 km from Ghaghas
3. Ch. 73.000 L/S, Bansal Enterprises, Lead 12 km (Village Bharatgarh)
4. Ch. 82.500 L/S, Ruhani Stone Crusher, Lead 3 Km (Near Jhajhra Village)
5. Ch.106+000 R/S. Kailur Stone Crusher Lead 1 Km
6. Ch.145+700 L/S, Jeevan Industry Crusher, Lead 8 Km

(II) Sand: A total of three (3) sources were identified as potential sources for sand within a lead distance of 2 km to 50 Kms. Lead chart of these identified sources is shown in the table below.

1. Ch. 73+200 R/S. from Kiratpur towards Hoshirpur Lead 50 Km (Swan River)
2. Ch. 76+700 L/S, From Bagla village Lead 1 Km (Kansa River)
3. Ch. 82.500 R/S, From Punjab Himachal Pradesh Border Lead 3 Km (Androla River, Jogon River, Mahadev River, Lohund River and Panjera River)

1.7.3 Manufactured Materials

(I) Cement: Ordinary Portland cement of Grade 43 and 53 manufactured by various manufacturers are locally available. Cement shall be conforming to IS: 8112 and / or IS: 12269. During material survey, the following factories were identified nearby the project area. List of factories are shown in Table 1.17.

Table 1.17: List of Cement Factories available near the project road

S. No	Name of Cement Company	Location/ Village	Lead from Project Road, Km	Remarks
1	ACC-Gagal Cement Works	Gagal	26	Km 151+300 (RHS)
2	Jaypee Himachal Cement Blending Unit (JHCBU)	Tikari (Pandiyana)	1.5	1.5 km on NH-21

(II) Structural Steel: High strength deformed bars manufactured by various steel manufacturing companies conforming to IS 1786 are available with local stockists. Before incorporation into the work, steel shall be got approved by the engineer.

(III) Bitumen: Since the project road will be subjected to moderate intensity of traffic during the design period and considering the prevailing climatic condition, it is recommended to use VG-30 Grade Bitumen conforming to IS: 73 - 2006 in the bituminous binder course and VG-20 in the wearing course. Two (2) sources are identified as probable sources of bitumen at IOCL, Mathura and IOCL, Panipat.

1.7.4 Other Construction materials

(I) Fly Ash: Source of Fly-ash is identified as Guru Gobind Singh Super Thermal Power Plant, at Ropar, near Ghanauli, Punjab, approximately at Km 52 of NH-21, left side of the road.

(II) Water: Six (6) sources of water samples were indentified and water samples were collected from the same sources located within the project-influence area.

1. Ch. 0+500, R/S Canal Water
2. Ch. 8+600, L/S 75 ft, Boring
3. Ch. 12+500, L/S 300 ft, Boring
4. Ch. 23+200, R/S River Water
5. Ch. 26+100, R/S River Water
6. Ch. 26+100, L/S 50 ft, Boring

Major Materials are to be used in this project as follow:

Table 1.18: Major Material Required for Construction from Kiratpur to Bilaspur Project

S. No	Item Description	Unit	Quantity
1	Cutting	Cum	3,460,101
2	Filling	Cum	3,164,544
3	Aggregate	MT	810,907
4	Boulder	MT	437,053
5	Cement	MT	45,694
6	Steel (Reinforcement, Structural Steel, HT Strends, Liners etc.)	MT	12,974
7	River Sand	MT	117,280
8	Bitumen	MT	8,143
9	Emulsion	MT	394
10	Geo Textile	Sq. M	123,000

1.8 SCOPE OF WORKS

The Terms of Reference (ToR) for carrying out the EIA study was approved by the Expert Appraisal Committee in its 109rd meeting held on 10th February, 2012 at Conference Hall-2, India Islamic Cultural Centre, 87-88, Lodhi Road, New Delhi.The summary of the scope of work related to EIA is as mentioned:

- The project required 3 tunnels of 1.75, 0.65 and 0.394 km. The project required 4 tunnels of 2.84 km. examine and submit the stability of slopes, control of soil erosion from embankment, the details of the tunnel and locations of tunneling with geological structural fraction.
- Examine and submit the details of Ventilation, drainage, Noise and vibration management measures in the tunnel area.
- The proposal requires 17.31 ha Protected forest land. Necessary Stage-I permission for diversion of forest area shall be submitted.

- It is indicated that 2035. nos. trees are proposed to be cut, the information should be provided about their species and whether it also involved any protected or endangered species. Necessary green belt shall be provided on both side of the highway with proper central verge and cost provision should be made for regular maintenance.
- The additional ToR and General Guidelines as per the annexure-I and Annexure-II respectively to this Minute shall also be considered for preparation of EIA/EMP.
- Submit the details of the road safety audit and plans for meeting the IRC safety requirements.

1.9 TRAFFIC CHARACTERISTIC

In order to comprehensively appreciate the traffic and travel characteristics on the project corridor the type of surveys, locations and duration, identified at the inception stage of the study have been followed during data collection exercise with minor modifications on account of site conditions. The present traffic scenarios are as follow:

Table 1.19: Traffic on Homogenous Sections

Location (Km)	ADT				AADT (Including Seasonal Factors)			
	Motorised Only		Including NMT		Motorised Only		Including NMT	
	Veh's/Day	PCUs	Veh's/Day	PCUs	Veh's/Day	PCUs	Veh's/Day	PCUs
Km. 91.500	5938	15068	5940	15069	5938	15068	5940	15069
Km. 102.000	8006	20070	8008	20075	8006	20070	8008	20075
Km. 128.000	6292	12784	6300	12791	6292	12784	6300	12791

With a view to capture section-wise traffic flow characteristics, the project corridor has been alienated into three traffic-homogeneous sections, based upon the locations of major intersections/urban settlements that act as main collectors or distributors of traffic along the project corridor; i.e., sections of more or less similar traffic characteristics form one homogeneous section and one heterogeneous section.

Table 1.20: Traffic on Homogenous Sections

Section	Section Name	Chainage (Km)		Length (Km)
		From	To	
Section: I	HS-I (Kiratpur to Swarghat)	73.200	95.000	21.8
Section: II	HS-II (Swarghat to Nauni chowk)	94.600	126.800	32.0
Section: III	HS-III (Nauni Chowk to Bamta chowk)	126.800	137.300	10.3

The traffic levels have been forecasted based on the possible growth in socio-economic indicators at the state level. Amongst all indicators, population, per capita income/ NSDP, agricultural, mining and industrial growth are considered to be key indicators affecting passenger and goods vehicular traffic growth on any corridor.

The approach to traffic forecast in this report, apart from relating economic growth and elasticity with vehicular growth, also incorporates area-specific disparities in economic growth by way of linking an area's specific (by traffic zones) economic growth in estimating traffic growth rate for future years.

Roadside interview data were used to assess the modal trip ends by traffic zone. The trip end factor (zonal contribution to overall) at the base year, multiplied with the economic growth of the contributing zones and their elasticity values, result in the modal growth factor. The summation of growth factors of the entire modal trip ends yields the traffic growth rate for that particular year.

Table 1.21: Projected Traffic on the Project Corridor

Year	HS-I		HS-II		HS-III	
	Vehicles	PCUs	Vehicles	PCUs	Vehicles	PCUs
2011	5940	15069	8008	20075	6300	12791
2016	7549	19163	10181	25539	7998	16242
2021	9604	24393	12954	32514	10162	20639
2026	12224	31062	16497	41421	12924	26252
2031	15569	39572	21015	52787	16451	33416
2036	19841	50439	26784	67288	20952	42562

The capacity analysis has been worked for the chainage as follows:

Table 1.22: Projected Traffic on the Project Corridor and Requirement of Lanes

Year	HS-I km 73.200 –km 95.000		HS-II km 94.600 to km 126.800		HS-III km 126.800 to km 137.300	
	AADT (PCUs)	Requirement	AADT (PCUs)	Requirement	AADT (PCUs)	Requirement
2011	19163	4-Lane	25539	4-Lane	16242	4-Lane
2016	20111	4-Lane	26802	4-Lane	17040	4-Lane
2021	24393	4-Lane	32514	6-Lane	20639	4-Lane
2026	31062	6-Lane	41421	6-Lane	26252	4-Lane
2031	39572	6-Lane	52787	6-Lane	33416	6-Lane
2036	50439	6-Lane	67288	6-Lane	42562	6-Lane

- As per the existing traffic condition the Project Corridor is feasible for 4-Lanning in the 2011.
- And as per traffic Projection the Project Corridor shall be feasible for 6-Lanning by 2026.

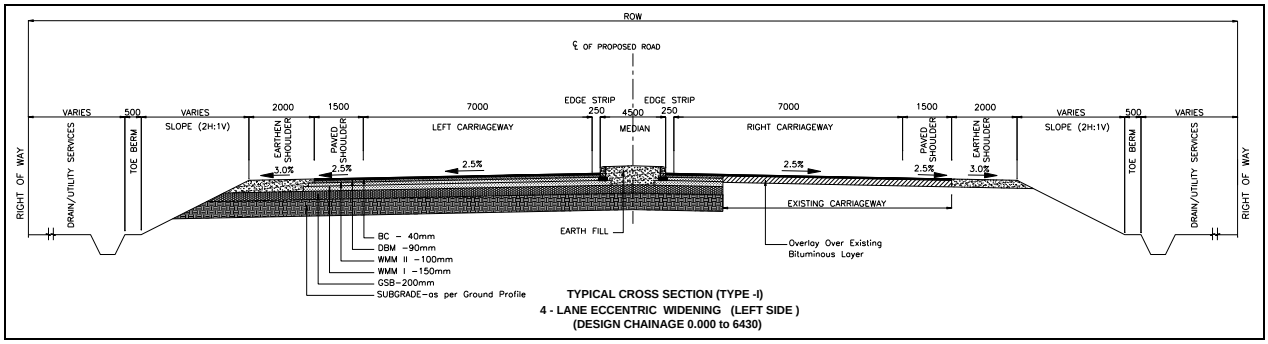
Accident Prone Area: The following locations are black spots on the corridor they are at Kanchi More between chainage Km. 82.000 to Km. 84.000, at Swarghat between Km. 95.000 to Km. 96.000, at Ghambar at Km. 103, at Chhadol at Km. 108.000, at Jamli from Km. 113.000 to 114.000 and at Nauni from Km. 122.000 to Km. 123.000.

Table 1.23: Year wise Accidents Records along the Project Corridor

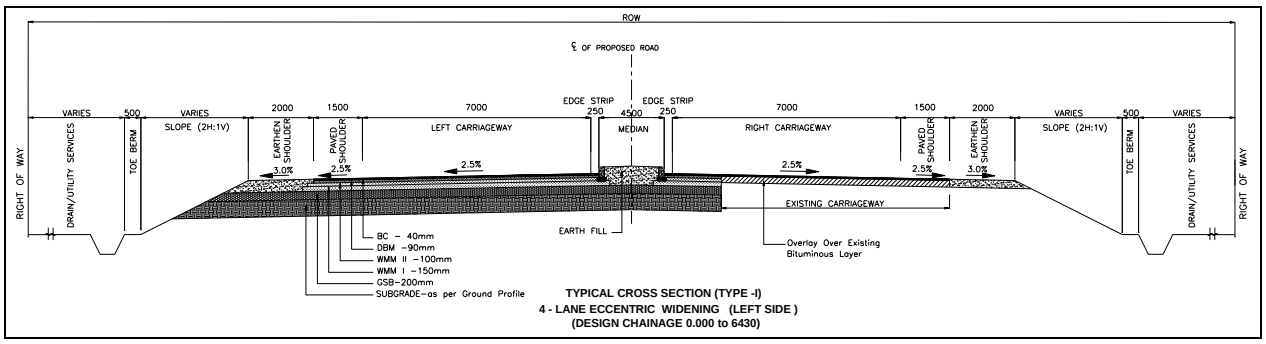
Year	No. of Total Accidents	Type of Accident		Number of Deaths/Injured/Total		
		Fatal	Serious	Deaths	Injured	Total Nos.
2011	114	7	107	19	174	193
2010	93	9	84	22	160	182
2009	86	11	75	26	148	174
2008	99	14	85	21	136	157
2007	108	12	96	22	140	162

1.9.1 Typical cross sections

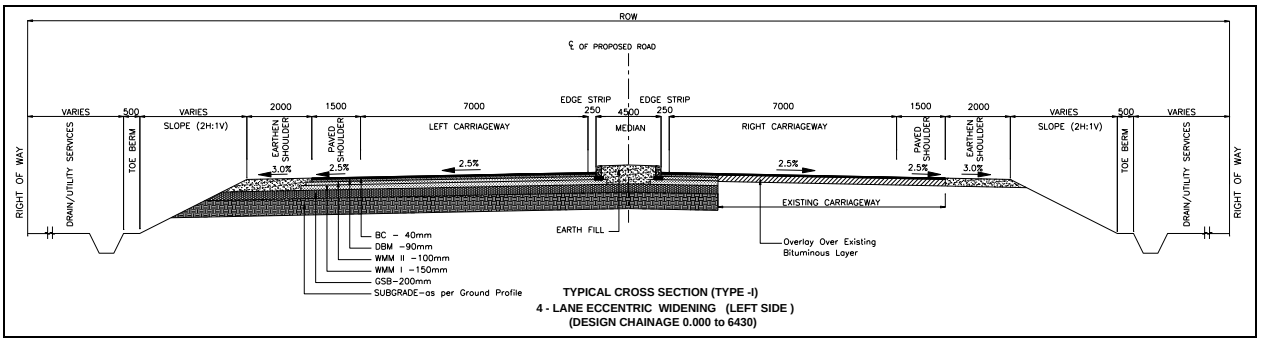
Cross sectional elements are based on the design standards and specifications. The proposed improvement includes four lane width with 1.5m/2.5m wide paved shoulder, 1.5m wide earthen shoulder, 2.0m wide median (in the entire stretch) and shyness strip 0.25m on both sides of median. 2 two lane tunnels and 1 tunnel with escape tunnel are proposed cross section drawings are as follows:



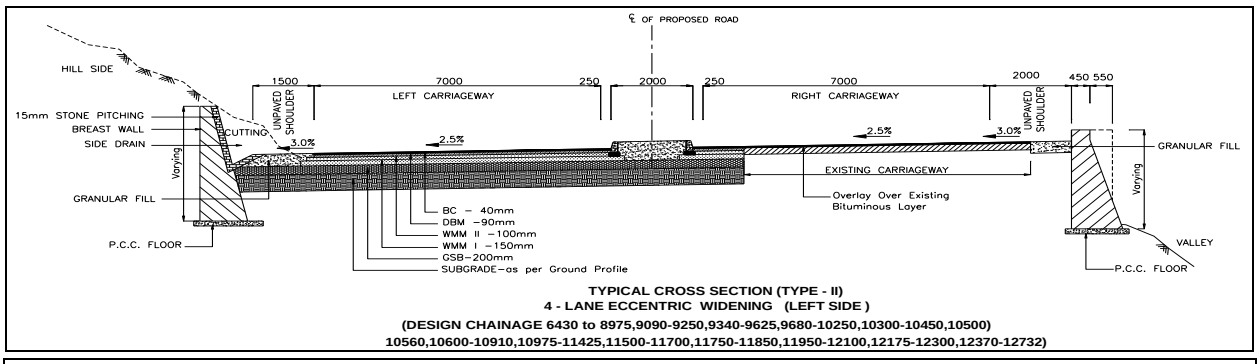
TYPICAL CROSS SECTION (TYPE -I)
4 - LANE ECCENTRIC WIDENING (LEFT SIDE)
(DESIGN CHAINAGE 0.000 to 6430)



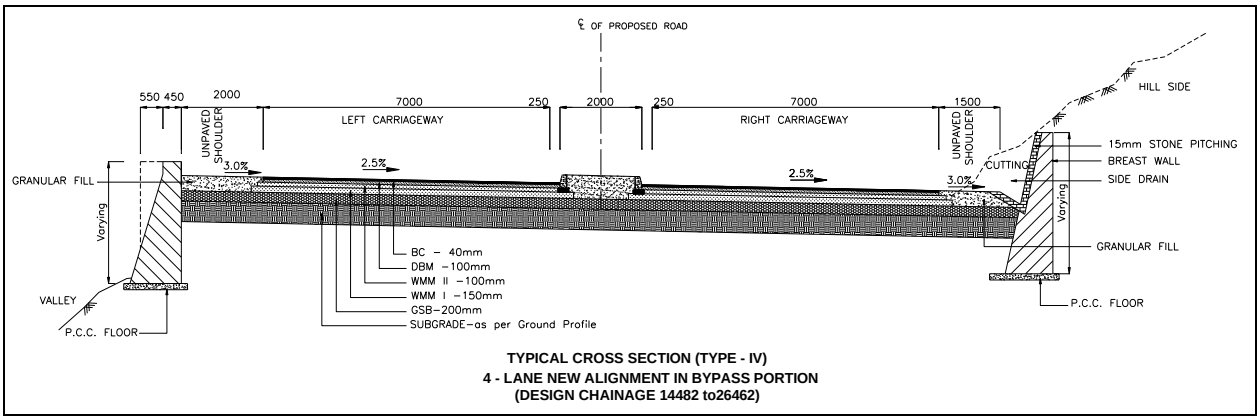
TYPICAL CROSS SECTION (TYPE -I)
4 - LANE ECCENTRIC WIDENING (LEFT SIDE)
(DESIGN CHAINAGE 0.000 to 6430)



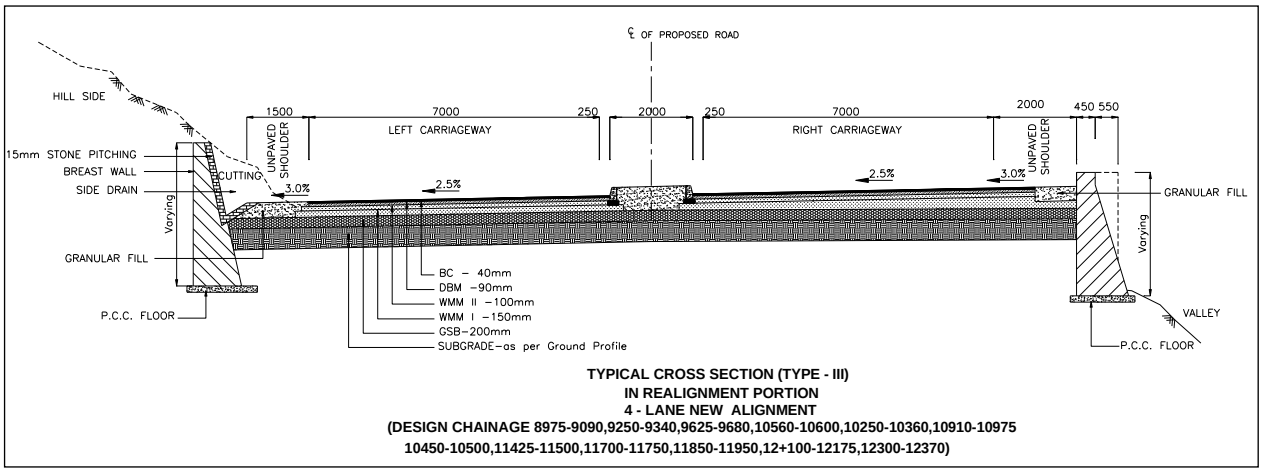
TYPICAL CROSS SECTION (TYPE -I)
4 - LANE ECCENTRIC WIDENING (LEFT SIDE)
(DESIGN CHAINAGE 0.000 to 6430)



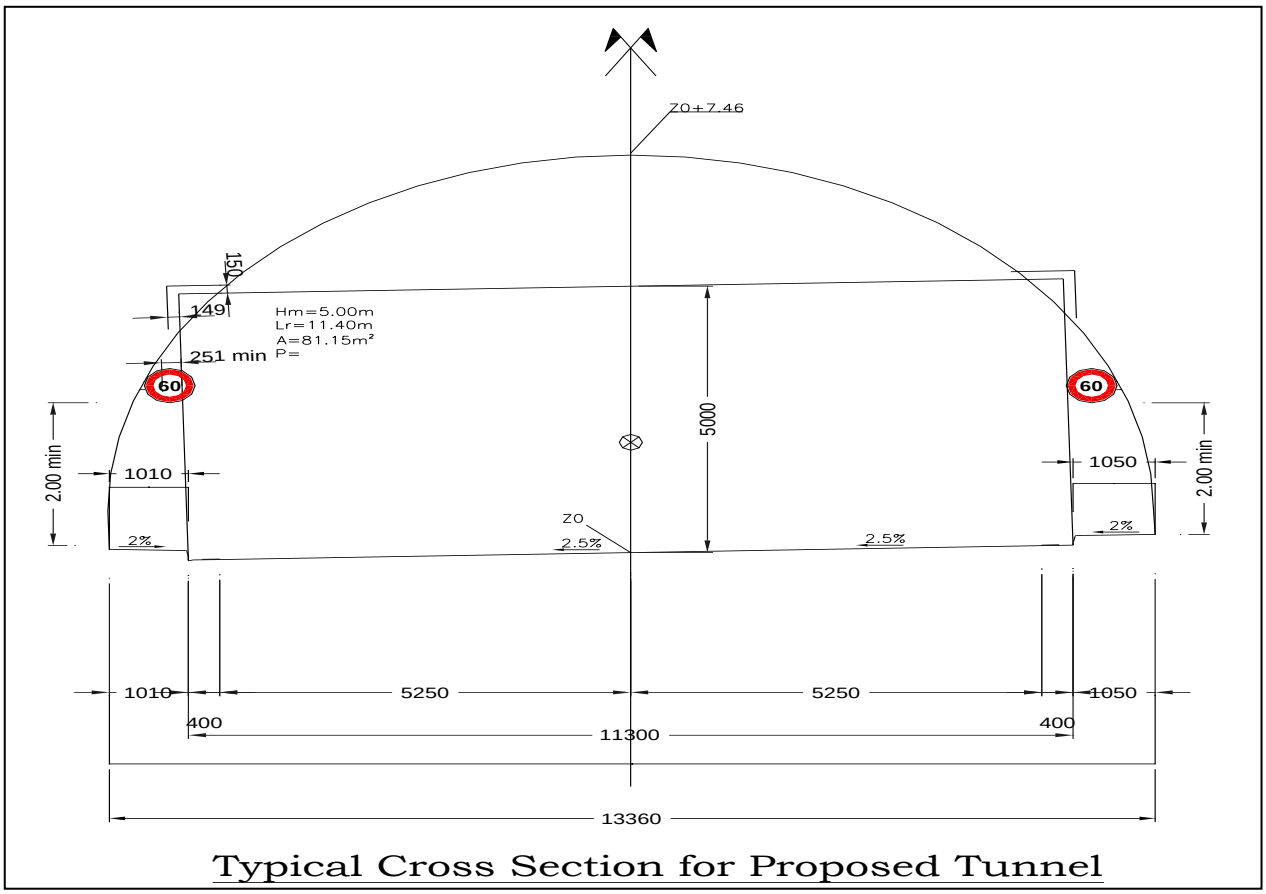
TYPICAL CROSS SECTION (TYPE - II)
4 - LANE ECCENTRIC WIDENING (LEFT SIDE)
(DESIGN CHAINAGE 6430 to 8975,9090-9250,9340-9625,9680-10250,10300-10450,10500)
10560,10600-10910,10975-11425,11500-11700,11750-11850,11950-12100,12175-12300,12370-12732)



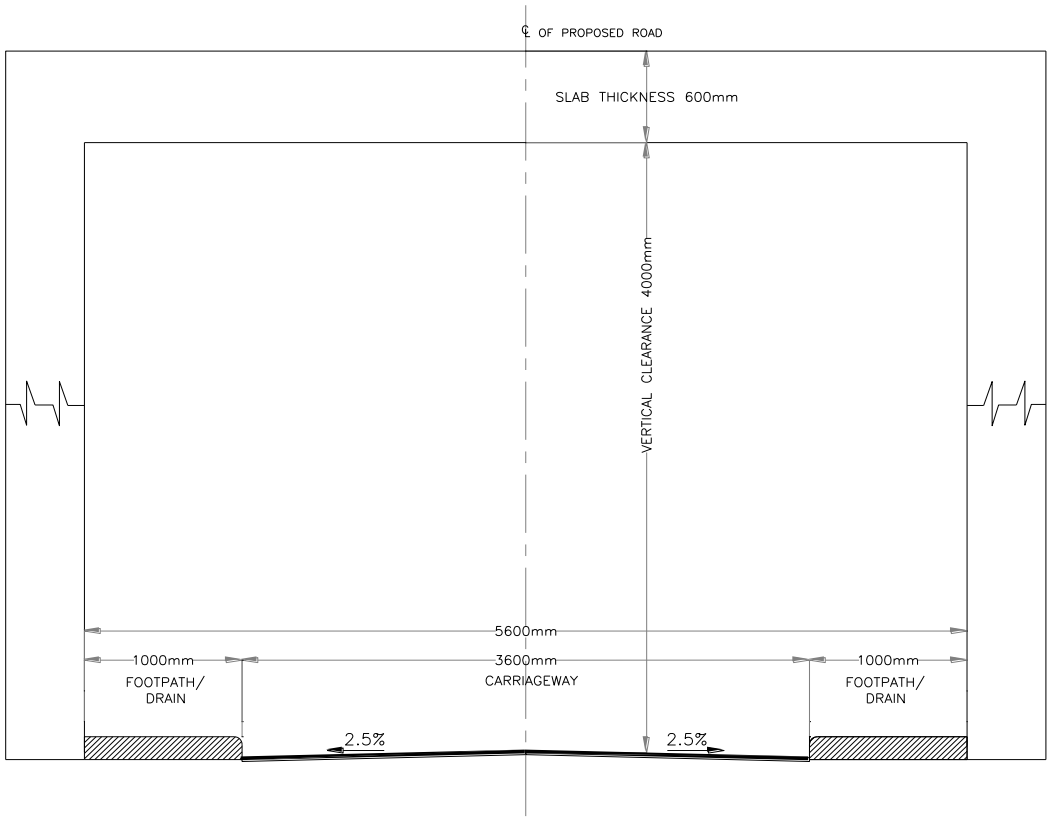
TYPICAL CROSS SECTION (TYPE - IV)
4 - LANE NEW ALIGNMENT IN BYPASS PORTION
(DESIGN CHAINAGE 14482 to26462)



TYPICAL CROSS SECTION (TYPE - III)
IN REALIGNMENT PORTION
4 - LANE NEW ALIGNMENT
(DESIGN CHAINAGE 8975-9090,9250-9340,9625-9680,10560-10600,10250-10360,10910-10975
10450-10500,11425-11500,11700-11750,11850-11950,12+100-12175,12300-12370)

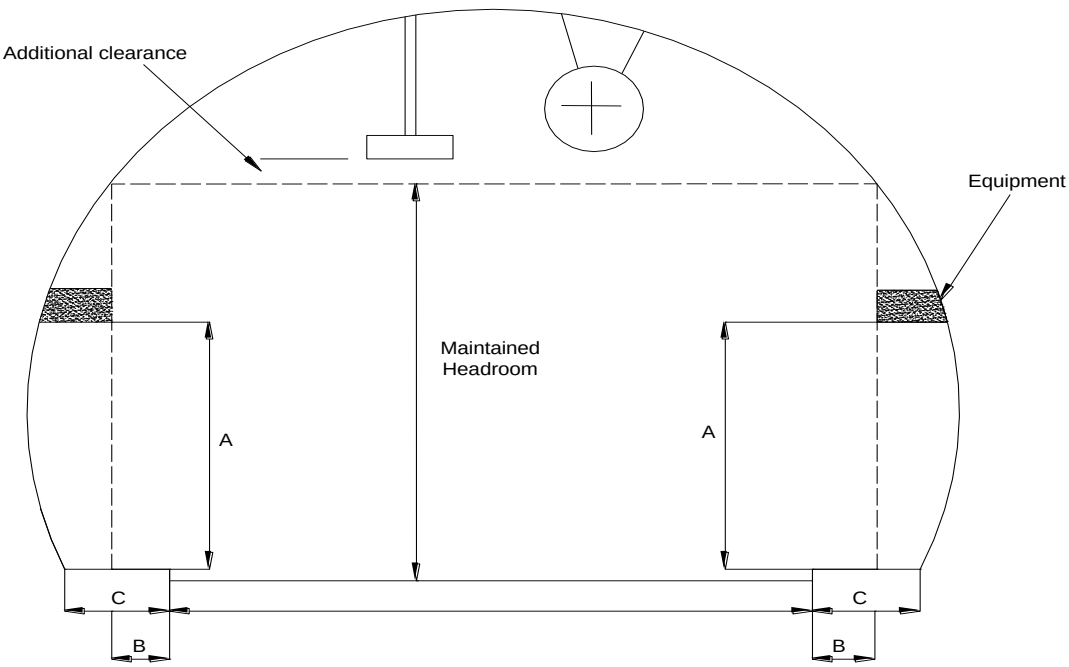


Typical Cross Section for Proposed Tunnel



TYPICAL CROSS SECTION (TYPE - VI)

PROPOSED ESCAPE TUNNEL AT DESIGN CHAINAGE 12732 to 14482



ALTERNATE CROSS SECTION FOR PROPOSED ESCAPE TUNNEL

1.10 LAND REQUIREMENT

Land is required in realignment stretches and forest stretch. The total land required for the project is 153.916 Ha, The breakup of Forest and Non-Forest land to be acquired for the project is given in Table 1.21 below.

Table 1.22: Land required for the project (Area in Ha)

S. No	State	Project Road	Forest land (Ha)	Non forest land (Ha)	Total (Ha)
1.	Punjab	0.000 to 8.800	0.113	74.438	74.551
2.	Himachal Pradesh	8.800 to 26+462	5.910	73.455	79.365
	Project Total	**0+000 to 26+462**	**6.023**	**147.893**	**153.916**

Source: Land Acquisition Plan, Voyants, 2012.

1.11 STRUCTURE OF REPORT

This EIA report has been structured into the following chapters:

Chapter 2 **Policy, Legal and Administrative Framework:** This chapter presents a review of the existing policies, legislations and institutional framework relevant to the project, at the National and the State levels.

Chapter 3 **Scope and Methodology of EIA:** This chapter briefly outlines the findings of environmental and social screening, details the scope of Environmental Assessment and also discusses the methodology of the EA.

Chapter 4 **Baseline Environmental Status and Socio Economic:** This chapter presents a consolidated picture of the existing environmental setting of the project and socio economic profile of the peolple affected due to project.

Chapter 5 **Alternative Options:** This chapter through light on analysis of Alternatives has been done to minimize the environmental impacts by considering different alternatives to determine the extent of mainstreaming of the environmental components.

Chapter 6 **Community Consultation:** This chapter outlines the stages and types of public consultation carried out during the project preparation stage and people's perceptions of the project benefits and the potential impacts and also describes the proceedings of Public hearing

Chapter 7 **Assessment of Impacts:** This chapter deals in Potential Impacts and Mitigation Measure identifies and quantifies the potential impacts on each of the environmental components due to the proposed project development.

Chapter 8 **Environmental Mitigation Measure and Cost:** This chapter includes the mitigation measure for anticipated impacts on air, water, noise, vibration, soil land use, and biodiversity and associated cost suggested thereof

Chapter 9 **Environmental Management Plan:** This chapter presents an elaborate listing of the nature of impacts on each of the environmental components and the avoidance and mitigation measures.

Chapter 10 **Environmental Monitoring Plan:** This chapter shows the proposed framework for location and time for different periods of monitoring the environmental parameter to assess the status and take proper mitigation measure as per suggested in Environmental Management Plan

Chapter 11 **Compliance of comments of TOR**, complainants of comments of Public Hearing and Proceedings of Public Hearing, disclosure of consultants.

2. Policy, Legal and Administrative Framework

This section presents a review of the existing legislations and institutional setting relevant to this project, at the National, State and local levels. Regulations concerning procedures and requirements that may directly concern the project and the capacity of the institutional agencies towards successful implementation of the Environmental Management Plan have been assessed. Besides, the chapter also presents the environmental clearances applicable to the project corridor due to proposed improvement.

2.1 INSTITUTIONAL SETTING

The environmental regulations, legislation, policy guidelines and control that may apply to this project, are the responsibility of a variety of government agencies. The following agencies would play an important role in this project.

2.1.1 Ministry of Environment and Forests (MoEF)

The primary responsibility for administration and implementation of the Government of India's (GoI) policy with respect to environmental management, conservation, ecologically sustainable development and pollution control rests with the Ministry of Environment and Forests (MoEF). Established in 1985, the MoEF is the agency primarily responsible for the review and approval of Environmental Impact Assessments (EIAs) pursuant to GoI legislation.

2.1.2 Central Pollution Control Board (CPCB)

A statutory authority attached to the MoEF and located in New Delhi. The role of the CPCB, (for this project) will only be in an advisory capacity while the project shall adhere to the norms and standards set up by the State Pollution Control Board (SPCB), Himachal Pradesh & Punjab.

2.1.3 State Pollution Control Board (SPCB)

The SPCBs (Himachal Pradesh & Punjab) has the mandate for environmental management at state level, with emphasis on air and water quality. It is empowered to issue No-Objection Certificate (NOC) in pursuant to 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. The State PCB establishes a review panel and circulates the application for public review and comment in each affected Districts. The State Pollution Control Board issues an NOC after accepting the application for the project.

2.1.4 State Forest Department:

The State Forest Department is responsible for the protection and managing the forest designated areas within the state. The Forest Department works out Forest Working Plans for the various forest divisions to manage and protect the forest resources. These plans form the basis for managing the forest resources and for chalking out specific plans and policies with respect to the conservation, protection and development of the forest areas. The Forest department will be responsible for granting clearances for road improvement works within forest areas, as well as for felling trees that need to be cleared for the project, according to the provisions of the Forest (Conservation) Act, 1980. Forest Department, Bilaspur will be responsible for granting clearances for road improvement works within the forest areas as well as felling trees that need to be cleared for the project, according to the provisions of the Forest (Conservation) Act, 1980.

2.2 THE LEGAL SETTING

The Government of India has laid out various policy guidelines acts and regulations for protection of environment, which have been explained in Table 2-1.

Table 2.1: Statutes, Policies, Regulations and Responsible Agencies

Agency	Statute/policy	Relevant objectives
Ministry of Environment and Forests	Environment (Protection) Act, 1986	To protect and improve the quality of the environment and to prevent, control and abate environmental pollution
	Forest Conservation Act 1927, Forest (Conservation) Act 1980 (as amended 1998) and Forest (Conservation) Rules 1981	To restrict deforestation by restricting clearing of forested areas.
	Wildlife (Protection) Act 1972	To protect wild animals and birds through the creation of National Parks and Sanctuaries
	Environmental Impact Assessment Notification, 14th Sept 2006 (amended on 11th October 2007)	To ensure that appropriate measures are taken to conserve and protect the environment before commencement of operations.
Pollution Control Board	Water (Prevention and Control of Pollution) Act 1974, as amended 1988.	To provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water.
	Air (Prevention and Control of Pollution) Act 1981(Amended in 1987).	To provide for the prevention, control & abatement of air pollution, and for the establishment of Boards to carry out these purposes.
Directorate of Town Panchayats	Panchayat Act	To provide for planning the District development from the Panchayat level and regulate land uses in rural as well as municipal areas.
Forest Department	Wildlife Protection Act, 1972	To protect wild animals and birds through the creation of National Parks and Sanctuaries.
	Forest (Conservation) Act 1980 (as amended 1998)	To protect and manage forests
Department of Transport	Central Motor Vehicles Act 1988	To control vehicular air and noise pollution. To regulate development of the transport sector, check and control vehicular air and noise pollution.
Department of Police	Motor Vehicles Act, 1988 Rules of Road Regulations, 1989	To enforce highway codes
Archaeological Survey of India	Ancient Monuments and Archaeological sites and Remains Act 1958	To protect and conserve cultural and historical remains found in India
Revenue Department	Land Acquisition Act 1894 Land Acquisition Act 1989	To set out rules for the acquisition of land by Government.

2.2.1 Resettlement and Rehabilitation Policy

Government of India has recently formulated the National Rehabilitation and Resettlement Policy 2007 which has wider social implication. The NRRP-2007 claims broader outlook over the earlier version of the Policy entitled, “National Policy on Resettlement and Rehabilitation for Project Affected Families, 2003. The NRRP-2007 has rightly pointed out the fact that many issues addressed by the NPRR-2003 require to be reviewed. The new Policy ensures participatory and transparent social assessment. The major objectives of the Policy are as follows;

to minimise displacement and to promote, as far as possible, non-displacing or least-displacing alternatives;
to ensure adequate rehabilitation package and expeditious implementation of rehabilitation with active people's participation
to protect the rights of weaker sections, especially members of SCs and STs.
to provide better standard of living and to ensure sustainable income to affected families
to integrate rehabilitation concerns into the development planning and implementation process
to facilitate harmonious relationship between the body which acquires land and the affected families through mutual cooperation.

NRRP-2007 states that whenever it is desired to undertake a new project or expansion of an existing project, which involves involuntary displacement of 400 or more families en masse in plain areas, or 200 or more families en masse in tribal or hilly areas, DDP blocks or areas mentioned in the Schedule V or Schedule VI to the Constitution, the appropriate Government shall ensure that a Social Impact Assessment (SIA) study is carried out in the proposed affected areas. In the case if the involuntary displacement is less than the number mentioned, adequate administrative arrangements shall be made by the appropriate Government for rehabilitation and resettlement of the affected families as per this policy.

A detailed Rehabilitation and Resettlement Plan is required to be prepared following the specific procedures mentioned in the Policy. The Administrator for Rehabilitation and Resettlement shall submit the draft scheme or plan for rehabilitation and resettlement to the appropriate Government for its approval. Section 6.17 also points out that in case of a project involving land acquisition on behalf of a requiring body, it shall be the responsibility of the appropriate Government to obtain the consent of the requiring body, to ensure that the necessary approvals as required under this policy have been obtained, and to make sure that the requiring body has agreed to bear the entire cost of rehabilitation and resettlement benefits and other expenditure for rehabilitation and resettlement of the affected families as communicated by the Administrator for Rehabilitation and Resettlement, before approving it.

The NRRP-2007 has made significant provisions for protecting the rights of vulnerable sections of the society. Section 7.21.1 states that in case of a project involving land acquisition on behalf of a requiring body which involves involuntary displacement of 200 or more Scheduled Tribes Families, a Tribal Development Plan shall be prepared.

As part of ensuring participation, the Policy insists that the concerned gram sabha or the panchayats shall be consulted in all areas of land acquisition. Another significant feature of the Policy is the indexation of rehabilitation grant and other benefits in which the monetary value of benefits shall be assessed based on the Consumer Price Index (CPI) of respective years. The institutional arrangements with respect to grievance redressal and also monitoring of rehabilitation and resettlement could ensure a sustainable and consistent delivery of benefits to the affected population.

2.2.2 Land Acquisition Act, 1894

The Land Acquisition Act (LA Act) of 1894, last amended in 1984, provides for the acquisition of land for public purposes and for Companies and for determining the amount of compensation to be made on account of such acquisition. As per the LA Act, the District Collector will function as the Land Acquisition Officer on behalf of the Government.

2.2.3 Provisions of the Panchayat (Extension to Scheduled Areas) Act 1996

The Act provides for the extension of the provisions of Part IX of the Constitution relating to the Panchayats in the Scheduled Areas. The Panchayats at the appropriate level and the Gram Sabha are endowed specially with the power to prevent alienation of land in the Scheduled Areas and to take appropriate action to restore any unlawfully alienated land of a Scheduled Tribe.

2.2.4 The National Highways Legislative Act, 1956 &1988

The National Highways Legislative Act, 1956 provides for the declaration of certain highways to be National Highways and for matters connected therewith. The National Highways Legislative Act 1988 provides for the constitution of an Authority for the development, maintenance and management of national highways and for matters connected therewith or incidental thereto.
The Government has amended the National Highways Act, 1956 to provide for the legal framework for private sector participation (Private sector participation is the key note of the Post NHDP). Under the amended Act, it is possible to: Assign to the private entrepreneurs responsibility for implementation and operation of projects for specified period by an agreement with the Government, authorise the entrepreneur to collect and retain the users fee (toll), authorize entrepreneur to regulate traffic on BOT road, and Punish any person encroaching and misusing the highway developed by the entrepreneur.

The President has given his assent to the Control of National Highways (Land and Traffic) Bill, 2002. The Control of National Highways (Land and Traffic) Act, 2003, seeks to regulate traffic as well as the right of way on the National Highways. It provides for prevention of unauthorised occupation of highway land and removal of such encroachment, control of access points to the National Highways, regulation of different types of traffic permitted on the National Highways, control of use of road land for public utilities and drains besides issue of licenses or lease deeds for temporary use of the National Highways. The provisions of the Act will be enforced from a date to be notified by the Government in the Ministry of Road Transport and Highways.

2.2.5 The National Highway Rules 1957 & 1997

The rules outline procedures for conduct of allocation and use of funds for highway construction related activities outlined under the National Highways Act 1956.The National Highway Rule 1997 has rules for Collection of Fees by any Person for the Use of Section of any National Highways/Permanent Bridges/Temporary Bridges on National Highways.

2.2.6 The National Highways Authority of India Act, 1988:

The Act provides for the constitution of an authority for the development, maintenance and management of National Highways and matters connected therewith or incidental thereto. The National Highways Authority of India that was constituted under National Highways Authority of India Act, 1988 and made operational in February 1995.

2.2.7 The Central Road Fund Act, 2000

To meet the challenges of accelerated funding requirement for all categories of roads in the country, the Central Road Fund has been augmented by increasing the levy of cess on petrol to Rs. 1/- per litre of petrol and charging a cess Rs. 1/- per litre of diesel. The Central Road Fund Act, 2000 has also been notified on 27-12-2000 to give statutory status. The Central Road Fund seeks to distribute the total of 100% of cess on petrol and 50% of cess on diesel in the following

way. National Highways would get 57% of the allocation, State Roads 30% and Safety works on Railroad crossings would get 12.5%.

2.3 CLEARANCE PROCEDURES

2.3.1 The EIA Notification

As per the provisions of the new amended EIA Notification dated 14th September 2006 (amended 1st December 2009), the requirement for Environmental Clearance have been quoted in the Box No. 2-1 below:

Box 2-1: Requirement and Procedure for seeking Environmental Clearance

REQUIREMENT FOR SEEKING ENVIRONMENTAL CLEARANCE
Categorization of projects and activities i) All projects and activities are broadly categorized into two categories-Category A and Category B ii) Category A: Expansion of National Highways greater than 30km involving additional right of way greater than 20m involving land acquisition. ii) Category B: All State Highway Projects & State Highway expansion projects in hilly terrain (above 1000m AMSL) iii) & or ecologically sensitive areas. iv) All projects or activities included as Category 'A' shall require prior environmental clearance from the Central Government in the MOEF on the recommendations of an Expert Appraisal Committee (EAC). v) All projects or activities included as Category 'B' will require prior environmental clearance from the State/Union territory Environment Impact Assessment Authority (SEIAA).

2.3.2 Procedure for Environmental Clearance:

The application seeking prior environmental clearance is made in the prescribed Form I annexed to the EIA Notification (Sept 06) and Supplementary Form IA, if applicable, provided in Appendix II, before commencing any construction activity, or preparation of land, at the site by the applicant. The environmental clearance process for new projects now comprises of a maximum of four steps, which are, Screening (only for Category B projects or activities): entailing the scrutiny of application (Form 1) by the concerned Expert Appraisal Committee (EAC) at the State level for determining whether or not the project requires further environmental studies and preparation of Environmental Impact Assessment Report for grant of environmental clearance. Category A and Category B1 projects require EIA Report.

In Scoping, the EAC (for Category A projects) and SEAC (for Category B projects) determines detailed comprehensive Terms of Reference (TOR) for the preparation of the EIA Report in relation to the project for which environmental clearance is sought. The TOR would be determined on the basis of information furnished in Form 1/1A.

2.3.3 Public Consultation

All Category A and B1 projects have to undertake Public Consultation. The authority for Public Hearing procedure rests with the State Pollution Control Board. Appraisal of the Final EIA Report by EAC/SEAC for grant of environmental clearance.

2.3.4 General Conditions

The General conditions of the EIA Notification 14th September 2006 states "Any project or activity specified in Category 'B' will be treated as Category A, if located in whole or in part within 10 km from the boundary of:

- Protected Areas notified under the Wild Life (Protection) Act, 1972,
- Critically Polluted areas as notified by the Central Pollution Control Board from time to time,
- Notified Eco-sensitive areas,
- Inter State Boundaries and International Boundaries. The project road under consideration is an improvement proposal of existing NH-21 which 26.462 Kms and involved two States they are Punjab and Himachal Pradesh and involves additional right of way greater than 20m requiring land acquisition. The project therefore classifies under 'Category 'A' and requires an environmental clearance from Expert Appraisal Committee (EAC), MoEF. Forest Clearance would be required to be taken from State Forest Department for land diversion of notified protected forest area that would come within the proposed ROW.

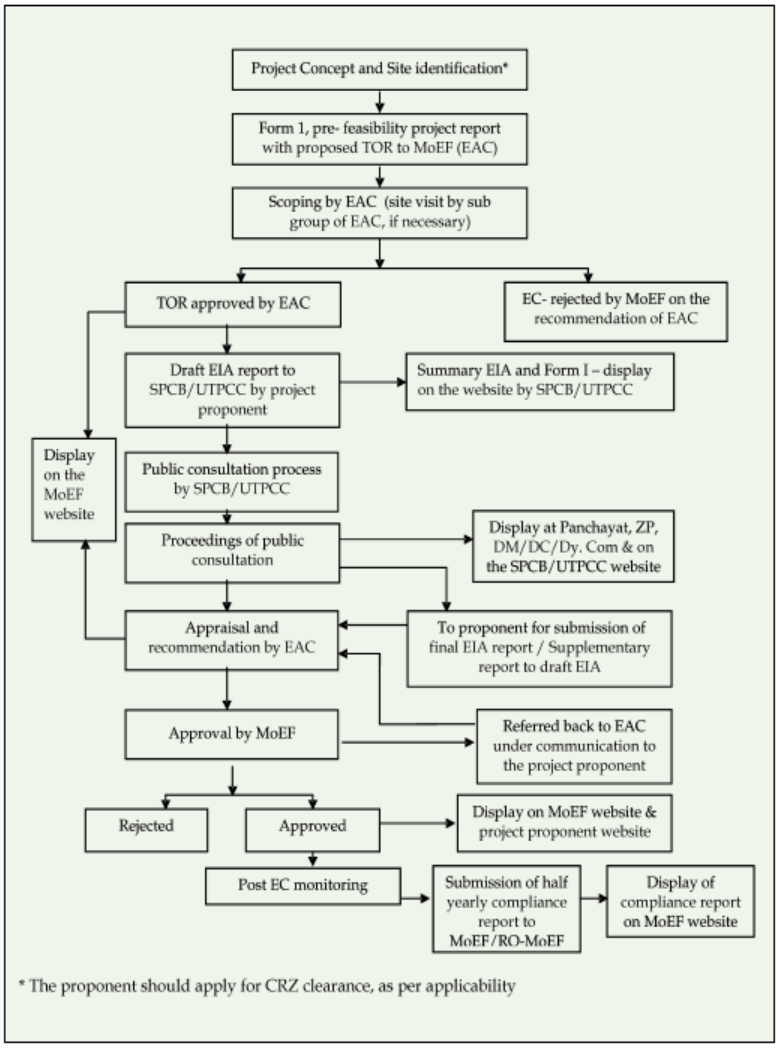


Fig 2.1: *Flow Chart for Environmental Clearance*

- Wildlife Clearance would be required to be taken from the Standing Committee of the National Board for Wildlife as the project road crosses a Wildlife Sanctuary and also located within 10 km of a Wildlife Sanctuary. The procedure for Environmental Clearance is shown in Flow Chart at Fig 2.1.

2.3.2 Forest Conservation Act, 1980

As stated in the Forest Conservation Act, 1980: "All proposals relating to diversion of forest land up to 20 hectares and proposals for clearing of naturally grown trees for reforestation shall be sent directly to the concerned Regional Office of the MOEF. All other proposals shall be sent to Secretary to the Government of India, MOEF. In respect of proposals involving diversion of forest area above 5 hectares and up to 20 hectares, the proposals shall be examined by the Regional Chief Conservator of Forests/Conservator of Forests in consultation with an Advisory Group consisting of representatives of the State Government from Revenue Department, Forest Department, Planning and/or Finance Department and concerned Department whose proposal is being examined. The views of the Advisory Group shall be recorded by the Regional Chief Conservator of Forests and along with the same; the proposal shall be sent to Secretary, MOEF for considering and final decision. It is to be clarified that views of this Advisory Group in no way

shall be binding while deciding the proposal. The meeting of the Advisory Group may be held at the State Capital. The proposal will not be deferred for want of quorum."

2.4 NATIONAL POLICIES

Also there are national policies to address various issues relating to the exploitation of natural resources and other environmental issues. All relevant national policies are given in Table 2.2.

Table 2.2: National Policies

S. No	National Policies	Year	Objective	Applicability
1.	National Environment Policy	2006	Sustainable Development	Direct
2.	National Water Policy	2002	Conservation and management of water resources	Direct
3.	Policy Statement on Abatement of Pollution	1992	National Policy on the Pollution control and prevention.	Direct
4.	National Conservation Strategy and Policy Statement on Environment and Development	1992	Strategy for development taking environmental concerns in to account in our development process.	Direct
5.	National Forest Policy	1998	Conservation and management of forests, wildlife sanctuaries etc.	Direct
6.	National Resettlement & Rehabilitation Policy (NRRP)	2007	All social issues relating to land acquisition resettlement and rehabilitation.	Direct
7.	National River Conservation Plan (NRCP)	2001	For the conservation management of issues relating to rivers.	Direct
8.	National Lake Conservation Plan (NLCP)		For the conservation management of issues relating to Lakes.	Direct
9.	Wildlife Conservation Strategy	2002	For the Conservation management of issues relating to wildlife.	Direct
10.	National Wildlife Action Plan	1982	Addresses the need of conserving the nation's biodiversity and emphasizes requirements of evolving prescriptions for management of multiple use areas which provide for wildlife habitat and forest products.	Direct

2.4.1 National Guidelines

The relevant environmental guidelines given in Table 2.3.

Table 2.3: National Guidelines

S. No.	Guideline	Year	Purpose	Applicability
1.	Environmental guidelines (MOEF) for rail/road/highway projects for the preparation of EIA report on Highways sector	1989	To guide in the preparation of EIA/EMP	Direct
2.	General guidelines (MOEF) as provided by the hand book of environmental procedures and Guidelines	1994	For the investors	Direct
3.	Environmental Impact Assessment (EIA) Manual	1998	For the environmental appraisal committee (EAC) members and consultants	Direct
4.	Guidelines for the collection of Net Present Value(NPV) for the recovery/collection of Net Present value of the forest land being diverted for non forestry purpose	2003	For the Forest land acquired under Forest Conservation Act,1980	Direct

S. No.	Guideline	Year	Purpose	Applicability
5.	MOEF EIA Manual	2010	To help project proponent and consultants for EIA report preparation.	Direct

2.4.2 Indian Road Congress (IRC) Codes

IRC codes and guidelines have been identified that have a direct role in the environmental management during design and construction stages. Indeed most of them were formulated without a proper environmental management backing, therefore a revision of these documents incorporating the environmental and social dimension would make these codes more sensible with double (Engineering and environmental) applicability i.e., both engineering as well as environmental management requirements. All these IRC codes are given in Table 2.4.

Table 2.4: IRC Codes

S. No.	IRC Code Theme	Year	Purpose	Applicability/ Comments
1.	Recommendations for Road Construction in Water Logged Areas	IRC: 34-1970	Construction in Water Logged Areas	Indirect
2.	Road Accident Forms A-1 (First Edition)	IRC: 53-1982	Safety of Pedestrians	Indirect
3.	Guidelines for Pedestrian Facilities	IRC: 103 -1988	EIA guide lines	Direct
4.	Guidelines for EIA of Highway Projects	IRC:104-1988	Control by Various Measures that includes Legislation	Direct
5.	Ribbon Developments on Highways and its Prevention	IRC: SP: 1996	Landscaping of Road	Direct
6.	Manual on Landscaping of road	IRC: SP: 21-1979	Highway Safety	In Direct
7.	Report containing recommendations of IRC Regional Workshops on Highway Safety	IRC: SP: 27-1984	Highway Safety for Children's	Direct
8.	Road Safety for Children (5-12 Years Old)	IRC: SP: 32-1988	Drainage	Direct
9.	Guidelines on road drainage	IRC: SP: 42-1994	Highways safety	Direct
10.	Highway Safety Code	IRC: SP: 44-994	Safety During Construction	Direct
11.	Guidelines for Safety in Construction Zones	IRC: SP: 55-2001	Hill Road	Direct
12.	Hill Road Manual	IRC: SP: 48-1988	Hill Road	Direct

2.4.3 Contract Provisions

The construction companies generally neglect environmental management provisions of MORTH specifications and FIDIC conditions of Contract. The MORTH Specifications (not FIDIC) and the provisions of environmental management in Indian systems are given in Table 2.5. The Fourth Edition of Specifications for roads and bridge works of Ministry of Road Transport and Highways published by the Indian Road Congress is the basic document to be followed in the road construction contracts.

Table 2.5: MORTH Specifications

S. No	Clauses	Environmental Management aspects
1.	111 Environment	Precautions for safeguarding the environment with 12 sub clauses that cover issues relating to all laws of the country, Borrow pits, quarry operations, soil erosion, sedimentation and water pollution, pollution from hot mix plants and batching plants, substances hazards to health, dust, clean orderly work site, traffic ability of the road
2.	112 Traffic Management & Safety	Arrangement for traffic during construction addresses the safety aspects with its six sub clauses. This is further improved by another IRC special publication for 'safety during construction 2000
3.	301.3.2 Top soil	Relates to Top soil management
4.	301.3.11	Disposal of excavated materials
5.	302	Blasting operations
6.	304.3.6	Public safety
7.	305.2.2.2	Borrow materials
8.	305.3.7	Drainage
9.	306	Soil erosion and sedimentation control
10.	307	Turfing with sods
11.	308	Seeding and mulching
12.	Annexure A to clause 501	Protection of environment includes water, air and noise quality control measures. Also included are control of wastes and emergency response
13.	2804.10	Personnel and Environment safety
14.	2809.3	Precautions during dismantling work

2.4.4 Cross Sectoral Laws

There are a number of laws that are cutting across all sectors and development process of the country. Some of these are directly relevant especially during the construction stage are listed in Table 2.6.

Table 2.6: Cross Sectoral Policies

S. No	Cross Sectoral Laws	Year	Objective	Applicability
1.	Minimum Wages Act,	1948	Grossly misused Act 1948, most important as far as the poverty ridden local people are concerned. For role of Social welfare department and labour department, a more effective mechanism needs to be developed.	Direct
2.	Child Labour (Prohibition and Regulation) Act, 1986	1986	Grossly misused Act, effective mechanism need to be established to abolish this from the highways system permanently.	Direct
3.	Labour Act	1988	The health and safety of workers employed in construction work etc	Direct
4.	The Factories Act	1948	Health and Safety considerations for workers (Need to extend the provisions to highways)	Direct
5.	The Right to Information Act (Very important Umbrella Act)	2005	One of the most important Acts, which will strengthen the right to freedom of speech and expression Act.	Direct

After several years of negligence, Government of India now decided to strictly apply the Child Labour Act to all sectors who are exploiting the children's at their younger age for personal, economic and other benefits. According to this law children's are for primary education till the age of 14 and then up to the age 18 years, children if employed should not be engaged in the

Hazardous working conditions. The Right to Information Act, 2005, is an umbrella act that covers the entire constitutional laws and policies and procedures pertaining to the country and its governance.

2.4.5 Environmental Framework of the State

The specific laws and policies that are formulated by the State government for achieving certain level of sustainability in the human actions are mentioned in Table 2.7.

Table 2.7: Environmental Framework of State Government

S. No	Legislation/Policy	Year	Objective	Applicability
1.	State Environmental Policy	2005: Himachal Pradesh & 2007: Punjab	Sustainable development of the State	Direct
2.	State Water Policy	2003: Himachal Pradesh & 2008 : Punjab	To protect and conserve water resources	Direct
3.	State Forest Policy	1980	Protection and preservation of forest and wildlife	Direct
4.	Himachal Pradesh Land Preservation Act	1978	Control on the private forests with ten year felling cycle	Direct
5.	The Himachal Pradesh Minor Minerals (concession) Revised Rules.	1971	Relating application for mining lease, its procedures authorities and application forms	Direct
6.	Punjab Land Preservation Act	1900	Control on the private forests with ten year felling cycle	Direct
7	Punjab Minor Mineral Concession Rules,	1964	Relating application for mining lease, its procedures authorities and application forms	Direct

2.4.6 Himachal Pradesh State Environmental Policy

The Himachal is the first State to have its own State Environmental Policy which came in to existence in 2005 prior to the July 2006 National Environmental policy. By formulating this policy, the Government of HP expresses its resolve to conserve and enhance the environment and follow a policy of sustainable development. This cannot be achieved without a whole hearted cooperation of all departments (that includes project proponent also), institutions, local bodies and the people at large. The NHAI therefore need to plan and implement the Road projects in a manner that incorporates all environmental safeguard measures, national policies, rules, codes and regulations and above all international best practices for environmental management for the implementation of Infrastructure projects.

2.4.7 Punjab State Environmental Policy:

Punjab State Environmental Policy has come into practice by 2007. Its resolve to conserve, enhance the environment and follow a policy of sustainable development. This cannot be achieved without a whole hearted cooperation of all departments (that includes project proponent also), institutions, local bodies and the people at large. The NHAI therefore need to plan and implement the Road projects in a manner that incorporates all environmental safeguard

measures, national policies, rules, codes and regulations and above all international best practices for environmental management for the implementation of Infrastructure projects.

2.4.8 Punjab and Himachal Pradesh State Water Policy

Both State and National water polices give highest priority for safe drinking water. Any impact on these resources of the common people is to be seen very seriously. Prior to demolishing or destruction of such structures, the project will have to provide alternative drinking water resources to the people. This new provision need to be monitored for the whole construction period to verify its adequacy in terms of quantity, quality and distance from the dwelling units. Since most of the drinking water sources of the people like Hand pumps, spring water sources, wells will be affected by the construction activities, this policy is directly relevant to the project.

2.4.9 Himachal Pradesh State Forest Policy

In 1980, the State Government has enunciated its own Forest Policy within the frame work of National Forest Policy. This was to meet the peculiar forest situation in the State. The policy guidelines contained are said to be still valid and cover almost all aspects of forestry in the State. Since forest and related issues are one of the few most important issues of the project implementation Forest policy is directly relevant.

2.4.10 Punjab State Forest Policy

In 2004 Punjab state Forest Amendment act has come into exists. State Government has enunciated its own Forest Policy within the frame work of National Forest Policy. This was to meet the peculiar forest situation in the State. The policy guidelines contained are said to be still valid and cover almost all aspects of forestry in the State. Since forest and related issues are one of the few most important issues of the project implementation Forest policy is directly relevant.

2.4.11 Punjab and Himachal Pradesh State Forest Department

Although the NHAI is managing the Right of Way (ROW), removal of trees from the highway land need written permission from the Forest Department. The State Forest Department has been involved in the project preparation by way of consultation. To avoid delays, application will be forwarded to concerned Forest Officer for an early approval for tree removal. During construction, trees will be cut and removed that are necessary based on safety requirements. The trees that will have to be removed will be marked prior to cutting. This is required, as there could be slight changes in the alignment or design because of the Contractors difficulties (e.g. for moving equipment). If such changes do occur a number of trees may be saved that would have been cut otherwise. Immediately after marking the trees, an application in plain paper (no prescribed application is available) will be filed with the local forest officer for obtaining a written permission. Some of the section requires Forest land for widening and for improvement of curves. These forests are protected forests and therefore require permission from the State/National Government as applicable. Further the following forest laws are directly applicable to road projects. While India Forest Act of 1927 remains an all pervasive Act for the constitution, management and protection of forests, various other laws, acts and rules enacted by the State government are to take care of the local needs.

2.4.12 Procedure for tree cutting permission

Forest clearance for forest land acquisition now requires a payment to the Forest department according to the Hon'ble Supreme Court Order dated October 30, 2002 and August 1, 2003 in

I.A. No 56 in writ petition (civil) No 202 of 1995 in the matter of compensatory afforestation Fund regarding collection of Net Present value (NPV) from the user agencies. Latter MOEF as per letter NO F.No.5-1/98-FC (PtII) dated September 17, 2003 and September 22, 2003 issued guidelines to all offices of the Forest departments for implementation. The ministry ordered all the States /UTs to comply with the Hon'ble courts and complete the collection process of NPV for the cases approved under the Forest conservation Act, 1980. The Net present Value (NPV) of forestland needs to be paid to the Forest department for the Forestland requirement for the infrastructure projects.

2.4.13 Punjab and Himachal Pradesh State Pollution Control Board (PPCB & HPSPCB)

The State Pollution Control Board (SPCB) plays a major role in environmental management at the State level, particularly with regard to air and water issues. Agency is also acting as a facilitator for Central and State environmental clearance process. The main functions are to:

- Plan and execute state-level air and water initiatives;
- Advise State Government on air, water and industry issues;
- Establish emission standards based on National minimum standards;
- Issue consent orders (permits) for industrial air and water discharges;
- Issue "No Objection Certificates" for "industrial development" (defined in such a way as to include road projects).
- Publish statistics and disseminate information; and
- Take legal action against defaulters.
- Facilitate the National Environmental clearance requirements at the state Level as a nodal agency coordinating all other stake holder institutions. These requirements also include public hearing.
- Action by the HP State PCB requires the submission of a questionnaire/application pursuant to the Water (Prevention and Control of Pollution) Act of 1974, the Cess Act of 1977 and Air (Prevention and Control of Pollution) Act of 1981.

2.4.14 Act for Ancient Monuments and archeological sites

If there are archaeological remains in the project area relating to Ancient Monuments and Archaeological sites & Remains Act 1958. There is a central list of protected monuments and a state list of protected monuments and other archaeology and remains. These are also coming within the purview of the Act. Still there are many archaeological remains not listed in both.

2.4.15 Environmental Clearance Requirements for the Project

The following Environmental Clearances are required to start the construction work.

- MOEF Clearance,
- NOC from State Pollution Control Board,
- Forest Clearance,
- Wildlife NOC,
- Debris Disposal from State Pollution Control Board and Permission from Ground Water Board.

3. Scope and Methodology of EIA

This chapter briefly outlines the findings of environmental and social screening, details the scope of Environmental Assessment and also discusses the methodology of the EA.

3.1 OUTPUTS OF ENVIRONMENTAL AND SOCIAL SCREENING

3.1.1 Environmental Screening

Environmental screening had been carried out as an integral part of the feasibility exercise. This was based on the analysis of baseline information on the project area collected through primary surveys and consultations with stakeholders. The issues that emerged out of the above exercise are as below.

Direct impact on sensitive areas like forests.

Impacts identified are short term and can be mitigated through an Environmental Management Plan.

The project requires environmental clearance from the MoEF as the project road passes through two states.

Some Educational institutions are present close to the road they will remain unaffected due to widening but would require noise barriers.

Religious structures are being impacted and would need relocation.

3.1.2 Social Screening

Social screening had also been conducted as an integral part of the feasibility analysis. Social screening has provided valuable inputs into the alignment finalisation and analysis. Consultation with the stakeholders and primary surveys conducted on the alignment provided inputs for social screening. The alignment is so selected that it has least impact on the structures and land adjacent to the corridor. The salient issues identified through the screening exercise are mentioned below.

The existing RoW (24-42 m) is adequate for widening in most of the project road, apart from a few realignment stretches (for about 26.462 Kms including .improvement of existing alignment to 4-lanes from Kiratpur to Kainchi More and Realignment section from Kainchi More to Nauni Chwok This would result in an acquisition of about 153.916 Ha of land (forest & non-forest land) and displacement of around 156 households. The addressal of these resettlement impacts would entail preparation of detailed RAP including formulation of entitlement frameworks specific to the project setting.

During design, adequate care needs to be given to minimize impact on structures adjacent to the road. Suitable compensatory measures are to be worked out in the entitlement framework to restore the livelihood of affected PAPs.

Budgetary provisions towards mitigation of the above environmental issues are being addressed in this report. The budgets regarding mitigation of social issues have been dealt with in the Rehabilitation Action Plan (RAP) report.

3.2 SCOPE AND OBJECTIVE OF EIA

The main objective of Environmental Impact Assessment involves Environmental Analysis and Design to improve decision-making and to ensure that the highway improvement options under consideration are environmentally sound and sustainable and contributes to the development of environmental assets. The Objectives of EIA, as stated in the ToR for Environmental Impact Assessment include:

Determination of the magnitude of environmental and social impacts so that due consideration is given to them during planning/design, construction and operation phases of project implementation;

Preparation of environmental enhancement plan and environmental management plans for enhancing and mitigating the negative impacts; and
Conducting and documenting community consultation sessions carried out on various social and environmental aspects of the project.

3.3 METHODOLOGY FOR EIA

After reviewing the policy, legal and administrative framework with in which the Environmental Assessment (EA) is to be carried out and also reviewing the existing institutions and legislations relevant to the project corridor at the national and state level, the methodology for the Environmental Impact Assessment had been finalized and discussed below.

3.3.1 Assessment of Baseline Environmental Status

Baseline conditions within the defined area were determined as per MoEF requirements for EA of highway projects. The data base for working out the baseline status was from both secondary and primary sources.

3.3.2 Assessment of Potential Impacts

Based on the baseline conditions, the significant impacts needing mitigation have been identified. The direct and indirect impacts likely to be induced due to the project have been adequately identified and addressed.

3.3.3 Integration of Environmental Assessments in the Design Process

Environmental, resettlement and rehabilitation issues of the project have been integrated into design and decision-making process. This has prompted the early identification of appropriate actions. Such actions included, for example, shift in alignments based on awareness of ribbon development & locations of cultural resources. The impact of construction of tunnels

3.3.4 Conducting Community Consultations

Public participation and community consultation has been taken up involving public understanding of the processes and mechanisms through which developmental problems and needs are investigated and solved.

3.3.5 Identification of Mitigation & Environmental Enhancement Measures

Positive actions not only to avoid adverse impacts, but also to capitalize on opportunities to correct environmental degradation or improve environmental conditions have been determined.

3.3.6 Preparation of the Preliminary Environmental Management Plan (EMP)

Environmental Management Plan (EMP) has been prepared to specify the steps necessary to ensure implementation of the mitigation measures suggested. It includes the monitoring plan and gives details of the resources budgeted and the implementation arrangements.

4. *Baseline Environmental Status*

This Chapter presents the existing baseline environmental status of the project corridor. The project corridor has been divided into a direct impact zone - the area within the proposed RoW and the immediate vicinity of the proposed RoW, and an indirect impact zone – the area within 10 km on either side of the project road. The baseline status of various environmental components was reviewed to predict the effect of the project on the respective components. The data for environmental components was collected from primary as well as secondary sources.

4.1 PROJECT INFLUENCE AREA

The area of influence of the project is defined considering MoEF requirements (EIA notification, 14th September 2006) and other statutory requirements. The baseline conditions within the defined area have been documented accordingly. As per MoEF guidelines for conducting EIA; the geographical scope of the EIA study will be of 10-15 km radius for highway projects. However, since the project involves widening of existing highway, the direct influence of the project is restricted within the Right of Way (ROW) only. The baseline status has been documented at the ROW level but major environmental features like wildlife sanctuary, national parks, eco-sensitive zone, industrial areas and also physical features like physiographic, hydrology; soil has been studied / recorded within 10-15 km radius of the project road.

Thus the study region has been delineated into 2 sections based on the magnitude of impacts anticipated in them. The project impact area includes the Corridor of Direct Impact i.e. the Proposed Right of Way (ROW) and the project influence area includes areas with potential indirect impacts. The distribution of villages within these 2 demarcated areas are presented in Table 4.1

Table 4.1: Project Impact and Influence Areas

S. No	Study Area	District	Tehsil	Number of Villages
1.	Project Impact Area (Corridor of Direct Impact)	Roopnagar	Anandpur Sahib	7
		Bilaspur	Naina Devi	13
			Bilaspur-Sadar	5
2.	Project Influence Area (Corridor of Indirect Impact)	Roopnagar	Anandpur Sahib	64
		Bilaspur	Jhanduta	126
			Naina Devi	60
			Bilaspur Sadar	149
		Solan	Nalagarh	90
	Project Total	**3**	**4**	**514**

4.2 INFLUENCE AREA OF PROJECT CORRIDOR: LEVEL OF ANALYSIS

The project corridor traverses through two states, three Districts and four Tehsil Anandpur Sahib in Roopnagar district in the Punjab State & Tehsil Naina Devi and Tehsil Balaspur-Sadar in Bilaspur district in Himachal Pradesh state 25 settlements are present in direct impact zone. (Refer Table 4.2).

Table 4.2 : Number of Settlements in Direct Impact Zones

S. No	State	Districts/Taluka	No of Villages along the Project Corridor
1.	Himachal Pradesh	**Bilaspur District**	**18**
		Naina Devi Tehsil	13
		Bilaspur-Sadar Tehsil	5
2.	Punjab	**Roopnagar District**	**7**
		Anandpur Sahib	7
	Himachal Pradesh + Punjab	**Project Impact Area**	**25**

4.3 ENVIRONMENTAL PROFILE OF THE PROJECT REGION

4.3.1 Physical Environment

The baseline environmental and social profile of the project area is discussed at the District level to highlight the overall scenario in the indirect influence zone of the project corridor. The information presented in the following sections refers to Roopnagar and Bilaspur Districts and their respective Tehsils. The data is presented separately for both the Districts and in a few cases up to Tehsil level, wherever available.

4.3.1.1 Climate and Meteorology

The meteorological data has been taken from the nearest IMD station at Shimla of last five years.

Climate of District Bilaspur: The climate of the project area is generally sub-tropical but changes into temperate in a few places on the top of upper hill ranges. The summers are invariably hot, temperature rising to 42^{o} C at some places. And it falls down to 30^{o}C soon after the monsoons. Temperature varies from minimum of 5°C in winter to the maximum of 42°C in summer. The winters start from October to February and are characterized by heavy frost in the lower hills and valleys and a light snowfall during January and February at high reaches. Once during January 1945 the snowfall occurred extensively over the district down to 490 m.
The valleys and the Gobind Sagar Lake become full of dense fog during January-February and the fog sometime persist even upto, mid-day at Bilaspur. A cold night breeze also blows down the Sutlej valley at certain places during the small hours of the morning.

Summers starts from March onwards and lasts up to middle of June. The weather is hot and humid. This is also the period of severe drought. The days in the month of May and June are very hot and dry. Occasional thunderstorms break the dry spell. Growth period also starts from the beginning of this season. The temperature during winter comes down to less than 2ºC.

Rainfall in this division varies from 1000 mm to 1800 mm, 70% of which is received during the monsoons which last from end of June to mid September. The average annual rainfall for division for the period 1976 to 1992 works out to be 1270 mm. The average numbers of rainy days come out to 61 per annum.

Being located in the Sub Himalayan region, the districts of Bilaspur receive heavy rainfall. As far as the temperature is concerned, maximum temperature was 43.80C while minimum -3.50C observed 2001.

Table 4.3 Bilaspur District Rainfall (in mm)

S. No.	Districts	2000	2001	2002
1	Bilaspur	894.1	1083.3	1049.9

(Source: Statistical Outline Himachal Pradesh 2002-03, pp-43)

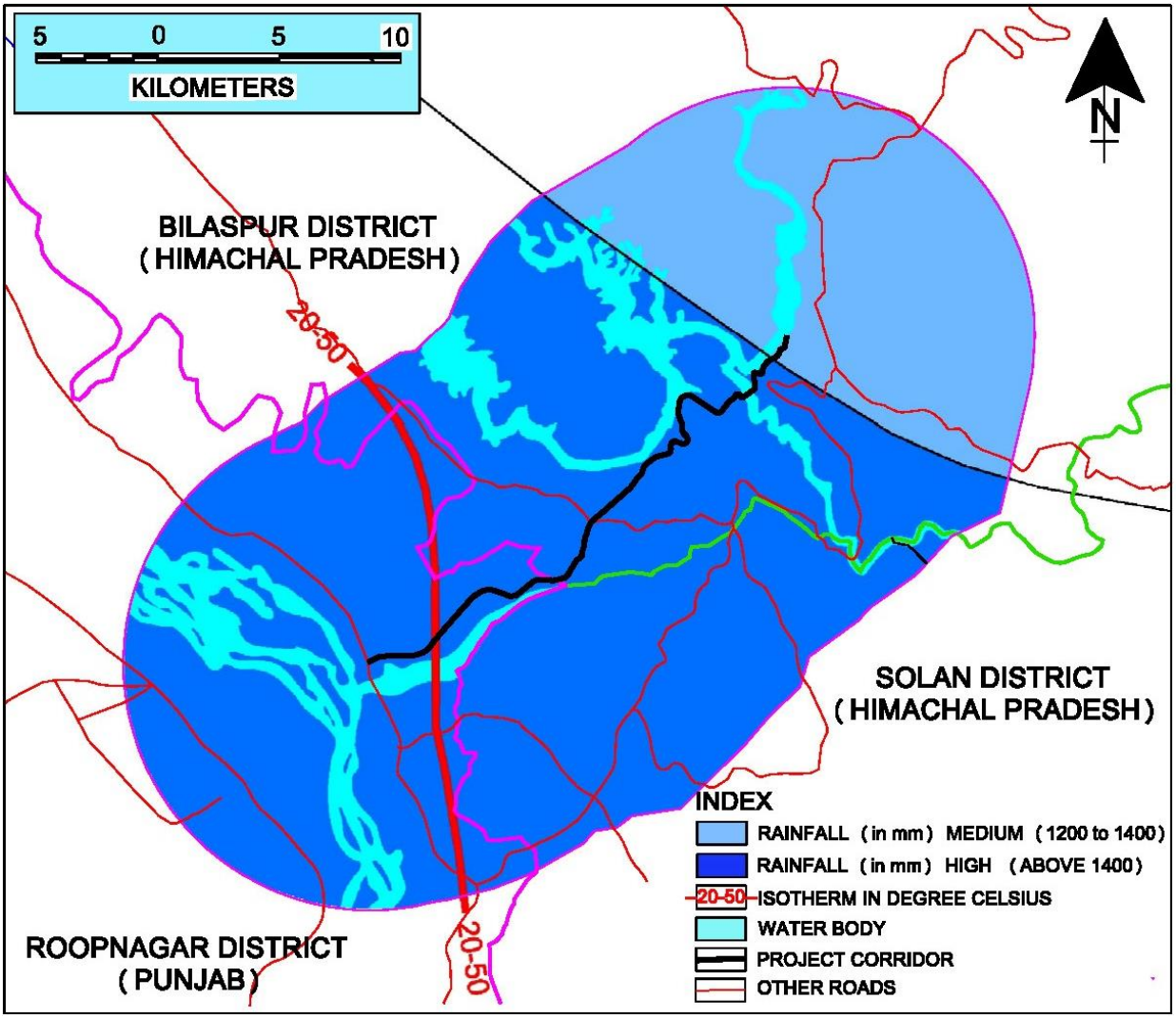


Figure 4-1: Climate and Rainfall

Climate of District Roopnagar: The climate of Roopnagar District is characterized by its general dryness (except in the south-west monsoon season), a hot summer and a bracing cold winter. The year may be divided into four seasons. The period from about middle of November to February is the cold season. This is followed by the summer season from March to about the end of June. The south-west monsoon season commences late in June and continues up to about middle of September. The period from mid September to the middle of November constitute the post-monsoon or transition season. The temperature ranges from minimum of 4° C in winter to 45° C in summer. May and June are generally hottest months and December and January are the coldest months. Relative humidity is high, averaging about 70 percent during monsoon. The average annual rainfall in district is 775.6 mm. About 78 percent of the annual rainfall is received during the period from June to September.

4.3.1.2 Physiography and Terrain

The project road passes through plane, rolling and mountainous terrain. It can be observed that physical attitude in the project area varies from 650 meters to 750 meters in Bilaspur district and 260 meter to in Roopnagar district. Physiographic system of Himachal Pradesh is part of Himalayan system. From south to North it can be topographically divided into three zones: the Shivaliks or Outer Himalayas, Inner Himalayas or middle Himalayas and the greater Himalayas or Alpines.

PHOTO 4.1 : LAND USE IN THE PROJECT AREA

PHOTO 4.2: LAND USE IN THE PROJECT AREA

The Physiography of Bilaspur District is criss-crossed by medium to low hills and deep valleys. The highest point is called Dhar Bahadurpur, which is at 6,738 ft. Above sea level, and the lowest point is about 1,000 ft. from sea level. The district has been divided into seven Dhars (hills), the major dhar (hill is Naina Devi where the "Kot Kahlu", the ancient capital of the State is situated. The physiography in general is 'high' to 'medium' and this can pose a constraint for industrial development.

PHOTO 4.3 : LAND USE IN THE PROJECT AREA

PHOTO 4.4: LAND USE IN THE PROJECT AREA

The altitude of Shivalik range varies between 350 meters to 1500 meters and the rainfall in this zone ranges between 150 cm to 175 cm. The altitude of Bilaspur Districts of Himachal Pradesh varies between 650 meters to 750 meters, the project area falls in Shivalik range of Himalayas. The Bilaspur district is situated in Satluj valley in the outer hills and covers area of 1,167 sq. Kms. The area is made up of consolidated deposits which can erode easily. The project area experiences problems of deforestation and a high rate of soil erosion. The land is suitable for cultivation of maize, wheat, ginger, sugarcane, paddy, citrus fruits and potatoes. The major land use pattern of the project area is shown in Photos 4.1 to 4.4.

Land use map of the study area i.e within 500m on either side of the proposed alignment to a scale of 1:25000 based on recent satellite imagery is shown in Fig. 1.2, whereas Table 4.4 gives the area break-up under various landuse.

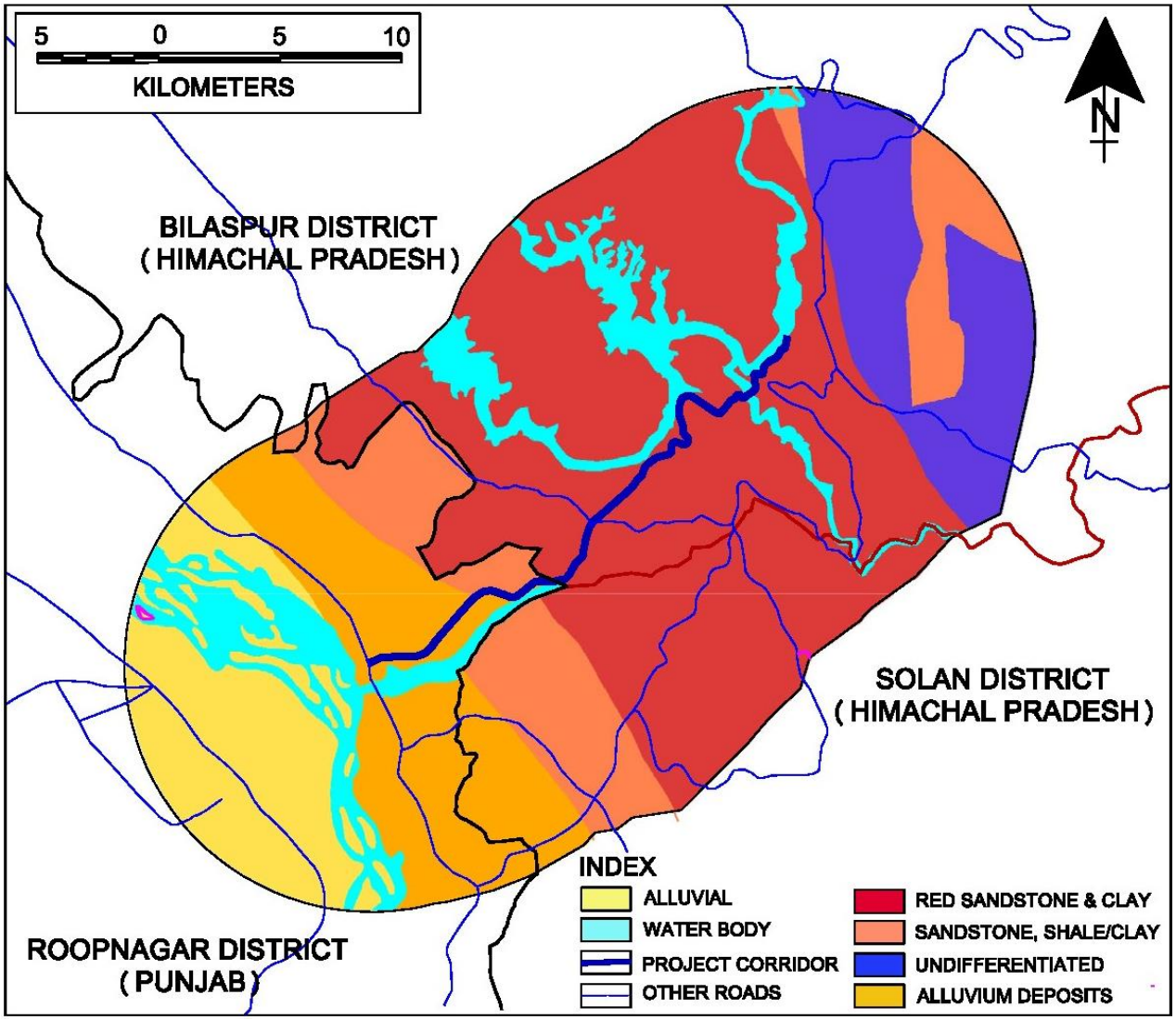


Figure 4-2: Physiographic of Project Region

Table 4.4: NH-21 Land Use within 500m buffer

S. No	Land use Type	Area in Hectares	Area in Percentage
1.	Agriculture	90.726	1.70
2.	Protected Forest	569.25	10.67
3.	Vegetation	2068.00	38.78
4.	Waterbodies (River, Canal and Streams)	316.48	5.93
5.	Settlements	212.00	3.98
6.	Industrial	7.43	0.14
	Total	**5332.63**	**100.00**

4.3.1.3 Geology

The project area lies in Western Himalayan region in a sector of Himalayan collisional belt known as sub Himalayas. This tectonic domain is bounded toward south by the Himalayan Frontal Thrust or Main Frontal Thrust (HFT or MFT); Main boundary thrust (MBT) and the Main Central Thrust (MCT) to the north. . These main thrusts as well as most of the belts and units of this NW region of Himalaya Orogeny show a regional strike of NW-SE to WNW-ESE with moderate to steep dips either towards north or the south.

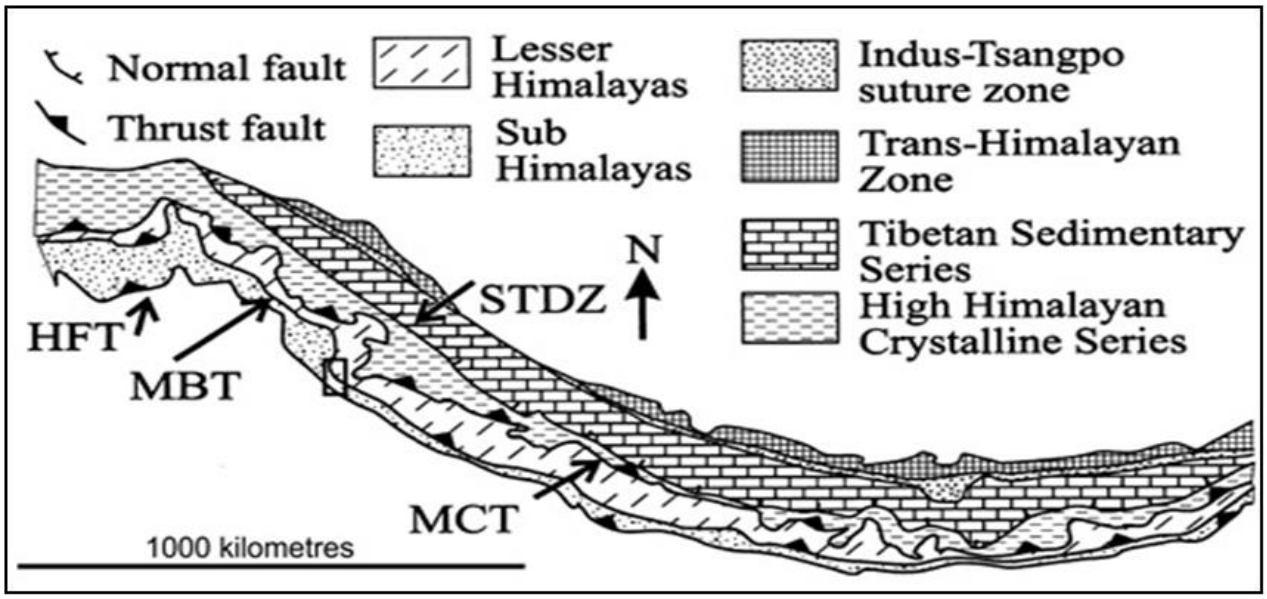


Figure 4.3: Potential Himalayan source rocks for the Sediments of the foredeep.

- MCT: Main Central Thrust;
- STDZ: South Tibetan Detachment Zone;
- MBT. Main Boundary Thrust;
- HFT= MFT: Main Frontal Thrust. In red square emphasized the studied area

Within the regional geology context, the project Kiratpur to Bilaspur will cross the rocks belonging to the Himalayan Foreland Basin of Shivaliks

- Upper Siwalik Fm sand stone, conglomerates deposition 7 Ma to Pleistocene:
- Middle Siwalik Fm sand stone with minor silt stone, shale, conglomerate deposition 11 to 7 Ma:
- Lower Siwalik Fm siltstone with minor sandstone, shale deposition 13 to 11 Ma:MSZ,
- Upper Dharamsala Fm (Kasauli) grey Sandstone, minor shale (fluvial / alluvial)deposition 16.5 to 13 Ma
- Lower Dharamsala Fm (Dagshai) Sandstone, silts, shale, caliches (fluvial / alluvial) deposition 20 to 16.5 Ma
- Subathu Fm Limestone, shale, minor fine grained sandstone (shallow marine) latest Paleocene -Middle Eocene:
- Singtali: This Cenozoic sedimentary rock consists on molasses sediments, representing the filling of foreland basin (foothills of the Himalayan Range), and an area where the sedimentary record of material eroded from the mountain belt is preserved.

Considering the available data coming from the World Stress Map (WSM) (a global compilation of information on the present-day stress field of the Earth's crust with 21.750 stress data records in its current WSM database release 2008,) the project zone falls very near the border between the Asian and Indian plate. The available stress indicators are Earthquake.

Focal Mechanisms, most of them indicating a compressive field with principal tensor NNESSW oriented (i.e. the direction of maximum horizontal compressive stress – SH max – is almost parallel to the direction of plate motion). At belt scale under thrusting of the Indian plate below the Eurasian plate, thrust faults are propagating to the foreland side of the Himalaya indicating southern most fronts as a most active zone. This is also shown by focal mechanism solution of a moderate to large earthquakes faced in kangra valley that are mainly thrust type events.

However, there are some events along the transverse fault indicating strike-slip motion.

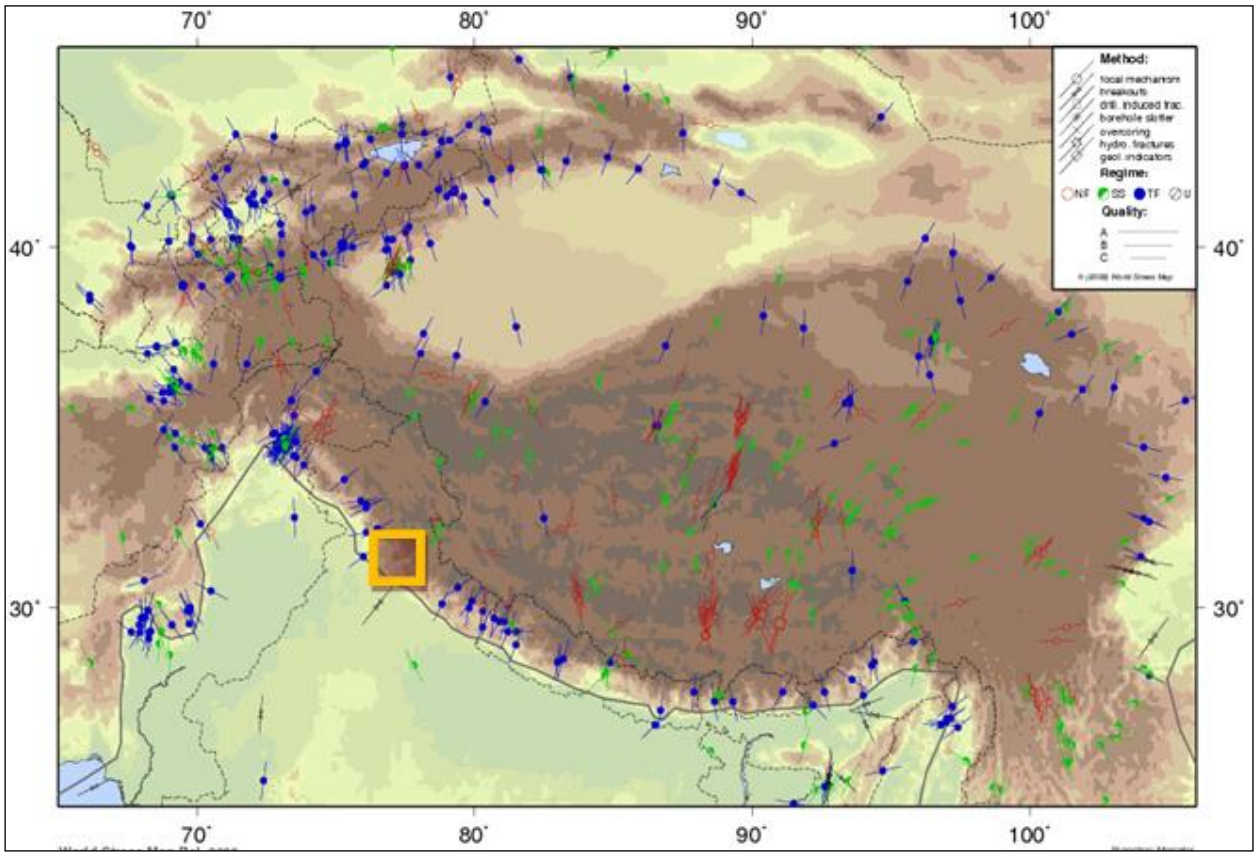


Figure 4.4: *World Stress Map (WSM), 2008; the project zone (yellow squaring) falls very near the border between the Asian and Indian plate. The available stress indicators are Earthquake Focal Mechanisms.*

Seismic Zoning Map of Himachal Pradesh: The Seismic Zoning Map of Himachal Pradesh, as incorporated in the Indian Standards Criteria for Earthquake Resistant Design of Structures (IS: 1893- 1984, Fourth Revision, issued in 1988), divides the state into two Seismic Zones. These Zones have been designated as Seismic Zone IV, and V, as shown in Figure 4.5. The Seismic Zoning Map of Himachal Pradesh has been prepared based on known magnitudes and known Epicenters of earthquakes, geologic and tectonic set up, litho logy and maximum intensities as recorded from damage surveys, etc. The map takes into account past history and future probabilities. The Seismicity Map of HP shows greater concentration of earthquake epicenters all along the Himalayan arc and the adjacent Indo-Gangetic plain.

Regional Geology of Project Area: The rock masses along the entire project road will be consists of sedimentary deposits of mudstone, sandstone, silt stone and conglomerates of the Shiwaliks formations. This sedimentary succession is classified as the Shiwalik formation Cenozoic age and bounded on the south by the Main Frontal Thrust and on the north by a complex of thrusts regionally referred as the Gambar Thrust, Bilaspur thrust Main Boundary Thrust (MBT). That delimited from the metamorphic complex, little outcropping in the area involved in the project. (Refer figure 4.6 & 4.7)

Lower Siwalik: Lower Siwalik rocks show facies variation over the areas of exposures in Himachal Himalaya. Lower Siwalik Subgroup rocks in the Jawalamukhi area consist of dominantly sandstone and Clay stone alternation. Contact between Upper Dharamsala and Lower Siwalik is normal. The Lower Siwalik subgroup varies in thickness from 1600 m thick in the Jawalamukhi area to 1900 m (Srikantia and Bhargava, 1998) in Paror-Sarkaghat area.

Mammalian fauna and shells of Unio are found in this sequence. The age is Upper Miocene (17 Ma - 10.8 Ma).

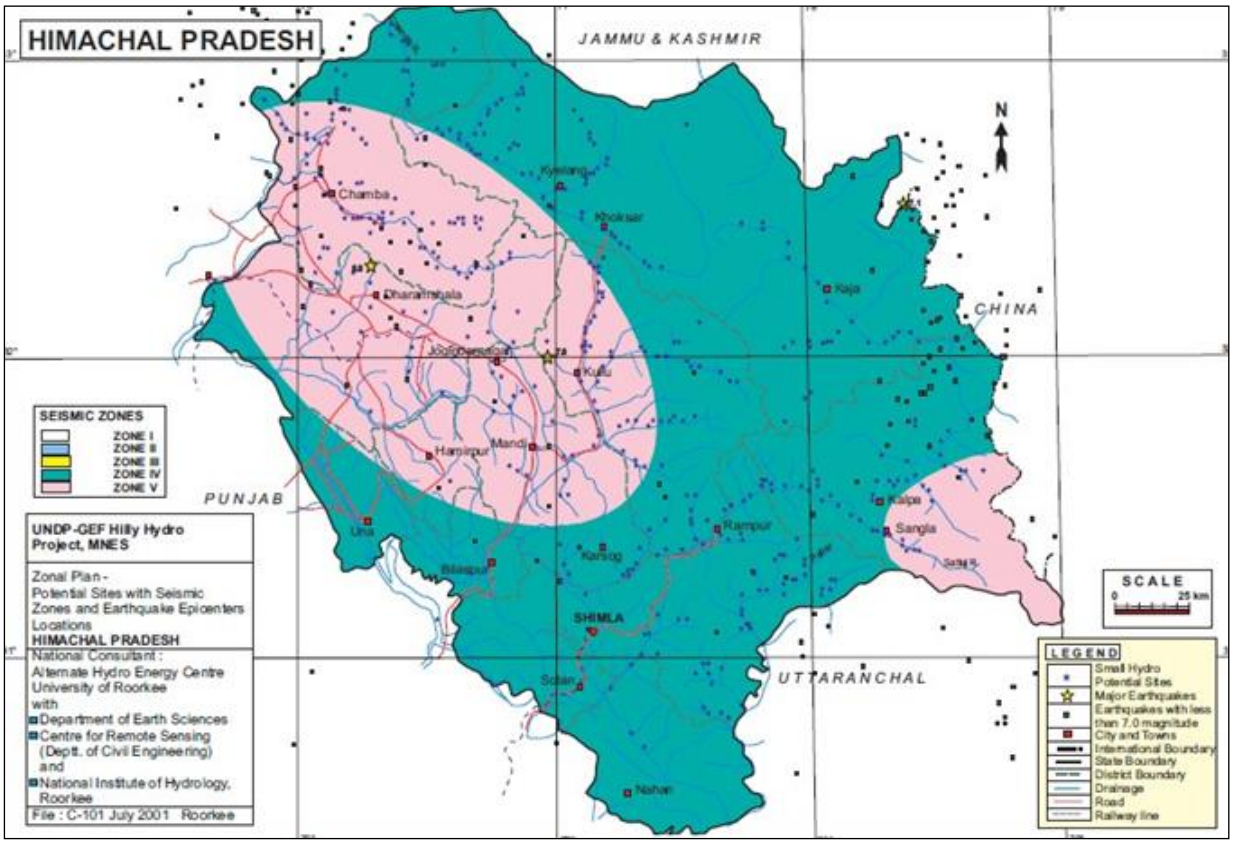


Figure 4.5: *Seismic Zoning Map of Himachal Pradesh*

Middle Siwalik: The Lower Siwalik Subgroup passes gradationally into Middle Siwalik. The rocks of this subgroup consist of dominantly sandstone of subgraywacke to arkosic nature, coarser, calcareous and micaceous with interbeds of earthy-red and silty clays. The thickness varies from 1400 m in Jawalmukhi area to 2000 m in Mandi area. Middle Siwalik Subgroup has yielded a rich collection of vertebrate fossils between Hamirpur and Haritalyangar (Prasad, 1970). The age of the Middle Siwalik is Pliocene (10.8 Ma - 5.22 Ma).

Upper Siwalik: The Upper Siwalik Subgroup dominantly consists of conglomerate facies in the upper part and alternations of sandstone, clay, and conglomerate in the lower part. The Upper Siwalik in this area is overlain by the still younger sediments i.e. Neogal Conglomerate and red clays of post – Upper Siwalik age representing the last phase of the Himalayan Orogeny. The Upper Siwalik attains maximum thickness of 2300 m in Bhakra Gorge and Janauri area where conglomerate facies becomes minor to negligible. It is mainly sandstone with silt. Further southward of Janauri the Upper Siwalik becomes highly argillaceous and is indicative of lacustrine origin. The age of the Upper Siwalik Subgroup is from Upper Pliocene (5.22 Ma) to Lower Pleistocene (0.22 Ma).

Subathu: Subathu unconformably overlies the Pre-tertiary namely Shali/Juansar and Simla group of rocks and comprises olive green and purple, oily looking gypseous shales with subordinate bands of limestone, sandstone and quartzite. Limestone is coquinite of broken oysters with Nummulites. Phosphates' nodules have been reported from green shales. Biostratigraphically, age of Subathu is Late Palaeocene to Early–Middle Eocene (Mathur, 1978). Najman et al., (2004) considered Subathu sediments as shallow marine environment deposits.

Rare pale current indicators (cross-beds) show NE directed flow (Najman et al.2004).

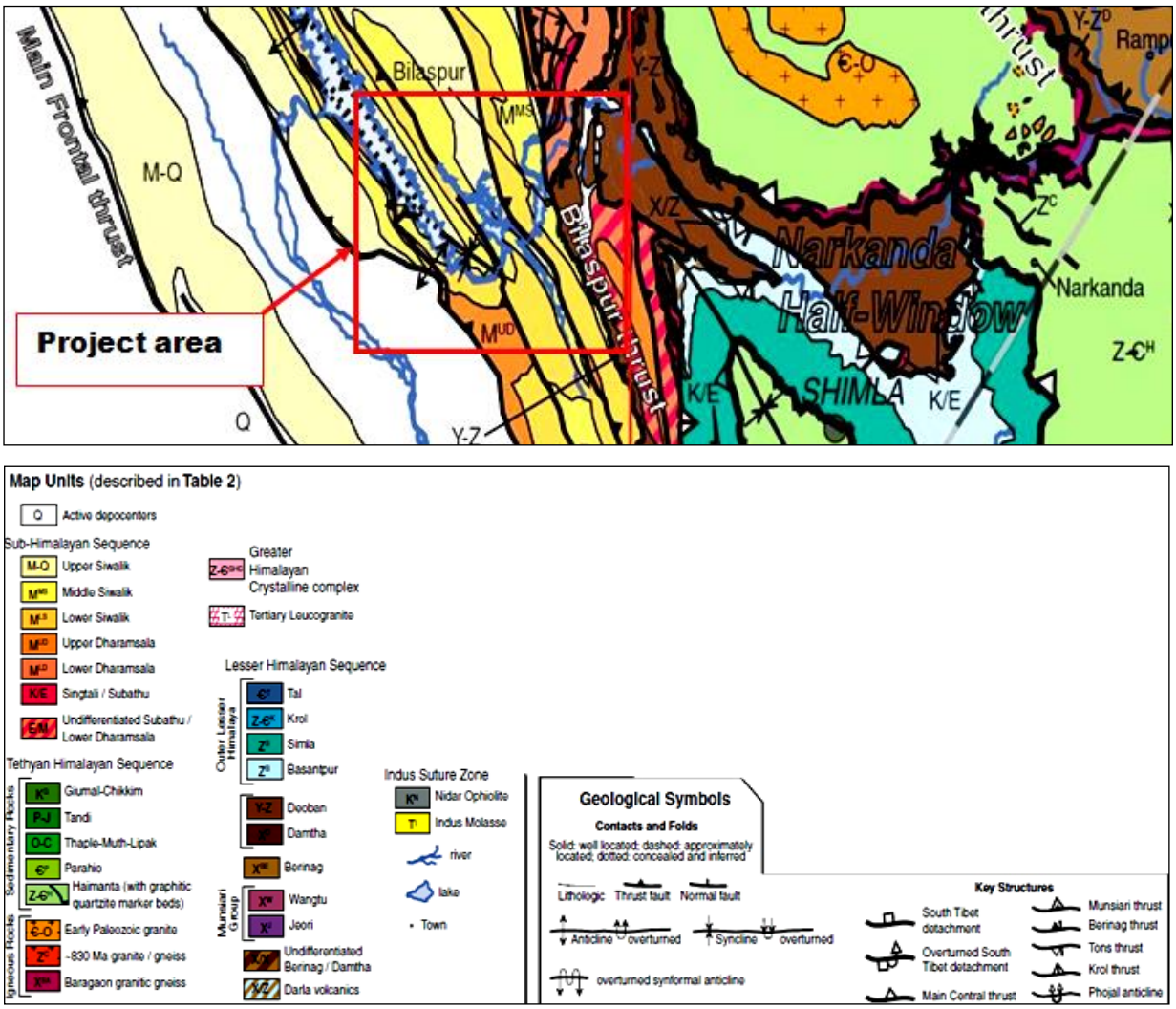


Figure 4.6: *Regional Geological Map of Project Area:*

Dharamsala: The Dharamsala Group Sedimentary sequence which has been subdivided to Lower and Upper Dharamsala sub-groups. The Lower Dharamsala Sub-group is comprised of massive or finely laminated, mottled, maroon and green micaceous mudstones and siltstones. The preferred palaeocurrent direction is SSW (Najman et al., 2004). Lower section of the Upper Dharamsala is predominantly of varied color mudstone. Olive mudstones containing abundant leaf moulds and carbonaceous organic matter are common. The inferred flow direction is SW (Najman et al., 2004). The palaeocurrent data indicate that two drainage systems commonly occurred synchronously in the foreland basin (Burbank and Beck, 1991; Miall, 1995).

The Siwalik Group is divisible into three subgroups respectively the Lower, Middle, and Upper on the basis of lithostratigraphy (Karunakaran and Ranga Rao, 1979).

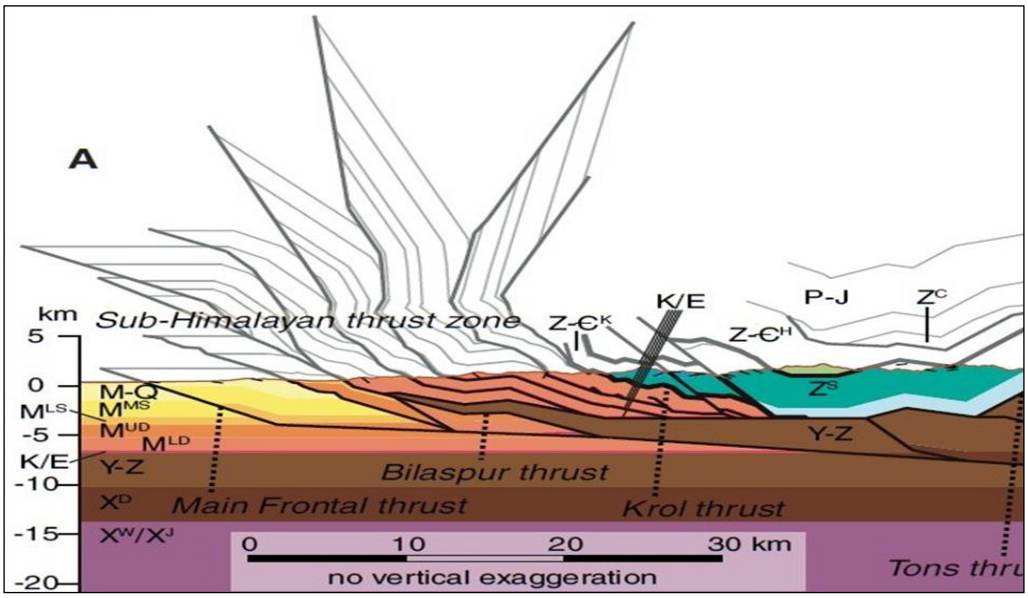


Figure 4.7: *Regional Geological Cross section of Project Area*

Observed Lithostratigraphy: The rock masses along the Tunnel number 1 belong to the upper shivalik Formation that is represented by a sequence of argillaceous and arenaceous rocks, forming a series of alternate of sandstones, siltstone/clay stone beds.

Tunnel Number- 1

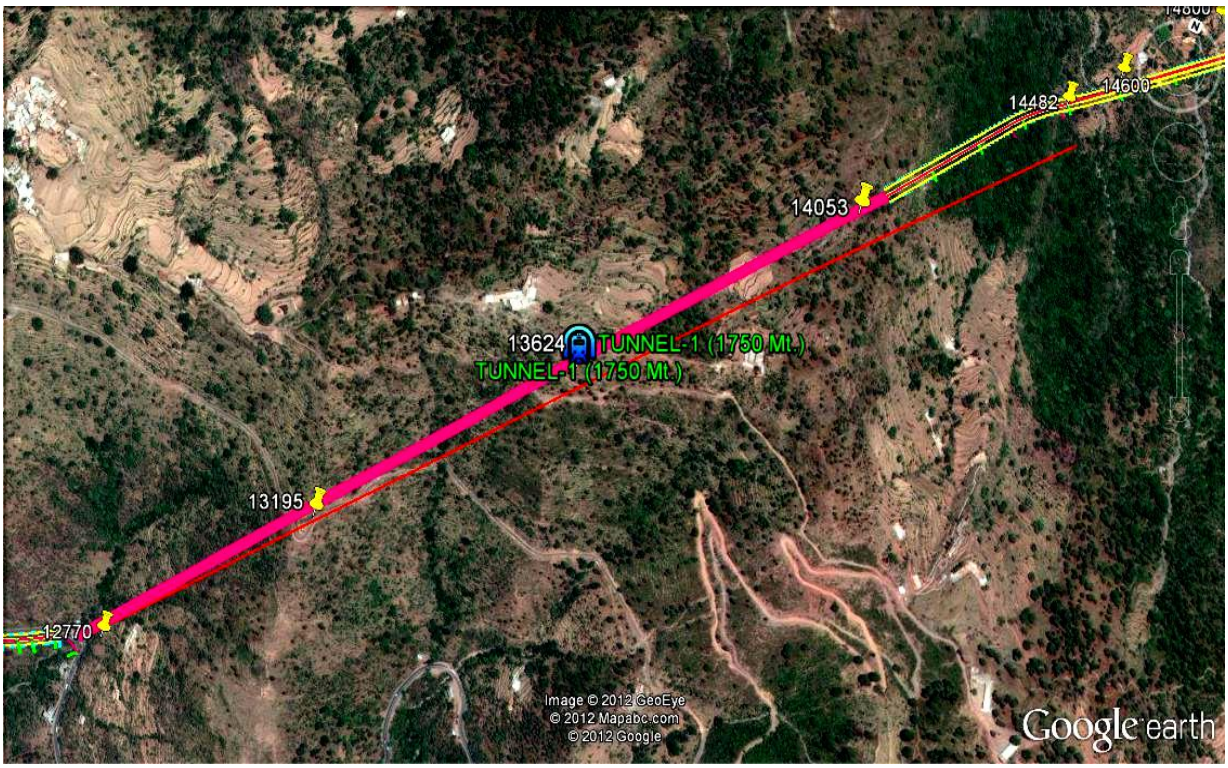
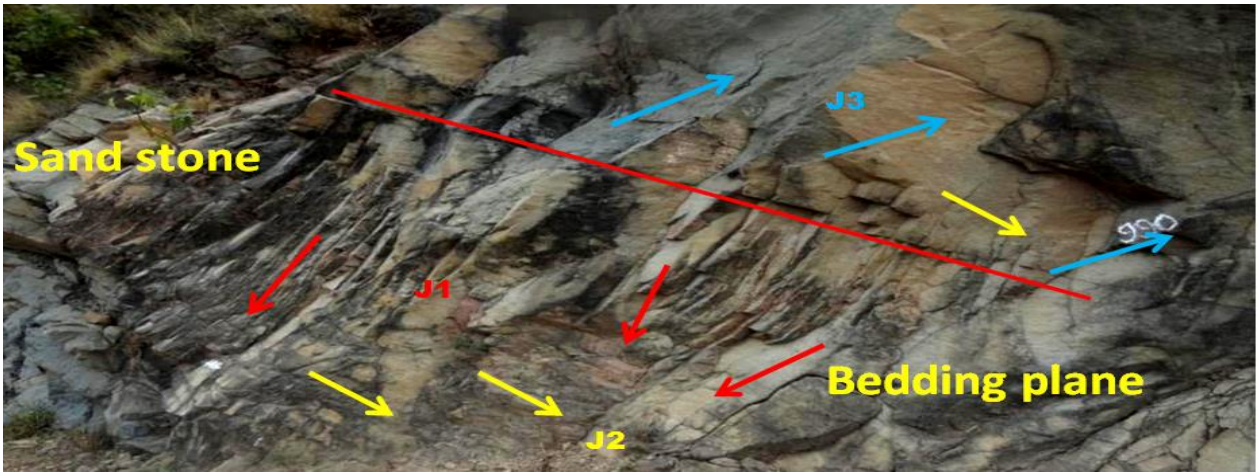


Figure 4.8 A: *Alignment of Tunnel Number- 1 on Google Earth*

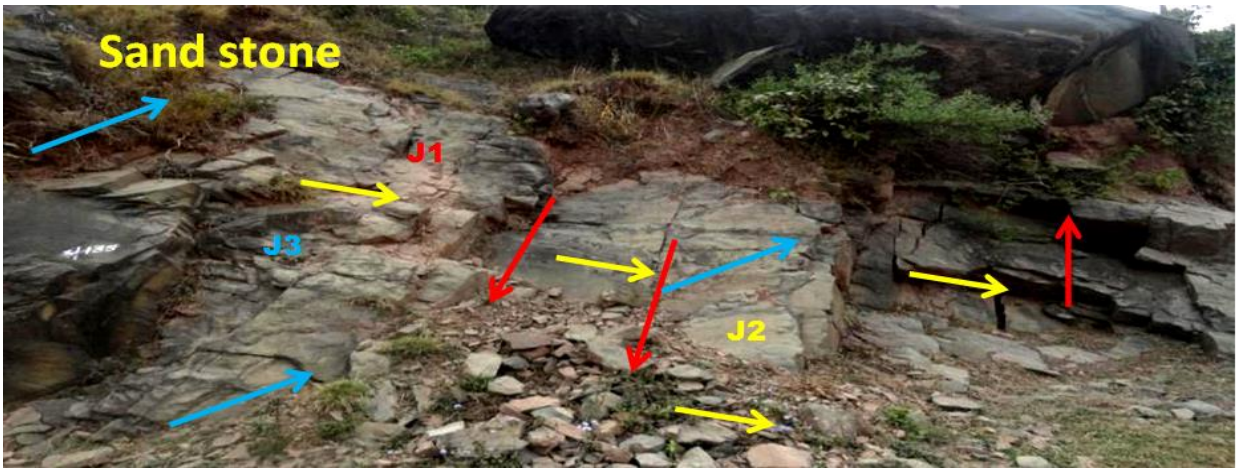
Sandstone: Massive to jointed and fine to coarse grained sand stones frequently show different sedimentary structure, like ripple marks, cross bedding and graded bedding. Weathering processes are common in very jointed and fractured strata. The total thickness varies from 2 to 5m.

Figure 4.8 B: Vertical Profile of Hill along Tunnel Alignment

This sandstone, for the nature of massive diagenized rocks and low weathering susceptibility, shows a competent geomechanical behavior. During the geological field observations the main outcrops observed concerns the sandstone beds with a fresh surface and a thin soil thickness. The joint sets show a low weathering of filling.



Stone Formation and Bedding Plane



Three sets of joints over Sand stone

Interbedded Siltstone and Clay stone: The siltstones are fine grained with well developed bedding laminations, often Micaceous, spotted, with calcite veins. The thicknesses vary from .5 m to 3M.The Clay stone are fine grained, soft to fairly hard, sometimes highly friable and crumbled when looses moisture. The clay stone inter bedded appears in the field totally incoherent, due to high fracture zones and high rate of Weathering.

Because of their closely alterance, the interbeded siltstone and clay stone were not differentiated. They appear moderately loosened and covered by eluvia materials (soil).

Clay stone: The dark red purple clay stone beds outcrop thinly bedded and highly jointed with a high susceptibility to weathering. Sporadic local outcrops only are observed where the intense erosion (fluvial and gully) exhume these layers under thick covers of alluvial materials.

Sandstone/Siltstone/Clay stone alternances: Some areas have been mapped decimetric to metric alternances of sandstone, siltstone and clay stone beds; they were not differentiated.

Structural Setting: As already reported in the regional geology, the investigated rocks for the design work of the Tunnel-1 have undergone a quite complex deformational history related to the Himalayan orogeny. In particular, these rocks, which are sandwiched between two regional thrust, HFT and Gambar thrust parallel to Govind Sagar Dam fells the effect of forceful regional tectonic activity. Here under a brief description will be given of main structural features that was recognized and measured during the field survey. In addition, the interference, which this features has with N-S alignment, are presented. Beds are dipping E to W at an angle of 45o to 55o the Strike of Rocks are tending 15o NE

Bedding: The bedding setup in the Tunnel 1 area feels the effect of a large scale fold, that affect all the Flysch succession. The axis of this fold, syncline, fold is towards Govind Sagar is direct NW/SE with SE dip. The tunnel project crosses the syncline structure from south to north. In geological consideration the position of the alignment within the fold structure. In correspondence of south portal area the bedding is dipping towards North West with gently angle 45o to 30o. The tunnel will be excavated on the left limb of the fold and its axis run almost parallel to the strike of the bedding planes, make unfavorable tunneling conditions.

Shear Zones and Faults Planes: The field mapping revealed several shear zones roughly parallel to the bedding. The mapped shear zone and fault planes have been plotted on a Schmidt diagram. The strike trend of shear zones, as shown in the diagram, vary between N-S, E-W, low angle dipping towards E and S, like the bedding: the field observations revealed that shear zones developed along the bedding planes especially the weak siltstone and clay stone layers, which have a less competent reologic behavior than sandstone layers. Along the shear planes are present decolorized cataclastic rocks and fault gouges one meter or less thick, showing sometimes inverse movements. Attention must be placed on the fact that normally and in particular along the shear zones, the siltstone and clay stone strata suffer of relevant erosion processes. As a result of these processes, most of the areas with bedrock of clay stone and siltstone are covered by alluvial materials with limited percentage of outcrop. This means that some shear zone (eventually affecting the rock masses at the tunnel level) could be present, masked by these erosion debris.

Tunnel Number - 2

Figure 4.9 A: *Alignment of Tunnel No 2 on Google*

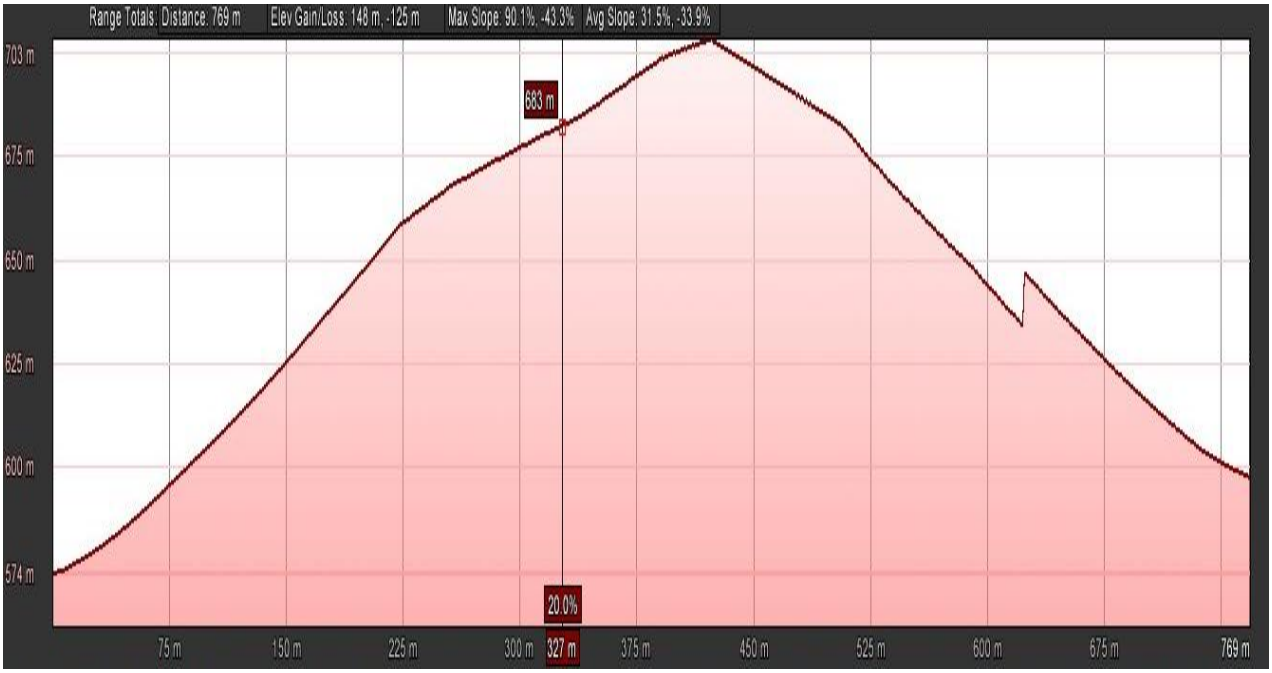


Figure 4.9 B: *Vertical Profile of Hill along Tunnel Alignment*

Cross Section of Hill Along Tunnel Alignment

Observed Litho Stratigraphy: The rock masses along the Tunnel number 2 belong to the upper shiwalik Formation that is represented by a sequence of argillaceous and Arenaceous rocks, now forming a series of alternate of sandstones, siltstone/clay stone beds.

Interbedded Siltstone and Clay stone: The siltstones are fine grained with well developed bedding laminations, often Micaceous, spotted, with films and veins of calcite. The thicknesses vary from 0.5 to 1m. The clay stone are fine grained, soft to fairly hard, sometimes highly friable and crumbled when looses moisture. The clay stone interbeded appears in the field totally incoherent, due to high fractures and high rate of loosening.

Sandstone: Massive to jointed and fine to coarse grained sandstones frequently show different sedimentary structure, like ripple marks, cross bedding and graded bedding. Shear zones are common in very jointed and fractured strata. The total thickness varies from 0.5m to 2m**.**

Structural Setting: As already reported in the regional geology, the investigated rocks for Tunnel number 2 works have undergone complex deformational history related to the Himalayan Orogeny. In particular, these rocks, which are sandwiched between two regional thrust, HFT and Gambar thrust parallel to Govind Sagar dam fells the effect of forceful regional tectonic activity.

Here under a brief description will be given of main structural features that was recognized and measured during the field survey. In addition, the interference, which this features has with N-S alignment, are presented. Beds are dipping E to W at an angle of 45° to 55° other Strike of Rocks are tending 15° NE.

Bedding: The bedding setup in the Tunnel 1 area feels the effect of a large scale fold, that affect all the Flysch succession. The axis of this syncline, fold is towards Govind Sagar is direct NW/SE with SE dip. The tunnel project crosses the core of syncline structure from West to East. The alignment falls within the fold structure. In correspondence of West portal area the bedding is dipping towards South West with gently angle 45° to 30°. The tunnel will be excavated on the core of the folded strata and its axis run across the dip direction of the bedding planes, make Favorable tunneling conditions.

Shear Zones and Faults Planes: The field mapping revealed several shear zones roughly parallel to the bedding. The mapped shear zone and fault planes have been plotted on a Schmidt diagram. The Strike trend of shear zones, as shown in the diagram, vary between N-S, E-W, low angle Dipping towards E and S, like the bedding: the field observations revealed that shear zones Developed along the bedding planes especially the weak siltstone and clay stone layers, Which have a less competent reologic behavior than sandstone layers.

Along the shear planes are present decolorized cataclastic rocks and fault gouges one meter or less thick, showing sometimes inverse movements. Attention must be placed on the fact that normally and in particular along the shear zones, the siltstone and clay stone strata suffer of relevant erosion processes. As a result of these processes, most of the areas with a bed rock of Clay stone and siltstone are covered by eluvia materials with limited percentage of outcrop. This means that some shear zone (eventually affecting the rock masses at the tunnel level) could be present, masked by these erosion debris.

Tunnel No. 3

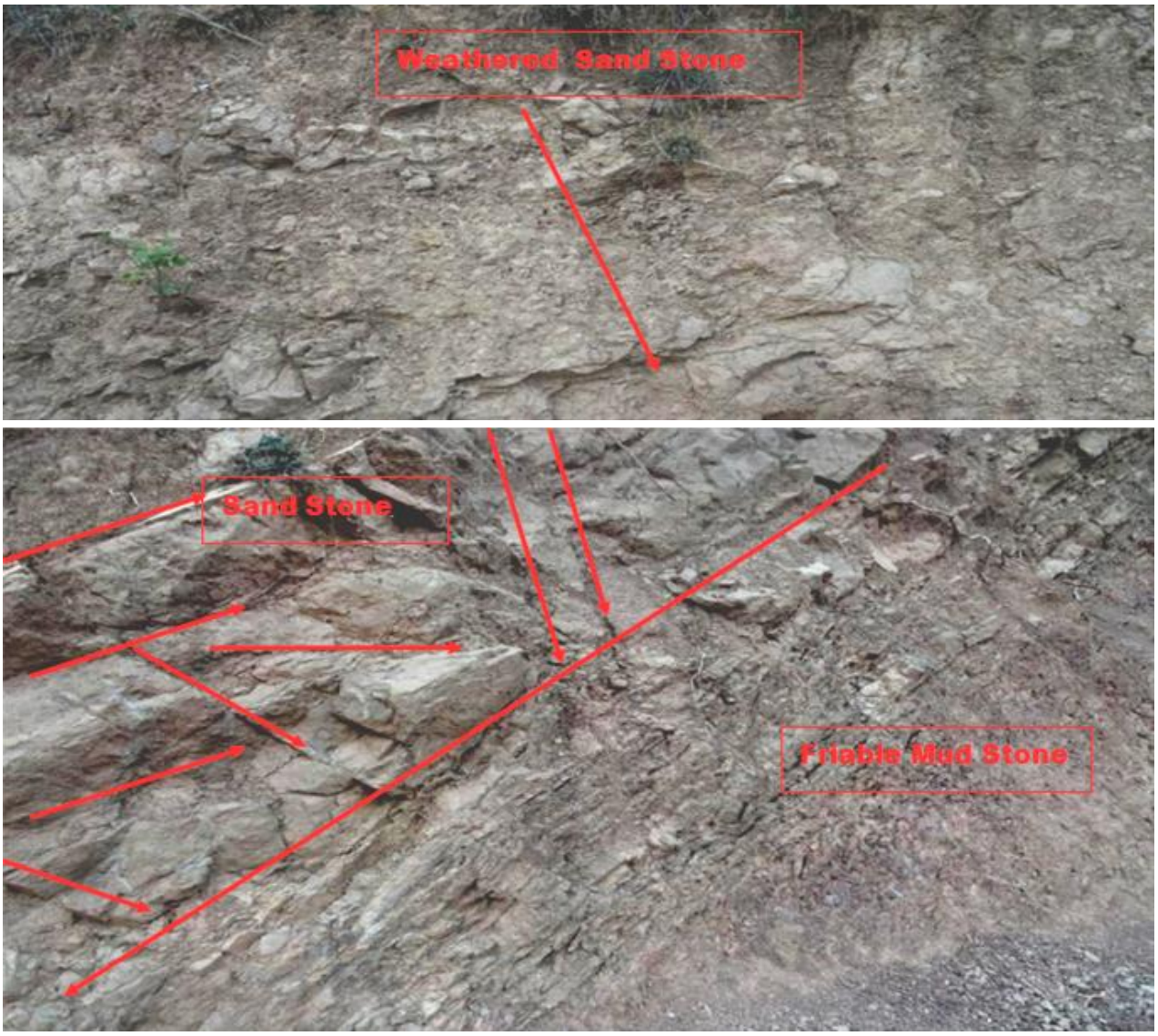
Figure 4.10 A: *Alignment of Tunnel No 3 on Google*

Figure 4.10 B: *Vertical Profile of Hill along Tunnel Alignment*

Cross Section Of Hill Along Tunnel Alignment

Observed Litho Stratigraphy: The rock masses along the Tunnel-3 belong the Middle shale Formation The rocks of this subgroup consist of dominantly sandstone of sub greywacke to arkosic nature, coarser, calcareous and micaceous with interbeds of earthy-red and silty clays.

That is represented by a sequence of originally argillaceous and arenaceous rocks, now forming a series of alternate of sandstones, siltstone/claystone beds



Interbedded Siltstone And Clay stone: The siltstones are fine grained with well developed bedding laminations, often micaceous. The thicknesses vary from 1 to 3m.

The Clay stone are fine grained; soft to fairly hard, sometimes highly friable and crumbled when looses moisture. The Clay stone interbedding appears in the field totally incoherent, due to high fractured and high rate of weathering.

Siltstone: The siltstones are fine grained with well developed bedding laminations, often micaceous, spotted, with films and veins of calcite. The thicknesses vary from 0.5 to 3m. The clay stone are fine grained, soft to fairly hard, sometimes highly friable and crumbled when looser moisture. The clay stone interbedding appears in the field totally incoherent, due to high rate of weathering and fractures due to stresses faced in past.

Clay stone: The dark brown clay stone beds outcrop thinly bedded and highly jointed with a high Susceptibility to weathering. Sporadic local outcrops only are observed where the intense erosion (fluvial and gully) exhume these layers under thick covers of alluvial materials.

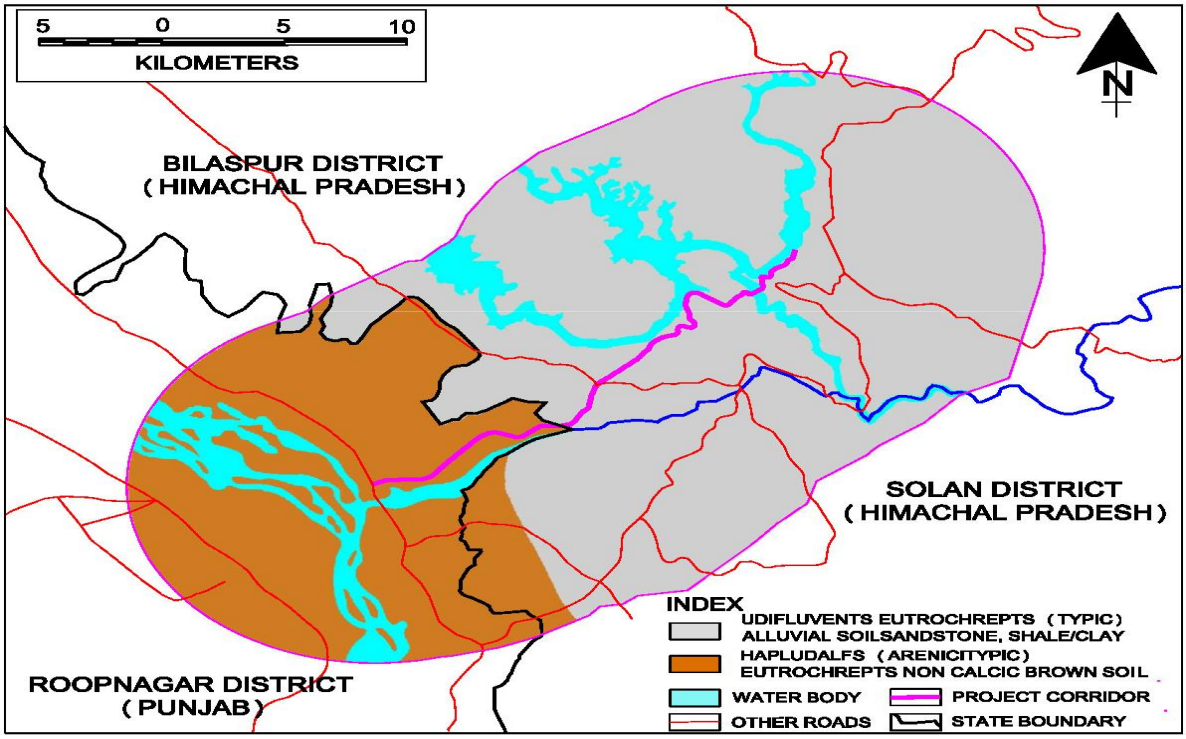
Structural Setting: As already reported in the regional geology, the investigated rocks for the design work of the Tunnel-3 have undergone several phases of deformational history related to the Himalayan orogeny. In particular, these rocks, which are sandwiched between two regional thrust, HFT and Gambar thrust parallel to Govind Sagar dam fells the effect of forceful regional tectonic activity. Here under a brief description will be given of main structural features that was recognized and measured during the field survey. In addition, the interference, which this features has with N-S alignment, are presented. Beds are dipping W to N at an angle of 25° to 35° the Strike of Rocks are tending 25° NW.

Bedding: The bedding setup in the Tunnel 3 area feels the effect of a large scale fold that affect all the Lower Shivalik succession near Govind Sagar is direct NW/SE with SE dip. The tunnel project crosses the horst portion of Gambar thrust from West to East. In correspondence of West portal area the bedding is dipping towards North with gently angle 45° to 30°. The tunnel will be excavated on the core of the folded strata and its axis run across the dip direction of the bedding planes, make Favorable tunneling conditions.

4.3.1.4 Soil

The soils of the Roopnagar District vary in texture generally from loam to silty clay loam except along the Sutlej River and chos where some sandy patches may be found. Chamkaur Sahib and Kharar blocks have sodic soils. The soils of Anandpur Sahib and Rupnagar blocks are undulating.

Figure 4.11 : *Soil along the Project Corridor*



The soil of Bilaspur district has great potentialities for growing various types of cereals, fruits, vegetables and other cash crops. The details of the types of soils available in the district are shown in Table 4.5.

Table 4.5: Soil Types

S. No	Category Of Soil	Location where found in the District
1.	Loamy Soil on Steep Slopes	In northern western & southern western part of Ghumarwin tehsil of Bilaspur District.
2.	Loamy Skeletal Soils on Steep Slope	Large patches in northern eastern & southern western part of Bilaspur Sadar and few patches observed in western part of Ghumarwin, and southern eastern part of Naina Devi of Bilaspur district.
3.	Loamy Skeletal Soils on Moderate Slope	Major portion of Ghumarwin, and eastern part of Jhandutta areas of Bilaspur district.
4.	Coarse Loamy soils on Gentle Slopes	Large patches observed in Jhandutta and Naina Devi of Bilaspur district.
5.	Fine loamy soils on moderate slopes	Some patches are observed only in Bilaspur Sadar of Bilaspur district.
6.	Deep fine loamy soils on moderate slopes	Very few patches are observed in northern part of Bilaspur Sadar, and southern eastern part of Ghumarwin & Jhandutta of Bilaspur district.
7.	Medium deep calcareous soils	Few patches are observed in northern eastern & southern western parts of Ghumarwin and northern eastern part of Jhandutta area of Bilaspur district.
8.	Medium deep coarse loamy soils	Patches are observed in southern western part of Naina Devi tehsil in Bilaspur district.
9.	Medium deep calcareous soils	A very small patch is observed at northern western part of Ghumarwin tehsil of Bilaspur district.

(Source: NBSS & LUP).

4.3.1.5 Land Utilisation Pattern

Land use / Land Cover: The land use map shows use and pattern of the land in the District. In effective planning, the land use map is most important. It gives an idea where lands are available and what is the present use of that land. The environmentally sensitive areas viz. protected forest, plantations and wet lands. It provides input for other thematic maps. It gives detailed information about the physical features of the District. The recent land use map has been prepared by NRSA based on satellite imageries taken during different seasons. This map shows the real land use which is in existence where as the legal land use may be different. Also, the forest area shown by the Forest Department, an authentic body defining forest areas may not match with the forests in the land use map of NRSA.

In Bilaspur district major portion of the land falls under the category of wasteland with major part of Ghumarwin tehsil utilized for the cultivation purpose which mainly includes single crop. However there are some elongated patches of reserved, protected and others forest found in the northern western parts of Naina Devi, northern western & southern eastern part of Jhandutta with some narrow patches in Bilaspur Sadar, and Ghumarwin tehsil. Degraded forests are observed in southern western & southern eastern parts of Naina Devi, southern eastern part of Jhandutta, and eastern part of Ghumarwin

The size of operational holdings in this Roopnagar district is generally very small. Small holdings coupled with varying topography are the limiting factors in introduction of mechanized farming. With less than 10% of holdings falling in the size group of 10 ha & above, a strategy wherein technological interventions feasible in small holdings are to be planned for higher and sustainable growth of agriculture. The total cultivated areas are 67%, 13% is under forest land, 13% is covered under Trees and srubs and misc whereas rest are fallow land.

The project road passes mainly through plain and rolling terrain. The project road passes through forest land, agricultural land and important settlements like Kiratpur, Masewal, Maura, Swarghat and Bilaspur. Rivers that cross the project road include Gaggar and Kansa. These are perennial rivers. There are no ponds along the corridor. About 5 educational institutes and 9 religious structures (including shrines) are present along the corridor.

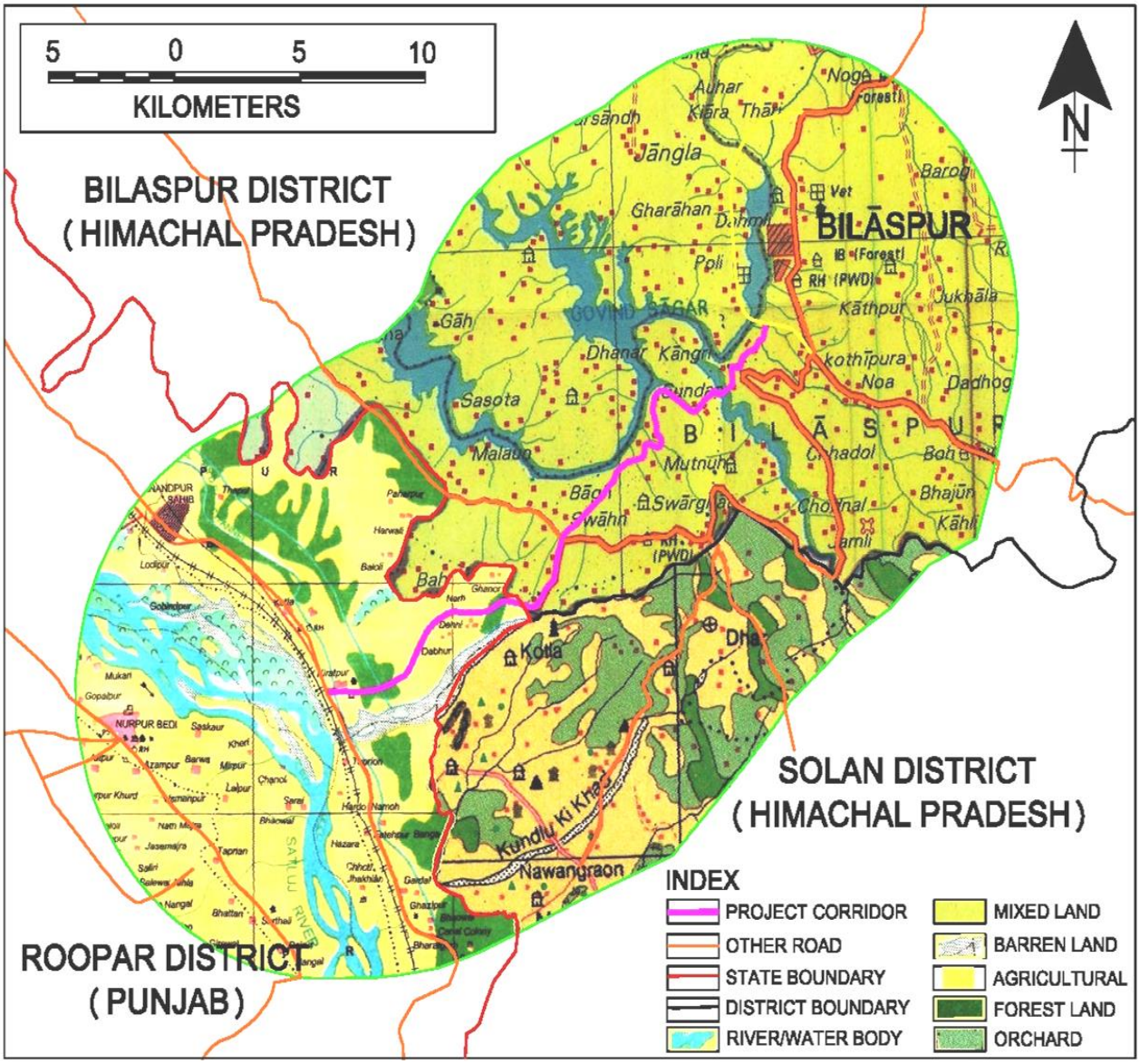


Figure 4.12: *Landuse along the Project Corridor*

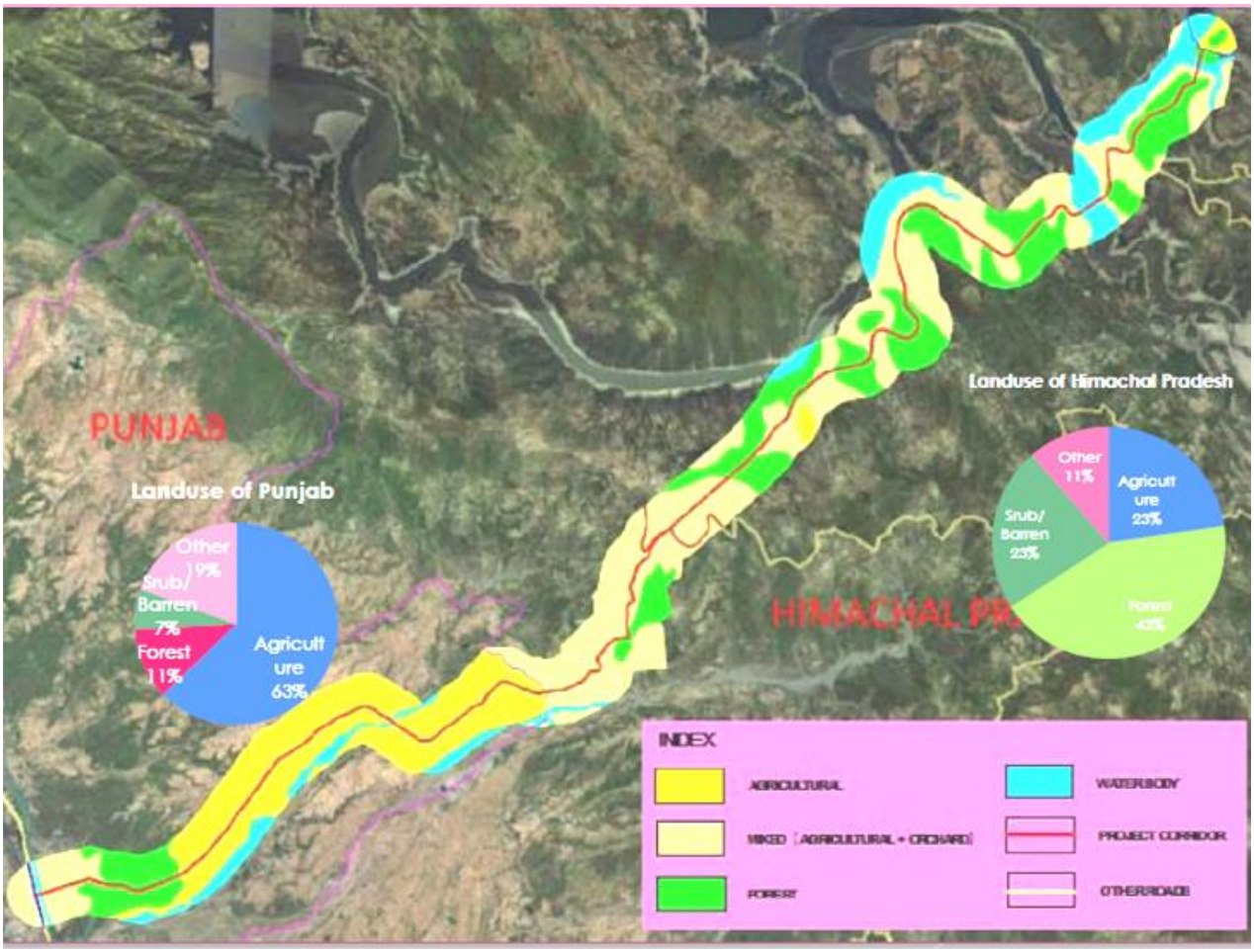


Figure 4.13: *Landuse on Remote Sensing Imagery*

4.3.1.6 Water Resources

Sutluj is the only snow fed river in the area. Sutluj River in Bilaspur now forms the Gobind Sagar Lake. The Gobind Sagar Lake is 90 km. long and encompasses an area of approximately 170 sq. km. The water level in the lake starts rising from May onwards due to increased inflow of water and the maximum level 513.7 m (1685 ft.) is attained during September-October. The water starts receding from mid October onwards till April when the lowest level of 440 m is attained and the river starts flowing down to Jagatkhana which is the lower limit of dead storage. The lake water however is not available for irrigation purposes because lifting of water is not permitted by the Bhakra Beas Management Board.

The following information regarding the Reservoir levels of Govind Sagar Lake have been collected:

- Full Reservoir Level : 1685 feet (513.7m)
- Maximum Reservoir Level : 1690 feet (515.25m)
- Dam Top Level : 1700 feet (518.3m)
- Flow observed at low stage in the months between March and August.

The principal tributaries of Sutlej River are Ghamber, Ghambrola and Ali Khad along the left bank and its tributaries Sukar and Sarhali along the right bank. All these streams are perennial. Water starts accumulating in their low reaches during high level of lake. Some lift irrigation schemes from these khads have been put under operation, many others are under consideration. Water from Ali Khad is also used for irrigation of some lands along its bank. Other subsidiary streams are generally dry except during the rainy season when these become raging torrents causing much erosion and carrying with them heavy detritus.

The rainfall is not very heavy and there is scarcity of water in the area. The situation usually becomes acute during the months of May and June when even drinking water in most of the places have to be carried from long distances. The situation has been eased to a great extent by installation of piped water supply and deep bored hand pumps. The surface and ground water resources in project area are shown in Photo 4.5 and 4.6.

Photo 4.5: *Surface water resource (Canal) at Km 0.400*

Photo 4.6: *Surface water resource Satluj river at Km18.3*

Two Khud namely Ghambhar Khud and Ghambhrola khud cross the project road at Km 23+200 and at Km. 26+200 respectively. The crossing of Satluj shall be over Govind Sagar Lake (approx 22 km upstream of Bhakra Dam) at Km 26+500.

Flood: The study area as a whole has not experienced any major flood during memorable past. However, River Satluj, an international river by origin, experienced a major flood in August, 2000 due to breach of a dam situated in the upper region of its catchment. The existing bridge on NH21 over Ghambhar and Ghambhorala, however, safely passed the freak flood of 2000 without any harmful afflux or scour. The existing stretch (of NH21) of the project road has never been subject to any adverse flood situation giving rise to overtopping of road, erosion etc.

Surface Water: The Himachal Pollution Control Board is monitoring water quality of the natural water bodies regularly under Monitoring of National Aquatic Resources (MINARS) program. The monitoring has been carried out in the month of April, July, October and January every year. In all 36 points have been selected on major rivers Satluj, Beas, Ravi, Yamuna, Parvati, Sirsa, Markanda & Sukhna and samples are being analyzed for 22 parameters which includes the physico-chemical and bacteriological contents. The monitoring result of surface water quality for the month of April 2007 and January 2008 are given in Tables 4.6 respectively.

In project area under MINARS programme surface water samples were taken from following locations:

1. Upstream of Slapper town;
2. Downstream of Slapper town;
3. Dehar power house;
4. Downstream of ACC Bermana; and
5. Downstream of Bilaspur.

The water quality is generally good as far as pH, DO and BOD is concerned. However bacteriological water quality does not fall under category A of drinking water standards. The

prime reason of higher coliform in Sutluj water is urban waste near towns, which is directly affecting the quality of water. Surface Water Quality of project area is given in Table 4.6.

Table 4.6: Surface Water Quality Project Area

Name of Monitoring Location	pH	DO mg/l	BOD mg/l	T.C. MPN/SPC/ 100 ml
April 2007				
Satjuj River U/S Slapper, 1014-R-SAT-A	7.59	9.5	0.5	170
Satluj River Dehar Power House, 1005-R-BEA-A	7.50	9.0	0.2	110
Satluj River D/S Slapper, 1015-R-SAT-A	7.62	9.5	0.4	49
Satluj River D/s ACC Barmana. Satluj River	7.76	9.5	0.5	70
Satluj River D/S Bilaspur, 1291-L-GOL-A	7.71	9.0	1.2	>2400
January 2008				
Satjuj River U/S Slapper, 1014-R-SAT-A	8.07	12.4	0.2	240
Satluj River Dehar Power House, 1005-R-BEA-A	7.92	12.5	0.5	920
Satluj River D/S Slapper, 1015-R-SAT-A	8.01	12.3	0.4	540
Satluj River D/s ACC Barmana. Satluj River	7.99	12	0.7	920
Satluj River D/S Bilaspur, 1291-L-GOL-A	7.9	12	0.8	540

Ground Water

Availability: As discussed with Mr. Ravindar Sharma Environmental Engineer, Himachal Pollution Control Board, Bilaspur, water quality in the area is generally good. Some time fecal coliforms particularly during rainy season and summer season were observed. There are many hand pumps in the project area; some of them will be directly affected due to acquisition of land for the new alignment. The quality of water of these hand pumps is fit for drinking purpose as stated by local people.

Bilaspur District: As per CGWB ground water is the major source of water in the Bilaspur district for irrigation and domestic use. There are large numbers of water supply wells & tube wells, springs, kulhs (water channels) and lift irrigation schemes implemented exclusively for irrigation purposes. In the low lying areas underlain by Siwalik rocks, depth to water level ranges from 2.50 to 15.00 m bgl. In upland/plateau areas the water level is generally deep. In valley areas, depth to water level ranges from near surface to 6 mbgl in pre monsoon. Quality of ground water in shallow aquifer is good for domestic and irrigation purpose in the district.

Table 4.7: Ground Water Scenario in Bilaspur District

S. No	*Bilaspur District (2004)*	
1.	Annual Replenishable Ground Water Resources (MCM)	Not estimated due to localized aquifers
2.	Net Annual GW DRAFT(MCM)	
3.	Stage of Ground Water Development (in %)	
4.	No. of over-exploited blocks	Nil
5.	No. of Critical Blocks	Nil
6.	No. of Blocks notified	Nil

Source – CGWB (http://cgwb.gov.in/District_Profile/HP/Bilaspur.pdf)

The district has a hilly terrain having very high slopes. The valley areas are narrow and isolated. The areas therefore not considered for estimation of the ground water resources being discontinuous aquifers

Rainfall is the major source recharge to the groundwater body apart from the influent seepage from the rivers, irrigated fields and inflow from upland areas whereas discharge from ground water mainly takes place from wells and tube wells; effluent seepages of ground water in the form of springs and base flow in streams etc.

Roopnagar District: Groundwater occurs under phreatic condition in the shallow aquifers of Quaternary alluvium deposits, Intermontane valley and Kandi formation while groundwater occurs under leaky confined to confined conditions in the deeper aquifers of alluvium. In the case of unconfined aquifers, the depth to water level varies from 2.7 to 10.3 m during pre-monsoon and 2.1 to 11.6 m during post-monsoon. Seasonal fluctuation shows that in general there is an overall fall in water level except few isolated patches. The long-term trend of water level (10 years) shows a general decline in the entire district. The maximum fall is observed along the intermontane valley and the decline is at the rate of 1.05 m/year. Near the Siwalik hill, groundwater occurs at greater depth when compared to alluvial plains where it occurs at shallow depth. Generally, the water level is deep in intermontane valley and slope towards central part of the valley. In the northern part, especially in the intermontane valley, groundwater flow is towards south and southeastern direction whereas in the southeastern part of the district, the groundwater flow is in the south and southwestern direction. The water table elevation is highest near the hills and lowest in the southeastern part, which in turns reflects the topographic gradient. The hydrauli gradient is steeper near the hills and gentles near the plains.

The aquifer parameters show marked difference depending upon the subsurface lithology. The yield is in the range of 1098-1500 lpm for 6.2 to 13.3 m drawdown. While the yield of wells tapping alluvial aquifers are in the range of 731 to 946 lpm for 4.4 to 8.2 m drawdown. This high discharge may be attributed to induced recharge from antecedent Sutlej River passing through the valley. The transmissivity value ranges from 123 to 1180 m2/day in Noorpur Bedi and Ropar Block respectively. Similarly, the lateral hydraulic conductivity ranges from 3 to 21.6 m/day. The storativity value is between 7.8*10-4 and 1.7*10-3 indicating semi-confined to confined conditions.

The block-wise groundwater resource potential of Ropar district was calculated based on GEC-97 by excluding hilly areas. The net groundwater availability of district is 440.92 MCM, while the gross groundwater draft is 414.09 MCM only. This leaves a balance of 19.29 MCM for future development purpose. The Groundwater availability chart of Anadpur Sahib is as follow:

Table 4.8: Block-wise Groundwater Resource of RoopNagar district

Block Name	Net Annual Ground Water Availability (MCM)	Existing Gross Ground Water Draft for irrigation (MCM)	Existing Gross Ground Water Draft for all uses (MCM)	Allocation for domestic and Industrial requirement supply upto next 25 ears (MCM)	Net Ground Water Availability for future Irrigation development (MCM)	Stage Ground Water Development (%)	Category
ANANDPUR SAHIB	54.58	16.67	26.58	11.69	26.21	49	SAFE

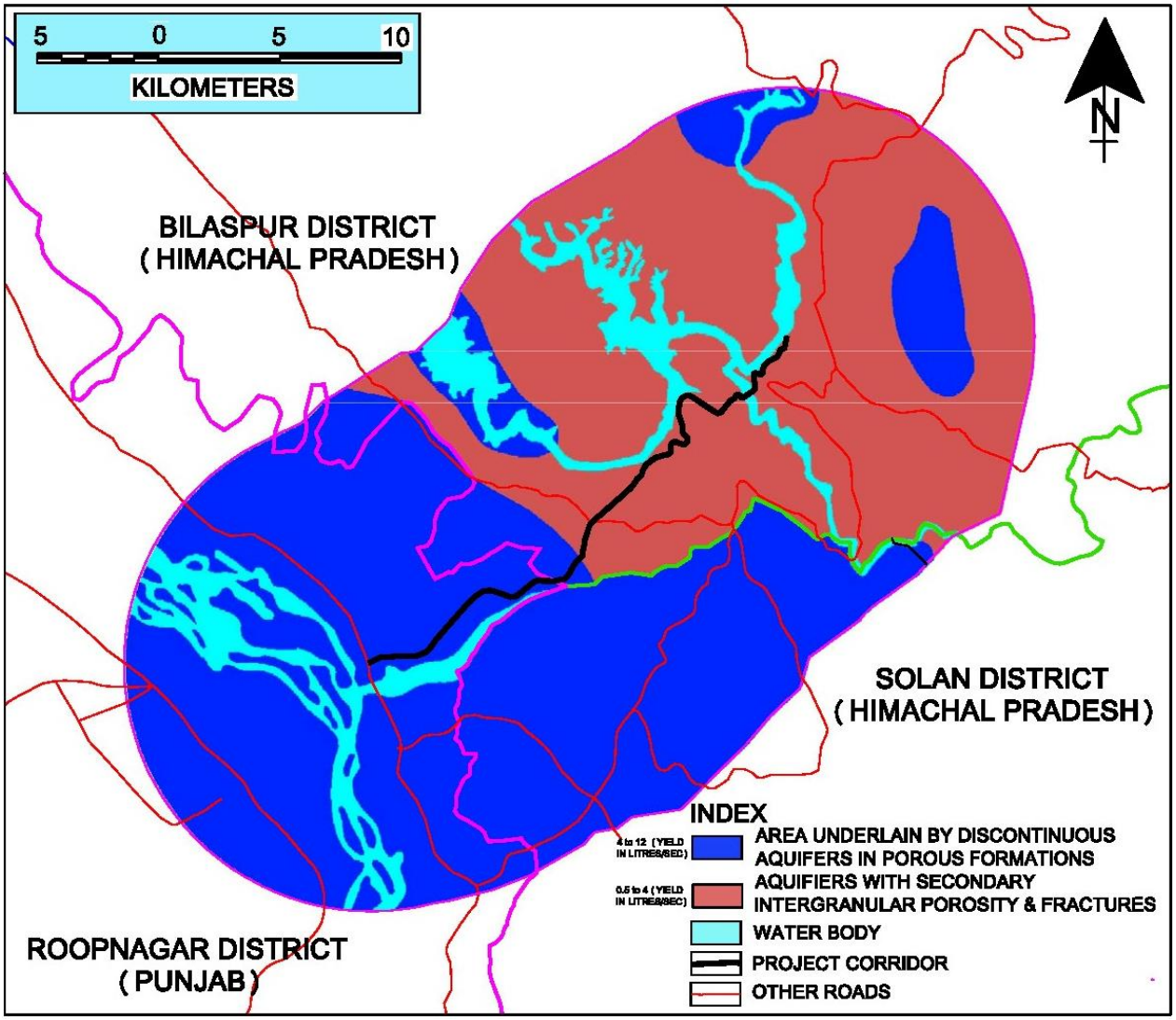


Figure 4.14 : *Hydrology and Underground Water Soil along the Project Corridor*

Groundwater resource evaluation in the Project Block shows that it the safe groundwater resource available for future development.

Quality: The surface water monitoring locations are given in Table 4.9 and have been identified in order to collect primary data of surface water quality of the project area.

Table 4.9: Surface Water Monitoring Locations

S. No	Sample Code	Chainage (Km)	Location	Remarks
1	10016031205	0.450	Village Kalyanpur (Bhakra Canal)	Canal
2	10016031206	26.500	Gobind Sagar Lake Downstream of the Bilaspur town (Near Bharadi Village)	Lake
3	10016031207	14.500	Satluj River (Nr. Bhagchal)	River

Three locations for ground water have also been identified in order to collect the primary data of ground water quality of the project area. The ground water locations are given in Table 4.10.

Table 4.10: Ground Water Monitoring Locations

S. No.	Report Code	Approx. Chainage (Km)	Location / Village	Remarks
1	10016031204	0.000	Kalyanpur	Hand Pump
2	10016031203	12.700	Kanchi More (Bhuai village)	Hand Pump
3	10016031202	26.500	Bharadi Village	Hand Pump

Methodology: The Samples were collected from the ground/surface water sources and preserved for testing. The samples were brought to the laboratory for further analysis. The Analysis was done as per Standard Method IS: 3025 method. The surface water monitoring at various locations within the study area are shown in Photos 4.7. whereas Ground Water monitoring in Photos 4.8.

Photo 4.7: Surface Water Monitoring Photographs

Photo 4.8: Ground Water Monitoring Photographs

The results of the Surface and Ground water quality monitoring are furnished in Table 4.11 and Table 4.12 respectively.

Table 4.11: Surface Water Quality Results along Project Road

S. No	Test Parameters	Unit	Sample code 10016031205	Sample code 10016031206	Sample code 10016031207	Test Method
1	Colour	Hazen unit	<5.0	<5.0	<5.0	IS 3025 (P-4)
2	Odour	--	Unobjectionable	Unobjectionable	Unobjectionable	IS 3025 (P-5)
3	Taste	--	Agreeable	Agreeable	Agreeable	IS 3025 (P-7)
4	Turbidity	NTU	8.2	3.2	3.3	IS 3025 (P-10)
5	pH	--	7.63	7.61	7.55	IS 3025 (P-11)
6	T. Hardness (as $CaCo_3$)	mg/l	160.0	184.0	80.0	IS 3025 (P-21)
7	Chloride (as Cl^-)	mg/l	7.94	27.79	23.82	IS 3025 (P-32)
8	Total Iron (as Fe)	mg/l	0.28	0.34	0.26	IS 3025 (P-53)
9	Phosphate	mg/l	< 0.05	0.13	0.15	IS 3025 (P-31)
10	Boron (as B)	mg/l	0.22	0.28	0.25	IS 3025 (P-57)
11	Calcium (as Ca)	mg/l	44.09	46.49	18.43	IS 3025 (P-40)
12	Alkalinity (as $CaCo_3$)	mg/l	136.0	142.0	39.6	IS 3025 (P-23)
13	Fluoride (as F^-)	mg/l	0.58	0.64	0.59	IS 3025 (P-60)
14	Sulphate (as So_4)	mg/l	31.28	39.73	14.7	IS 3025 (P-24)
15	Total Dissolved Solid	mg/l	274.00	364.0	118.0	IS 3025 (P-16)
16	Nitrate (as No_3)	mg/l	5.31	5.38	2.45	IS 3025 (P- 34)
17	Magnesium (as Mg)	mg/l	12.15	16.52	8.3	IS 3025 (P-46)
18	BOD (3 Days at 27 Deg.C)	mg/l	< 2.0	< 2.0	< 2.0	IS 3025 (P-44)
19	COD (as O_2)	mg/l	10.2	8.2	6.9	IS 3025 (P-58)

S. No	Test Parameters	Unit	Sample code 10016031205	Sample code 10016031206	Sample code 10016031207	Test Method
20	Electrical Conductivity	µS/cm	263	359.0	187.0	IS 3025 P-14
21	T. Coliform	MPN/ 100ml	36	92	58	IS 1622: 1981
22	F. Coliform	MPN/ 100ml	21	2	12	IS 1622: 1981
23	E Coli	MPN/ 100ml	Absent	Absent	Absent	IS 1622: 1981
24	Sodium Absorption Ratio	meq/l	<1.0	<1.0	<1.0	By Calculation

Source: *Monitoring & Analysis as done by M/s Eko Pro Engineers Pvt. Ltd.*

Table 4.12: Ground Water Quality Results along Project Road

S. No.	Test Parameters	Unit	Sample code 10016031204	Sample code 10016031203	Sample code 10016031202	Test Method
1	Turbidity	NTU	<1.0	<1.0	2.3	IS 3025 (P-10)
2	pH	--	7.97	6.99	7.13	IS 3025 (P-11)
3	Total Hardness	mg/L	142.0	400.0	326.0	IS 3025 (P-21)
4	Iron (as Fe)	mg/L	0.12	0.22	0.64	IS 3025 (P-53)
5	Chloride (as Cl^-)	mg/L	5.96	31.76	11.91	IS 3025 (P-32)
6	Flouride (as F^-)	mg/L	0.32	0.57	0.68	IS 3025 (P-60)
7	Magnesium (as Mg)	mg/L	22.38	34.02	41.31	IS 3025 (P-46)
8	Copper (as Cu)	mg/L	<0.02	<0.02	<0.02	IS 3025 (P-42)
9	Manganese (as Mn)	mg/L	<0.05	<0.05	<0.05	IS 3025 (P-59)
10	Sulphate (as SO_4^{--})	mg/L	36.45	58.83	48.99	IS 3025 (P-24)
11	Phenolic Compounds	mg/L	<0.001	<0.001	<0.001	IS 3025 (P-43)
12	Mercury (as Hg)	mg/L	<0.001	<0.001	<0.001	IS 3025 (P-48)
13	Selenium (as Se)	mg/L	<0.005	<0.005	<0.005	IS 3025 (P-56)
14	Arsenic (as As)	mg/L	<0.01	<0.01	<0.01	IS 3025 (P-37)
15	Cyanide (as Cn)	mg/L	<0.01	<0.01	<0.01	IS 3025 (P-27)
16	Lead (as Pb)	mg/L	<0.01	<0.01	<0.01	IS 3025 (P- 47)
17	Zinc (as Zn)	mg/L	0.24	0.34	0.32	IS 3025 (P-49)
18	Chromium (as Cr^{+6})	mg/L	<0.01	<0.01	<0.01	IS 3025 (P-52)
19	Cadmium (as Cd)	mg/L	<0.01	<0.01	<0.01	IS 3025 (P-41)
20	Aluminium (as Al)	mg/L	<0.01	<0.01	<0.01	IS 3025 (P-55)
21	Boron (as B)	mg/L	0.16	0.28	0.24	IS 3025 (P-57)

S. No.	Test Parameters	Unit	Sample code 10016031204	Sample code 10016031203	Sample code 10016031202	Test Method
22	Anionic Detergents (as MBAS)	mg/L	<0.05	<0.05	<0.05	IS 13428 Annex-K
23	Temperature	^{0}C	21.0	20.0	22.0	APHA 2550 B

Source: *Monitoring & Analysis as done by M/s Eko Pro Engineers Pvt. Ltd.*

Air Quality & Noise

Air Quality

A total of six (6) ambient air monitoring stations were identified based on the different existing land use pattern. Monitoring was carried out in March 2012 at a frequency of twice a week at each station adopting a 24 hour schedule. CO has been measured 8 hourly.

The ambient air quality in the corridor was monitored with the ambient air quality norms stipulated by CPCB. Station wise monitoring results (average of eight observations per station) are shown in Table 4.13.

Table 4.13: Station wise Monitoring Results

Monitoring Location & Report Code	Area Category	Pollutant Concentration (µg/m^3) 24 hourly mean values						
		PM_{10}	$PM_{2.5}$	SO_2	NOx	CO	O_3	NH_3
Gara & Maura 40016031202	Rural Section	74.35	36.63	11.32	23.48	<1.15	<10.0	<20.0
Masewal 40016031203	Rural & Residential	62.4	28.33	7.25	16.22	<1.15	<10.0	<20.0
Kiratpur 40016031204	Commercial	67.3	31.54	8.30	19.47	<1.15	<10.0	<20.0
Bharadi 40016031205	Rural Section	70.33	33.10	10.41	21.48	<1.15	<10.0	<20.0
Mehla 40016031206	Rural Section	60.37	27.45	7.30	18.53	<1.15	<10.0	<20.0
Tunnu 40016031207	Rural Section	68.36	33.71	9.61	21.67	<1.15	<10.0	<20.0

The monitoring results show that the concentration of all pollutants in ambient air is well within the CPCB standards in all stations along the corridor.

Noise Level

To assess background noise levels in the study area, ambient noise monitoring was conducted. A total of six (6) locations were identified along the project road, based on different categories of area. Ambient noise level or sound pressure levels (SPL) were measured by a portable sound level meter having built in facilities to read noise level directly in dB(A).

From the SPL values, equivalent continuous sound pressure level values (Leq) were calculated. Noise measurement was conducted as per IS: 4954 as adopted by CPCB. Ambient noise level monitoring was carried out in the month of March 2012.

Description of the noise monitoring stations and the Noise levels at each station are given below in Table no. 4.14.

Table 4.14: Noise Monitoring Results

Sl. No.	Monitoring Location & Report Code	Area Category	Noise Levels, dB(A)	
			Day Time (0600 - 1800 hrs.)	Night Time (1800 to 0600 hrs.)
			Leq Day dB(A)	**Leq Night** dB(A)
1	Mehla 70023031211	Residential	50.3	41.4
2	Tunnu 70023031212	Residential	59.3	45.5
3	Kiratpur 70023031215	Commercial	60.2	51.2
4	Bharadi 70023031216	Residential	52.8	42.5
5	Gara-Maura 70023031217	Commercial	63.3	53.3
6	Masewal 70023031218	Commerical	51.3	39.3
Leq Norms for Residential Areas*			*55*	*45*
Leq Norms for Commercial Areas*			*65*	*55*

Noise level is maximum at the Sausar market during day & night time. The ambient noise levels are mainly due to traffic along the project corridor.

Sensitive Locations

These include schools and colleges along the project road. There are about 14 educational institutes, most of them are primary schools. Most of the educational institutes are present outside the Right of Way thus remains unaffected.

4.3.2 Ecological Environment

The natural vegetation follows a climatic altitudinal zonation. In the altitude range of 300-900m, as in Bilaspur and Roopnagar district, the vegetation is tropical 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 dominant tree species is Sal, as a timber tree, Sal is extremely valuable as the wood being strong, elastic and durable. Favoring the growth of Agava (Banskeora). On several slopes, the trees are completely absent and only grass cover is seen.
Though most of the forests have been protected but small patches particularly in the valley bottom and along the lower slopes have been terraced into cultivated fields. The plantation in the townships mostly consists of some ornament species and avenue and fruit trees.

4.3.2.1 Forest

The Forests of Himachal Pradesh known for their grandeur and majesty are like a green pearl in the Himalayan crown. This life supporting systems are presently under great stress due to impact of modern civilization, economic development and growth in human and cattle population.

According to national Forest Policy, 1988, at least two third i.e. 66% of the geographical area should be under forest in the hilly states like Himachal Pradesh. However, keeping in view that

about 20 % of the area is inaccessible and beyond the tree limit, the State Government aims to bring 50% of the geographical area under forest cover.

The forests of the State have been classified on an ecological basis as laid down by Champion and Seth, and can be broadly classified into Coniferous Forests and broad-leaved Forests. Distribution of various species follows fairly regular altitudinal stratification. The vegetation varies from Dry Scrub Forests at lower altitudes to Alpine Pastures at higher altitudes. In between these two extremes, distinct vegetation zones of Mixed Deciduous Forests, Bamboo, Chil, Oaks, Deodar, Kail, Fir and Spruce, are found. The richness and diversity of our flora can be gauged from the fact that, out of total 45,000 species found in the country as many as 3,295 species (7.32%) are reported in the State. More than 95% of the species are endemic to Himachal Pradesh and characteristic of Western Himalayan flora, while about 5% (150 species) are exotic, introduced over the last 150 years.

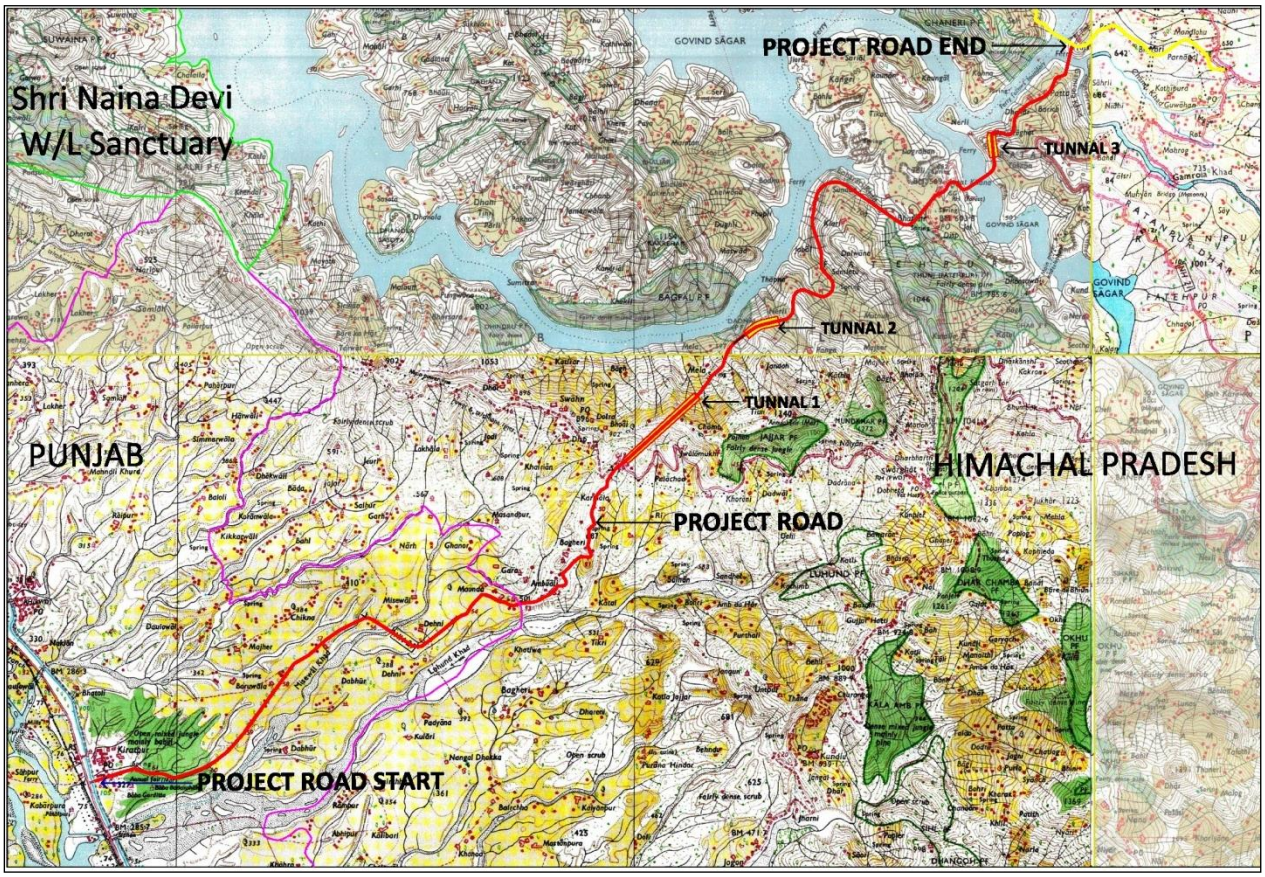


Figure 4.15: *Forests in the Project Corridor*

Although there is no reserved forest along the road, but all Government waste land is declared as Protected Forest (PF) in 1952 in Himachal Pradesh and Punjab as discussed with Assistant Conservator of Forest Bilaspur and Project road falls under following forest ranges:

- Gara to Bharadi is Bilaspur Forest Division
  - Sadar Forest Range
  - Swarghat Forest Range
- Kalyanpur to Maura is Roopnagar Forest Division
  - Anandpur Forest Range

4.3.2.2 Roadside Plantation

There is very good plantation along the new alignment as well as the existing road portion which have taken place over a period of last 40 years. The road side land is either private land or

government land, in private land there are commercial establishments along the road and in government land trees are planted along both side of the road. There are approximately 8059 numbers of trees along the entire project road which will be confirmed after a detailed tree inventory. The roadside trees are shown in Photo 4.9 and 4.10.

Photo 4.9: Roadside Plantation along existing road

Photo 4.10: Roadside Plantation

Table 4.15: Inventory of Trees in the Proposed Project Corridor

S. No	Specie		Class									Tree
	Botanical	Local	V	IV	III	IIA	IIB	IA	IB	IC	ID	Total
Punjab Section Km. 0.000 to Km. 8.800												
1	*Mangifera indica*	Aam	1			1		2				4
2	*Cassia fistuca*	Alish	4	1		1						6
3	*Premna latifolia*	Baken	5									5
4	*Ficus bengalensis*	Banian	2		1	1	1					5
5	*Zizphus mauratiana*	Ber	1									1
6	*Grewia elastica*	Beuli	1	1								2
7	*Butea monosperma*	Brahmadake		2								2
8	*Acacia arabica*	Babool	10	2								12
9	*Dianthus*	Caimpari	1									1
10	*Butea monosperma*	Dake	20	19	5							44
11	*Pseudotsuga menziesil*	Dougula	9									9
12	*Tamarindus indica*	Imli	5	6	3							14
13	*Synonyms*	Gadeela			1							1
14	*Ficus glomerata*	Gular	17	13	7	4	2	1				44
15	*Syzygium caryophyatum*	Jamun	3	4	2	1		1				11
16	*Mitragyna parvifolia*	Kalam	2									2
17	*Garuga pinnata*	Kakad	2									2
18	*Acacia catechu*	Khair	81	86	46	6	2					221
19	*Acacia arabica*	Kikar	5	18	14	5	2	1				45
20	*Nyctanthes arbortristis*	Koori		1								1
21	*Azadirachta indica*	Neem	11	9								20
22	*Ficus religiosa*	Pipal	1	1	4				1			7
23	*Lirioendron tulipifera*	Popular			1			1				2
24	*Carrisa carandas*	Rasooda	15	5	1							21
25	*Eucalyptus camaldulensis*	Safeda	5	22	131	284	370	166	117			1095
26	*Moringa oleifera Lam*	Sanjana		1								1
27	*Lannea coromandelica*	Salambra	4	3	2							9

S. No	Specie		Class									Tree
	Botanical	Local	V	IV	III	IIA	IIB	IA	IB	IC	ID	Total
28	*Morus serrata*	Sahtoot	16	12	9	4						41
29	*Dalbergia sissoo*	Shisham	18	21	7	5		1				52
30	*Albizzia lebbek*	Sari	4	3	3							10
31	*Salmalia malabarica*	Simal	5		3							8
32	*Cedrela toona*	Tune	6	5	1	1			1			14
33	*Pineapple strawberry*	Stracoberry	4	3	2	1						10
34		**Punjab Total**	**258**	**238**	**243**	**314**	**377**	**173**	**119**	**0**	**0**	**1722**
In Himachal Pradesh section from Km. 8.800 to Km. 26.600												
35	*Cassia fistuca*	Amaltash	115	26	5		1					**147**
36	*Phyllanthus emblica*	Amla	21	3	1	1						**26**
37	*Jatropoha curcuas*	Arand	6									**6**
38	*Premna latifolia*	Bakar	5	2								**7**
39	*Terminalia belerica*	Bahera		1								**1**
40	*Sapium insigne*	Balodhar	6	2								**8**
41	*Zizphus mauratiana*	Ber	28	10			1					**39**
42	*Ficus bangelsis*	Barota	2							1		**3**
43	*Feronia limonia*	Barnah	33	4								**37**
44	*Crataeva religiosa*	Barna	8									**8**
45	*Grewia elastica*	Beul	129	16	2		2	2	1			**152**
46	*Salix tetrasperma*	Beuns	3	1	3		1					**8**
47	*Aegle marmelos*	Bil	12	8	3							**23**
48	*Ehretia laevis*	Chamror	8	6	1							**15**
49	*Albizzia chinensis*	Cheoli	2				1	1				**4**
50	*Anogeissus latifolia*	Chhal	194	63	15	6				1		**279**
51	*Pinus longifolia*	Chil	213	115	74	38	26	24	24	1	3	**518**
52	*Diospyros cordifolia*	Dabarna	1									**1**
53	*Ficus palmata*	Dagla	1	1								**2**
54	*Diospyros cordifolia*	Dakainan	27	5								**32**
55	*Punica granatum*	Daran	15	8								**23**
56	*Ficus palmate*	Dhaghla	2									**2**
57	*Butea monosperma*	Dhak	15	9	1							**25**
58	*Casearia tomentosa*	Goela	37	10	3							**50**
59	*Ficus glomerata*	Gullar	73	11	5	1	4			1		**95**
60	*Tamarindus indica*	Imli	4	1								**5**
61	*Nerium odorum*	Jagel	17	1								**18**
62	*Jacaranda mimosaefolia*	Jakrinda	45									**45**
63	*Syzygium caryophyatum*	Jamun	58	15	10	1		1				**85**
64	*Carrisa carandas*	Kachnar	22	11								**33**
65	*Mitragyna parvifolia*	Kalam	45	15	5	1	1					**67**
66	*Mallotus philippinensis*	Kamal	448	41	6	1						**496**
67	*Flacourtia xylosma*	Kangu	272	7	1							**280**
68	*Pistacia integerrima*	Kakkar	10	4		3	1					**18**
69	*Carissa carandas*	Karonda	1		1							**2**
70	*Pyrus pashia*	Kainth	192	49	4							**245**
71	*Acacia catechu*	Khair	1180	165	8	4						**1357**
72	*Celtis australis*	Khirak	2		17							**19**
73	*Acacia arabica*	Kikar	3	55	3		1					**62**
74	*Albizzia odoratissma*	Karmaru	1	1								**2**

S. No	Specie		Class									Tree
	Botanical	Local	V	IV	III	IIA	IIB	IA	IB	IC	ID	Total
75	*Nyctanthes arbortristis*	Koori	114	17								**131**
76	*Leucaena leucacephala*	Lasunia	36	8	1							**45**
77	*Mangifera indica*	Mango	30	22	3	3	3	2	1		1	**65**
78	*Thuja compacta*	Morepankhi	19	1								**20**
79	*Pyrus pyrifolia*	Naspati	1									**1**
80	*Azadirachta indica*	Neem	14	5								**19**
81	*Erythrina suberosa*	Pariara	1			1						**2**
82	*Ficus religiosa*	Pipal	1	1	2				1	1		**6**
83	*Randia dumetorum*	Rara	1	3								**4**
84	*Litsea glutinosa*	Rehan	1									**1**
85	*Wendlandia exserta*	Ratela	346	20								**366**
86	*Moringa oleifera*	Rasunna	1									**1**
87	*Acacia leucophloea*	Reur	35	6	2							**43**
88	*Sapindus mukorossi*	Ritha	1		0							**1**
89	*Eucalyptus camaldulensis*	Safeda	95	83	61	31	8					**278**
90	*Lannea coromandelica*	Salambra	259	100	34	6	1					**400**
91	*Dalbergia sissoo*	Shisham	324	126	17		1					**468**
92	*Albizzia lebbek*	Sirin	27	21	8							**56**
93	*Salmalia malabarica*	Simal	9	1	7	4	3				1	**25**
94	*Pongamia pinnata*	Sukhchain	9									**9**
95	*Oroxylum indicum*	Tatplanga	5									**5**
96	*Ficus roxburghii*	Tiamli	34	5								**39**
97	*Morus serrata*	Toot	18	5	2							**25**
98	*Cedrela toona*	Tuni	45	13	3	2						**63**
99	*Rhus cotinus*	Tung	9	1								**10**
100	*Others*	Umaraya	9			0	0	0	0	0	0	**9**
	Himachal Pradesh Total		**4700**	**1104**	**308**	**103**	**55**	**30**	**27**	**5**	**5**	**6337**
	Project Total		**4958**	**1342**	**551**	**417**	**432**	**203**	**146**	**5**	**5**	**8059**

4.3.2.3 Fauna

There are plenty of fauna in the study area. The wild lives present in the study area are mainly Langoor, Monkey, Wild Bore, Barking Deer, Jackle, Hare and Sambhar etc. Among domestic animals: cow, buffaloes, mules, hens, dogs, goats, oxen, cats are common. Mules are used to carry loads on mountain track.

Wild Animals: Many kind of wild species are present in the study area. The Deer of many species including harin (Antilopecrevicapra), spotted deer (axis maculates – H. Cheetal), Barking deer (Muntiacusmuntijakay – H. Kakar). The Khargosh (*Lepusnigricolis*) is also noticed in the project area. Also seen are Newala (mongoose), wild dogs, fox, wild cats, lakarbaggha (Hyaena), monkey, langur, and sehi.

Wild Birds: The resident birds include peafowl; black and grey partridge, sand grouse and jungle fowl, while the migrants include snipe, quail and varieties of waterfowl visit the project area in large numbers in winter. The other birds of the project area are Pigeon, Red Jungle Fowl, Bater, Lamurgi, Kalatittar, Safedtittar, Dhaner and Harial.

4.3.2.4 Wildlife

Protection[1] of Wild Life: After independence and merger of princely State of Bilaspur With Himachal Pradesh, the Punjab Wild Birds and Wild Animal, Act of 1933 was extended to the Forests of this Division. Separate rules under this act were notified in the year 1958. These rules remained in force till the new central Wildlife (protection) Act 1972 was adopted in the state on 24.2.1973. New rules under this act were framed and made effective from 24.2.1975. The notification regarding these rules as well as the Wildlife (Protection) Act 1972 and various amendments have been given in Himachal Pradesh Forest Manual Volume-I and may be consulted for details. There are two Wildlife Sanctuaries they are Gobind Sagar wildlife Sanctuary and Naina Devi wildlife sanctuary in the radius of 10 to 15 kilometers along the proposed alignment.

Wildlife Sanctuaries[2] of Project Area: There are two wildlife sanctuaries in this Bilaspur Division namely Shri Naina Devi and Gobind Sagar which are under the control of D.F.O Wild Life Hamirpur and D.F.O Bilaspur.

Naina Devi Wildlife Sanctuary was set up in 1962 and it is situated around 30 km from Bilaspur. It is spread over 123 sq.kms of land, covered by northern dry mixed deciduous forest. The common inhabitants of the sanctuary include Langur, Monkeys, Wild Bore, Barking Deer, Jackle, Indian Hare, Sambhar, Ghoral, Snakes, Pigeon and Red Jungle Fowl.

Gobind Sagar Wildlife Sanctuary was set up in 1962 and it is situated near the project corridor, infect crosses this lake at two locations, therefore permission will be required as per regulation. The Sanctuary (wetland reserve) 1962 and it is situated in Bilaspur District. It includes 100 sq km area around the Govind Sagar reservoir created after the Bhakra Dam was erected across the River Sutlej. The scenic features include northern dry mixed deciduous forest and Bhakra Nangal Dam, fed by the Sutlej River. It provides habitat for several native species of fish and a winter refuge for migratory waterfowl. Recently, Government of Himachal Pradesh has declared to denotify the same which was intimated by Chief Wildlife Warden vide letter No. WL/Rationalization of Boundaries/4717.

4.4 SOCIO-ECONOMIC PROFILE OF THE INFLUENCE AREA

The socio-economic profile along the project corridor takes into account the socio as well as the economic aspects.

- Population Distribution;
- Sex Ratio;
- Literacy Rate;
- Share of Vulnerable Groups and
- Workforce Participation Ratio.

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[1] ***The Salient Features of Wildlife (Protection) Act are as follows:***

i) Constitution of State Wildlife Advisory Boards to advise the State Government.
a) In selection of areas to be declared as sanctuaries, National park, Game reserves, closed areas and their administration.
b) In formulating the policy of granting licenses and permits under this act and other such allied matters.
ii) Lays down procedure for the creation of sanctuaries, National Parks, Game reserves and closed areas and also guide lines for their management.
iii) Appointment of Chief Wild Life Warden and Other Officials.
iv) Lays down rules for hunting of Wild animals and grant of hunting permits.
v) Provides for control on trade or commerce in Wild animals, animal articles and trophies.

[2] ***Declaration of Sanctuary***

The State Government may, by notification, declare its intention under sub-section (1) of section 18 to constitute any area other than an area comprised within any reserve forest or the territorial waters as a sanctuary if it considers that such area is of adequate ecological, faunal, floral, geomorphiological, natural or zoological significance, for the purpose of protecting, propagating or developing wild life or its environment.

- Cultural Properties

4.4.1 Population Distribution

The project influence area comprises of 3 tehsils falling under two districts namely Roopnagar and Bilaspur. The total population along the project corridor is 8626. The population distribution is in Anandpur Sahib tehsil where the population is 4271 where as Bilaspur Sadar is having lowest population distribution as per 2001 census. Tehsil wise demographic characteristics in project influence area are presented in Table 4-16.

Table 4-16: Male Female Population along the Project Corridor, 2001

District	Tehsil	Population		Total
		Male	Female	
Roopnagar	Anandpur Sahib	3373	898	4271
Roopnagar District Total		**3373**	**898**	**4271**
Bilaspur	Naina Devi Ji	1729	921	2650
	Bilaspur - Sadar	708	997	1705
Bilaspur District Total		**2437**	**1918**	**4355**
Project Influence Area		**5810**	**2816**	**8626**

Source: Census of India, 2001

4.4.2 Sex Ratio of the Influence Area

As per the Census estimates (2001) number of Sex ratio (females/1000 male) of project influence area is 917. (Refer Table 4-17). The highest sex ratio of 997 registered in Bilaspur - Sadar tehsil and the lowest in Roopnagar tehsil along the project influence are.

Table 4-17: Sex Ratio of Tehsil along the Project Corridor, 2001

District	Tehsil	Population		Sex Ratio
		Male	Female	
Roopnagar	Anandpur Sahib	3373	898	898
Roopnagar District Total		**3373**	**898**	**898**
Bilaspur	Naina Devi Ji	1729	921	921
	Bilaspur - Sadar	708	997	997
Bilaspur District Total		**2437**	**1918**	**1918**
Project Influence Area		**5810**	**2816**	**2816**

Source: Census of India, 2001 *Note: Figures are rounded off to first decimal place

4.4.3 Vulnerable groups in the Influence Area

Distribution of scheduled caste (SC) and scheduled tribe (ST) population is presented in Table 4-18. The percentage distribution of scheduled caste is higher in Bilaspur District where as in Roopnagar district the scheduled tribes in project influence area is nil. In Bilaspur district the scheduled cast population is 28.53% where the ST population is 1.29 % to total population.

Table 4-18: SC &ST Population along the Project Corridor, 2001

District	Tehsil	Population 2001		% To Total Population	
		Schedule Cast	Schedule Tribe	Schedule Cast	Schedule Tribe
Roopnagar	Anandpur Sahib	1408	0	21.99	0.00
Roopnagar District Total		**1408**	**0**	21.99	0.00
Bilaspur	Naina Devi Ji	843	2	25.38	0.06
	Bilaspur - Sadar	508	59	35.93	4.17
Bilaspur District Total		**1351**	**61**	**28.53**	**1.29**
Project Influence Area		**2759**	**61**	**24.77**	**0.55**

Source: Census of India, 2001; Note: Figures are rounded off to first decimal place

4.4.4 Literacy Rate

As per the Census estimates (2001), about 36.15% of the population are literate along the project corridor whereas about 37.36% population are literate in Bilaspur Sadar Tehisil, whereas in the Roopnagar Tehsil literate rate is 35.25%. (Table 4-19).

Table 4-19: Literacy Rate of Tehsil along the Project Corridor, 2001

District	Tehsil	Literates		Literacy Rate (%)	
		Male	Female	Male	Female
Roopnagar	Anandpur Sahib	2257	1500	35.25	23.43
Roopnagar District Total		2257	1500	**35.25**	**23.43**
Bilaspur	Naina Devi Ji	1239	804	37.31	24.21
	Bilaspur - Sadar	530	408	37.48	28.85
Bilaspur District Total		**1769**	**1212**	37.36	**25.60**
Project Influence Area		**4026**	**2712**	**36.15**	**24.35**

Source: Census of India, 2001; Note: Figures are rounded of to first decimal place

4.4.5 Workforce Participation

Table 4-20 describes the workforce participation ratio (WPR) at district and tehsil (Project Influence Area). The work participation rate along the project corridor is 50.18%. In the case of Bilaspur Sadar tehsil the WPR ratio is highest along the project corridor, which is 50.26% where as in Anandpur Sahib tehsil it is the lowest, which is 49.47%. For details see Figure 4-18 presents the WPR along the Project Corridor.

Table 4-20: Workforce Participation Ratio along Project Corridor, 2001

District	Tehsil	Workers			Percentage
		Main	Marginal	Non	Share
Roopnagar	Anandpur Sahib	3167	2412	755	49.47
Roopnagar District Total		3167	2412	755	49.47
Bilaspur	Naina Devi Ji	1640	1399	241	49.38
	Bilaspur - Sadar	740	561	179	52.33
Bilaspur District Total		2380	1960	420	50.26
Project Influence Area		6287	4933	1354	50.18

Source: Population Totals of Punjab and Himachal Pradesh, Census of India, 2001; Note: Figures are rounded of to first decimal place

4.4.6 Cultural Properties

A number of religious properties are present along the project road. The entire road stretch has about 69 religious structures (temples, mosques & shrines). Most of these are temples. Noteworthy temples along the stretch include the Banjari Mata Temple in the Sillewani Ghat section and the Bajrangbali temple in Borgaon. Some of the religious structures will be affected due to widening. This has been discussed in the Impact chapter. Most of the structures are small or medium sized.

Photo 4.11: Dargah / Mazar of *Peer Baba*

Photo 4.12: Temple of Godess Saraswati

4.5 SOCIO IMPACT ASSESSMENT

4.5.1 Influence Area of the Project Corridor

Upgradation of Kiratpur to Bilaspur section of NH-21 is expected to have both positive and negative impacts on the environment and social aspects (especially on the people) along the Corridor of Direct Impact (CODI). Despite several efforts to modify the design of the project highway to minimize losses to the Project Affected People, some of them would be negatively impacted especially due to land acquisition and clearing of illegal habitation from public ROW. Also, there would be losses to a few religious and cultural properties and loss of economic opportunities/livelihood, sources of earning, etc., as a result of the project. The following sections deal with various aspects of impacts that would result due to the reasons cited above.

4.5.2 Impact of Project on People

The impacts are generally classified into three types, impacts to private land, structures and community properties. The impact to private land has been elucidated from revenue maps and data as collected from the relevant revenue officials and departments. The impact on structures is to all the types are listed in the Table 4.21. These are the structures within the Proposed ROW and all are titleholders.

Table 4.21: Number of Structures Affected along the Project Corridor

S. No	Type of Structures	Numbers	Area
1	**Residential**	**57**	**5028**
1a	Pucca	39	3350
1b	Semi Pucca	16	1490
1c	Kutcha	2	188
2	**Commercial**	**76**	5179
2a	Pucca	18	1694
2b	Semi Pucca	48	3176
2c	Kutcha	8	309
3	**Mixed (**Pucca)	**4**	**1050**
4	**Petrol Pump**	**2**	**60**
5	**Government**	**5**	**1078**
5a	Pucca	3	208
5b	Semi Pucca	2	1500
	Total	**144**	**12395**

Source: Socio-economic Survey, 2012

In addition to this there are some squatters and encroachments identified through the primary surveys conducted by the Social team of Voyants between 4th of March to 10th of March 2012. All the structures details will be submitted along with the draft DPR.

4.5.3 Impact on Community Properties

12 handpumps and 17 water tanks would be affected. Considerable impact on the loss of water sources along the project corridor is envisaged. This impact is likely to be significant given the concern about not available of piped water supply along the project corridor. The data also signify that all the people along the project corridor are dependent on underground water for their use. (For details see Table 4.22).

Table 4.22: Common Properties along the Project Corridor

Public / Semi Public Strucure					Religious Strucutures			Total
Government	Educational	Bus Stop	Hand Pump	Water Tank	Temple	Shrine	Peer Baba	
8	4	6	12	17	3	3	1	**54**

Source: Census Survey, 2012

4.5.4 Age and Gender Distribution

The age wise and sex wise distribution, gender distribution and gender ratio of PAP's has been detailed out in the Table 4.23. 1039 of the population (males, females and children) are in the age group between 0 to 80 years. In which the male population 37%, female population is 31% and rest 32% are children's below six of age.

Table 4-23: Age and Sex wise Distribution of People along the Project Corridor

Category	Males	Females	Children below 6 years
Project Affected Persons	388	320	331

Source: Census Survey, 2012

4.5.5 Vulnerable Groups Affected in the Project

The household which will be going to be affected due to proposed widening is around twenty four for details see **Table 4.24.** The table also provides the number of vulnerable families who are getting affected due to project. More than 77% of the household is falling in the General category, and rest 23% of them are in the category of Scheduled Cast.

Table 4.24: Vulnerable Groups of Affected in the Project

General	Scheduled Caste	Scheduled Tribe	Other Backward Class	Total
121	35	0	0	**156**

Source: Census Survey, 2012

4.5.6 Occupational Pattern

Table 4.25 describes about different types of occupation and no. 350 of people involved in each of these categories of work. It reveals that majority of the people; about 36% of the people are involved in Cultivators activity followed by others (26%), Agricultural Labour and Artisans which contribute 10% each. In Total 350 PAP's are affected due to this project in which more than 45% of the people are engaged in Primary activity, 26% of them are in Secondary Sector and 30% of the people are in Services and sector.

Table 4.25: Occupational Pattern of Affected in the Project

S. No.	Category of Occupation	No. of People	% To the total Population
1	Shopkeeper	114	36
2	Teacher	13	4
3	Helper	84	26

S. No.	Category of Occupation	No. of People	% To the total Population
4	Painter	5	2
5	Factory Worker	4	1
6	Driver	26	8
7	Student	5	2
8	Cultivators	70	22
	Total	**321**	**100**

Source: Census Survey, 2012

4.6 LAND ACQUISITION IN THE PROJECT

The surveys conducted by the Consultants during the Feasibility Study revealed that the ROW was relatively free of encumbrances. Even at settlements no major encroachments have been observed and sufficient ROW is available for improvements being proposed as a part of the project development.

However, along the existing project corridor the RoW varies from 20 to 45 Meters and in proposed realignment sections the total land acquisition is 45 meters. The additional RoW will be used for development of realignment and geometric improvements. The land requirement for both these purposes together is 142.48 Ha.

Requirement for Land

The importance of land requirement in development projects needs no introduction. The ownership of such land may vest with the Government or any private person. For linear pattern projects such as the construction of roads, canals, pipelines, etc., minimum horizontal strip of land is required for improvements along the finalized alignment under acquisition. The land acquisition is generally spread over administrative boundaries of different districts. This necessitates coordination between the concerned administrative units. Further, another general feature observed is of encroachment along such linear projects. In this project, on examination it has been observed that such encroachment (encroachment here refers to Government Land) has been prominent at settlement stretches along the corridor. Such encroachments will be cleared due to requirement of land for the project corridor improvement.

Acquisition of Private Land

However, for the legal private property holders, the acquisition of the land would be taken-care of under the aegis of the Land Acquisition Act 1894 (amended 1984) (L.A Act). The L.A Act is applicable to all parts of India, but Land Acquisition by this process is lengthy. So for faster land acquisition National Highway Act of 1956 will be taken. Under the provisions of this act, the Government or any department of the Government can acquire land from the people for public purpose.

Legal Framework for Land Acquisition

With the increase of movement of traffic on account of industrial advancement it was found necessary that important highways of the country be developed. To achieve this objective The National Highways Bill, 1956 was introduced in the Parliament. It came on the Statute Book as the National Highways Act, 1956 (48 of 1956). The Land Acquisition (LA) for this project is to be undertaken in accordance with the provisions of this act. The following are the major provisions of the act for the land acquisition.

Section 3(a) of the said act provides for notification declaring competenta authority (SDM / Land Acquistion Officer) of the project and list out the name of the district, tehsil, village from where the proposed road alignment may pass.

Section 3(A) provides for notification to landowners about the interest of the Government to acquire the notified land;

Section 3(B) & 3(F) provides power and right to the person authorized by the Central Government to make inspection, survey, measurements, valuation or inquiry;

Section 3(C) permits landowners to express their objections against such land acquisition;

Section 3(D) declaration of acquisition after hearing objections (if any) made to the Competent Authority;

Section 3(E) provides power to take possession of land once the amount determined by the Competent Authority has been deposited under sub-section (1) of section 3(H);

Section 3(G) allows the Competent Authority to decide on the compensation to be paid;

Section 3(H) provision for deposit of payment determined under section 3(G) in the manner as may be laid down by rules made in this behalf of the central government;

Section 3(J) provides that the Land Acquisition Act, 1894 shall not apply to The Land Acquisition Act, 1956.

4.7 METHODOLOGY FOR COLLECTION OF LAND RECORDS

In order to determine the extent of private property that will be acquired under the project, the Consultants requested the respective District Magistrates of the two districts to arrange through the concerned revenue officials to provide the Revenue maps of all the villages through which the corridor traverses. The concerned officers from the Revenue Department of Anandpur Sahib Tehsil in Roopnagar District and Naina Devi Ji and Bilaspur Sadar in Bilaspur District were then approached to obtain a copy of the village maps with the demarcated individual plots. The widening plan developed as part of the Feasibility study was superimposed on these village maps to identify the individual plots that are being affected. The plots numbers of these affected plots were provided to the Revenue Officer for verification of plot numbers and provide the land records for each of them. All this has been compiled as part of the Land Acquisition Report, an independent document prepared for this project.

Table 4-26: Number of Plots Affected with area along the Project Corridor

S. No	State	District	Tehsil	Village	From	To	Gram Panchyat	No of affected Plots	Land Acquisition (Sq. Mts)
1	Punjab	Roopnagar	Anandpur Sahib	Kalyanpur	0.000	2.650	Kalyanpur	**Land Acquisiton Done**	
2				Dabur	2.650	2.900	Dabur	1	24.16
3				Baruwal	2.600	4.550	Baruwal	70	15137.84
4				Massewal	4.550	6.150	Masewal	60	13079.01
5				Dehni	6.150	7.050	Dahini	47	11564.23
6				Chamrauli	7.050	7.900	Maura	27	11998.73
7				Maura	7.900	8.780	Maura	121	78438.58
8	Himachal Pradesh	Bilaspur	Naina Devi Ji	Gara	8+780	9+792	Swhan	69	64647.23
9				Ree	9+792	10+607	Ree	15	18000.25
10				Buhai	10+607	14+427	Swhan	55	83075.867
11				Mehla	14+427	16+995	Kutehla	46	54307.120
12				Jangal Dadnal	16+995	17+107	Kutehla	3	21601.58
13				Thapna	17+107	18+641	Kutehla	50	67196.32
14				Samletu	18+641	20+038	Kutehla	47	30620.79
15				Jabbal	20+038	20+959	Kutehla	11	34558.55
16				Sunhan	20+959	22+320	Tali	6	61366.418
17				Kyariya	22+32	22+828	Kutehla	4	26988.40
18				Jungal Ftehpur	22+828	23+472	Kutehla	1	37452.93
19				Bhated	23+472	24+627	Tali	25	439321.44
20				Tali	24+627	24+788	Tali	50	47997.05

S. No	State	District	Tehsil	Village	From	To	Gram Panchyat	No of affected Plots	Land Acquisition (Sq. Mts)
21			Bilaspur - Sadar	Tunnu	24+788	25+282	Kaller	25	76236.16
22				Jool	25+282	25+362	Kaller	2	134164.23
23				Dalyar	25+362	25+495	Kaller	7	12501.36
24				Patta	25+495	26+257	Kaller	64	51169.45
25				Bharadi	26+257	26+462	Raghunath pura	15	22404.65

Source: Land Acquisition Plan, 2012.

Land Rates

The value of the land for the purpose of calculating the compensation has been based on the village wise circle rate which based upon the registry rate of the plot collected from the concerned revenue offices at the district level for each Development Block. The registry rates for each village are availble at respective Compentant Authority / SDM office and their web sites. The land that shall be acquired from any government agency has also been estimated based on the circle rates. In case there is no cost incurred in transferring such land the budget estimated for land acquisition will be decreased accordingly. The general observation has been that the ribbon development along the project corridor has affected the traditional land use in the region. The barren/agricultural land has been converted for commercial purpose. The consultants have considered the market values of commercial land for calculating the cost estimates of land being acquired.

Summary of Procedure Adopted for Widening of Existing Road

The following steps are followed in the preparation of land acquisition plan.

Step-1(Project Initiation): The NHAI has directed the Consultant for preparing LAP. Simultaneously, NHAI has issued letters to Concerned District Collectors, acknowledging them about the project and also to provide necessary documents to Consultants. District Collectors issued letters to Tehsildars, who consecutively directed Revenue Officer to provide respective Village Maps, Revenue Records and Cost of Land to the Consultant for preparation of LAP.

Step-2 (Identification of Villages): The Consultant has identified the villages through which the corridor passes.

Step-3 (Collection of Revenue Maps): After the identification of villages, the Consultant approached respective Revenue Officer for collecting Revenue Maps

Step-4 (Overlapping of Revenue Maps): Once after gathering Revenue Maps, the proposed widening plan would be overlapped on the maps with the help of software packages.

Step-5 (Identification of Affected Plots): The exercise of overlapping could bring out specifically the affected plots. Such affected plots have been market out.

Step-6 (Demarcation): After identification of affected plots, the specific area of the affected plot could be demarcated.

Step-7 (Collection of Land Records): On demarcating the affected area, land records would be collected from Revenue Officer. This could fulfil the requirements of 3A.

Step-8 (Compilation): After collecting land records for all the plots from respective Revenue Officer, the same has been sorted out for affected plots.

Step-9 (Final Land Acquisition Plan): All the information collected from Revenue Officer has been worked out with respect to proposed widening plan. Finally this forms the LAP for submission to NHAI. The process adopted for land acquisition is depicted in the Flow Chart below.

4.8 R&R IMPLEMENTATION ARRANGEMENTS

Introduction

Efficient implementation of Resettlement Action Plan (RAP) prior to handing over the site for civil construction works is a prerequisite step in the project. Implementation of RAP is designed and the entitlements for the project affected persons are estimated as per the guidelines of National Rehabilitation and Resettlement Policy (NRRP), 2007. This would expedite the overall implementation of the project and will also provide adequate support to the population affected/displaced due to the proposed project. However, its worth to metion here that, Ministry of Road and Transportation (MoRTH), National Highways Authority of India (NHAI) and other departments of Central Goverment decide weather the NRRP will applicable to the project or not.

4.8.1 Proposed Entitlement Framework

The project requires approximately 142.48 Ha of land to be acquired. Households adversely affected by the project due to land acquisition, would be compensated for the loss of land and structures at replacement cost. Project Affected Households (PAHs) losing livelihoods would be assisted through income restoration measures. Residents of squatter settlements belonging to vulnerable groups would be provided with one-time shifting allowance. All non-title holders within RoW would be allowed to salvage material assets belonging to them.

In the context of entitlements the following relevant definitions may have been adopted in the project. Resettlement and rehabilitation measures would be provided following these definitions.

"Affected Family" means

1. a family whose primary place of residence or other property or source of livelihood is adversely affected by the acquisition of land for a project or involuntary displacement for any other reason; or
2. any tenure holder, tenant, lessee or owner of other property, who on account of acquisition of land (including plot in the abadi or other property) in the affected area or otherwise, has been involuntarily displaced from such land or other property; or
3. any agricultural or non-agricultural labourer, landless person (not having homestead land, agricultural land, or either homestead or agricultural land), rural artisan, small trader or self-employed person; who has been residing or engaged in any trade, business, occupation or vocation continuously for a period of not less than three years preceding the date of declaration of the affected area, and who has been deprived of earning his livelihood or alienated wholly or substantially from the main source of his trade, business, occupation or vocation because of the acquisition of land in the affected area or being involuntarily displaced or any other reason;

"Affected Area" means area of village or locality notified by the appropriate Government as part of this Policy.

"Agricultural Labourer" means a person primarily resident in the affected area for a period of not less than three years immediately before the declaration of the affected area who does not hold any land in the affected area but who earns his livelihood principally by manual labour on agricultural land therein immediately before such declaration and who has been deprived of his livelihood.

"Agricultural Land" includes land being used for the purpose of –

1. agriculture or horticulture;
2. dairy farming, poultry farming pisci-culture, breeding of livestock or nursery growing medical herbs;
3. raising of crops, grass or garden produce; and
4. land used by an agriculturist for the grazing of cattle, but does not include land used for cutting of wood only;

"Appropriate Government" means

1. in relation to the acquisition of land for the purpose of the Union, the Central Government;
2. in relation to a project which is executed by the Central Government agency or undertaking or by any other agency on the orders or directions of the Central Government, the Central Government;
3. in relation to the acquisition of land for purposes other than (i) and (ii) above, the State Government; and
4. in relation to the rehabilitation and resettlement of persons involuntarily displaced due to any other reason, the State Government;

"BPL Family": the below poverty line (BPL) families shall be those as defined by the Planning Commission of India from time to time and included in a BPL list for the time being in force;

"Commissioner for Rehabilitation and Resettlement" means the Commissioner for Rehabilitation and Resettlement appointed by the State Government not below the rank of Commissioner or of equivalent rank of that Government;

"Family" includes a person, his or her spouse, minor sons, unmarried daughters, minor brothers, unmarried sisters, father, mother and other relatives residing with him or her and dependent on him or her for their livelihood; and includes "nuclear family" consisting of a person, his or her spouse and minor children;

"Holding" means the total land held by a person as an occupant or tenant or as both;

"Khatedar" means a person whose name is included in the revenue records of the parcel of land under reference;

"Land Acquisition" or **"Acquisition of Land"** means acquisition of land under the Land Acquisition Act, 1956 (48 of 1956), as amended from time to time, or any other law of the Union or a State for the time being in force; **"Marginal Farmer"** means a cultivator with an un-irrigated land holding up to one hectare or irrigated land holding up to half hectare;

"Non-Agricultural Labourer" means a person who is not an agricultural labourer but is primarily residing in the affected area for a period of not less than three years immediately before the declaration of the affected area and who does not hold any land under the affected area but who earns his livelihood principally by manual labour or as a rural artisan immediately before such declaration and show has been deprived of earning his livelihood principally by manual labour or as such artisan in the affected area;

"Occupiers" means members of the Scheduled Tribes in possession of forest land prior to the 13th day of December 2005;

"Small Farmer" means a cultivator with an un-irrigated land holding upto two hectares or with an irrigated land holding up to one hectare, but more than the holding of a marginal farmer.

"Vulnerable Group" includes persons such as the disabled, destitute, orphans, widows, unmarried girls, abandoned women, or persons above fifty years of age; who are not provided or cannot immediately be provided with alternative livelihood, and who are not otherwise covered as part of a family;

Community Property: A community property is a structure or a piece of land that embodies a public utility, facility or a cultural / religious entity that belongs to a community or a group. For example a shrine, temple, mosque, church, school, well or a tube well is a community property.

Compensation: Compensation refers to restitution made to property under the Land Acquisition Act, 1894. In this context it refers to payment made by the Government exercising 'Eminent Domain'.

Right of Way (RoW): Means the entire strip of land traversed by any highway, street, county road or roadway easement including (longitudinal drains, service roads and embankment) for the purpose of vehicle travel, and includes the entire width of the land dedicated or acquired by law for right-of-way purposes. All along the NH-21 available RoW is not enough to contract road so additional land upto 45 meters of PRoW will be acquired.

Cut-off Date: Cut-off date is established to identify and enumerate the Entitled Persons. For titleholders /

legal owners, the cut-off date will be the notification by the PIU declaring the intention to acquire the property. The date of serving the notice u/s 3A of National Highway Act of 1956 will be established as the cut-off date.

Encroacher: Any person illegally occupying public property by extending their land boundary or a portion of their building onto the RoW is an encroacher.

Entitled Person (EP): Entitled Person includes all PAPs who qualify for, or are entitled to, compensation / assistance since being impacted by the project. The basis for identification of Entitled Persons (EP) in the project will be the cut-off date.

Project Affected Household (PAH): Any household living, cultivating land or carrying on business, trade or any other occupation within the Corridor of Impact (CoI) who are impacted by the project is a Project Affected Household. All the members of a PAH in the project will be treated as PAPs.

Project Affected Person (PAP): Any individual (part of the PAHs) living, cultivating land or carrying on business, trade or any other occupation within the Corridor of Impact (CoI) who are impacted by the project is a Project Affected Person (PAP).

Present Market Rate: Present market rate in the project refers to the valuation of a project-affected property as per the up-dated Circle Rate or BSR Rate respectively for land and structures.

Titleholder/Private Property Owners: Private property owners are persons who have legal title to structures, land or other assets. These property owners are entitled to compensation under the National Highway Act of 1956.

Non-titleholder: Squatters and encroachers are non-titleholders, as they do not have any legal title of the parcel of land they occupy. However, some of the non-titleholders are found to pay certain taxes regularly to local self governments for present occupancy for their housing/commercial establishment. The NH Act 1956 for Land Acquisition does not recognize the usufruct right so they are not eligible to any compensation or assistance as per the statues. The R&R Policy for the project also does not specify any assistance for non-titleholders.

Encroachment: Private structures, which extend from private land to government land, are classified as encroachment. The portion of the structure in government land is considered illegal occupancy and is not eligible for any compensation for assistance as per the R&R Policy for the project.

Squatter: Any person having structures entirely within the public RoW for residential and/or commercial purposes is a squatter.

The proposed Entitlement Framework for Project Affected Persons (PAP) for this project has been presented in Table 4-27. PAPs are entitled for various types of rehabilitation and resettlement benefits depending upon the type of loss due to the project.

Table 4-27: Proposed Entitlement Matrix for Project Affected Persons

S. No	Category / Target Group	Details	Entitlement
A	**Homestead land / House Building Assistance**		
1	Each affected family	Any affected family owning house and whose house has been acquired or lost	Free of cost house site to the extent of actual loss of area of the acquired house but not more than 250 Sq. m of land in rural areas / 150 Sq. m of land in urban areas for each nuclear family. In urban areas, a house of up to 100 Sq. m carpet area. Such house may be offered in a multi-storied building complex.
2	Each affected below poverty line family	Affected families without homestead land and which has been residing in the affected area continuously for a period of 3 years preceding the date of declaration of the affected area	A house of minimum 100 Sq. m carpet area in rural areas, or 50 Sq. m carpet area in urban areas (which may be offered, wherever applicable, in a multi-storied building complex), as the case may be in the resettlement area

S. No	Category / Target Group	Details	Entitlement
		and which has been involuntarily displaced from such area	
B	**Agricultural Land**		
1	Each displaced family owning agricultural land	Affected families owning agricultural land in the affected area and whose entire land has been acquired or lost	Agricultural land or cultivable wasteland to the extent of actual land loss, subject to a maximum of 1 ha of irrigated land or 2 ha of un-irrigated land or cultivable wasteland
2	Each affected family who have been reduced to the status of marginal farmers		Agricultural land or cultivable wasteland to the extent of actual land loss, subject to a maximum of 1 ha of irrigated land or 2 ha of un-irrigated land or cultivable wasteland
C	**Land Development**		
1	Each Khatedar in the affected family	In case of allotment of wasteland or degraded land in lieu of the acquired land	One-time financial assistance of such amount as the appropriate Government may decide but not less than Rs.15000/- per hectare
D	**Agricultural Production**		
1	Each Khatedar in the affected family	In case of allotment of agricultural land in lieu of the acquired land	One-time financial assistance of such amount as the appropriate Government may decide but not less than Rs.10000/
E	**Construction of Cattle Shed**		
1	Each displaced family which is having cattle		Financial assistance of such amount as the appropriate Government may decide but not less than Rs.15000/-
F	**Shifting Allowance**		
1	Each displaced family	Allowance for shifting of family, building materials, belongings and cattle	One-time financial assistance of such amount as the appropriate Government may decide but not less than Rs.10000/
G	**Construction of Working Shed or Shop**		
1	Each displaced person who is a rural artisan, small trader or self-employed person		One-time financial assistance of such amount as the appropriate Government may decide but not less than Rs.25000/
H	**Employment Assistance**		
1	At least one person per affected family		The requiring body shall give preference in providing employment in the project, subject to the availability of
			vacancies and suitability of the affected person for employment
			Arrange for training of the affected persons, so as to enable such persons to take on suitable jobs
			Offer scholarships and other skill development opportunities to the eligible persons from the affected families as per the criteria as may be fixed by the appropriate Government
			Give preference to the affected persons or their groups or cooperatives in the allotment of outsourced contracts, shops or other economic opportunities coming up in or around the project site
			Give preference to willing landless labourers and unemployed affected persons while engaging labour in the project during the construction phase
2	Affected persons		Necessary training facilities shall be offered for development of entrepreneurship,

S. No	Category / Target Group	Details	Entitlement
			technical and professional skills for self employment.
I	**Rehabilitation Grant**		
1	Each affected family	Affected families who have not been provided agricultural land or employment	750 days minimum agricultural wages
J	**Subsistence Allowance**		
1	Each affected family		25 days minimum agricultural wages per month for a period of one year from date of displacement
K	**Annuity Policies**		
1	Vulnerable affected persons (as per Para 6.4(v) of the Policy)	Project authorities shall, at their cost, arrange for annuity policies that will pay a pension for life to the vulnerable affected persons	Minimum of Rs.500 per month
L	**Ex-Gratia**		
1	Each Owner (Khatedar) in the affected family	In case of linear acquisitions, in projects relating to railway lines, highways, transmission lines, laying of pipelines and other such projects wherein only narrow stretch of land is acquired for the purpose of the project or is utilised for right of way	Rs. 20000 in addition to the compensation or any other benefits due under the Act or programme or scheme under which the land, house or other property is acquired
M	**Assistance to Vulnerable Groups**		
1	Each scheduled tribe affected family	Additional one-time financial assistance for loss of customary rights or usages of forest produce	500 days minimum agricultural wages
2	Each scheduled tribe affected family	Those resettled out of the district	25% higher rehabilitation and resettlement benefits in monetary terms (in respect of items specified in paragraphs 7.9 to 7.12 of the Policy)
3	Affected families of scheduled tribe		Land free of cost for community and religious gathering

4.8.1.1 Livelihood Restoration of Vulnerable Squatters

Since the project is to be implemented on a commercial format, there are no inherent funds devoted to restoration of livelihoods of non-title holder occupants within the CoI / public RoW, who would be evicted due to the project. However, the Consultants feel that since there would be substantial losses to livelihoods due to such eviction, it would be worthwhile on the part of the project authorities to integrate at least the vulnerable squatter and the PAPs in various development / welfare programmes of the State and Central Governments.

To this end, the Consultants suggest in the following a range of Government aided programmes undertaken through the District Rural Development Authority (DRDA) in the State of Madhya Pradesh in which vulnerable squatter and the PAPs losing livelihoods may be integrated with.

- Pradhan Mantri Gram Sadak Yojana (PMGSY)
- Swarnjayanti Gram Swarozgar Yojana (SGSY)
- Sampoorna Gramin Rozgar Yojana (SGRY)
- Indira Awas Yojana
- Credit-cum-Subsidy Scheme for Rural Housing
- Innovative Stream for Rural Housing and Habitat Development
- Rural building Centres
- Samagra Awas Yojana

- National Social Assistance Programme
- Council for advancement of People's Action and Rural Technology
- Rajiv Gandhi National Drinking Water Mission
- Centrally sponsored Rural Sanitation Programme
- Drought Prone Area Programme
- Wastelands Development

4.8.1.2 Relocation and Preservation of Community / Cultural Property

The detail of the community/cultural properties has been provided in the Environmental Impact Assessment Report**.** The construction costs for community/cultural properties have been presented in the Environmental Management Plan of the project.

Implementation Arrangements

Implementation of RAP is one of the major tasks that need to be carried out during the project implementation. The PAPs would receive adequate notice, counselling and assistance before handing over their assets. The implementation of RAP begins with land acquisition, payment of compensation, identifying the relocation sites for community /cultural property in consultation with the affected people and assisting them for enrolling them in Governmental welfare programmes. The R&R activities are a part of the RAP.

Institutional Arrangements

The NHAI is responsible for implementation of the complete resettlement and rehabilitation of all those affected by the project. For implementation of RAP, the NHAI should focus on four critical aspects. Establish a Project Implementation Unit (PIU) exclusive to this Project. It is suggested that NHAI may designate the State Level H& RW (National Highway Division) to act as PIU for this Project; Appointment of NGOs to assist in implementation of RAP. This is essential to carry out implementation activities of RAP inclusive of issuing and distribution of Photo Identity Cards, counseling, disbursement of compensation money, etc. to the PAPs. Establish a District Level Committee (DLC) in the project District, where acquisition of land for the project will take place; and establish a Grievance Redressal Committee (GRC).

Project Implementation Unit

The PIU will be headed by a Project Director. The NHAI Project Implementation Unit (PIU) will be responsible for implementation of the R & R component of the project. It is responsible for planning of the entire R & R activities, implementing in consultation with the PAPs, considering R&R as a process of development.

While land acquisition is the responsibility of the State Government on behalf of the NHAI, (land acquisition is the responsibility of the State/District Administration) the responsibility of the Project Implementation Unit (PIU) is to ensure that the delays between the date of notification and the date of award are reduced to eliminate the hardship caused to the affected people, are minimized. This is possible if the PIU works in coordination with the District Level Committee set up to review the progress of land acquisition.

For the implementation of the Resettlement Action Plan and to address the grievances of the PAPs owing to the project, a Manager has to be designated as Resettlement and Rehabilitation Officer (RRO), and shall oversee the implementation of R & R activities.

District Level Committee (DLC)

RAP implementation will be coordinated through District Level Committee. The District Level Committee (DLC) is an ad hoc committee and will be dissolved later once the R & R implementation is complete. The committee will comprise of the District Collector and officially deputed Land Acquisition Officer (LAO), Talukadars of affected Talukas, Pradhans of Block Development Offices of affected Blocks, Project Director, RRO, representative of the Non-Government Organization (NGO) and representatives of the

PAPs. The DLC will play a coordinating role in land acquisition and compensation, assistance and so forth.

Table 4-28: Roles and Responsibilities of PIU and NGOs

Implementation Staff	Roles and Responsibilities
Project Director at Project Implementation Unit (PIU)	Overall responsibilities for land acquisition and R&R activities in the field. Make budgetary provisions for land acquisition and R&R activities. Liaison with district administration for land acquisition and implementation of R&R. Participate in the district level committee.
Manager as RRO at PIU	Co-ordinate with district administration and NGOs responsible for land acquisition and R&R. Print Policy and Identity Cards for the PAPs. Ensure that the land acquisition plans as per the alignments are submitted to the district administration for acquisition. Liaison with the District Administration for dovetailing Government's schemes for income generation and development programs for the PAPs. Co-ordinate with the NGOs appointed for implementation of the R&R. Monitor physical and financial progress on land acquisition and R&R implementation activities including shifting of people. Organize regular meetings with the NGOs to review the progress of R&R.
Non Government Organization	Co-ordinate with the RRO to implement R&R activities. Verification of PAFs listed out in the RAP. Issue Identity Card to the PAFs Facilitate the RRO in organising the public information campaign at the commencement of the R&R activities. Assist the PAPs in receiving the payment of compensation, opening of the Bank accounts and facilitates the vulnerable PAPs in ensuring that they get their dues on time and are not left out to deteriorate to the stages of impoverishment. Ensure that the PAPs receive their entitlements on time. Participate in the meetings organized by the PIU. Submit monthly progress report.

4.8.1.3 Implementation Procedure

- The RAP is implemented through the following five stages:
- Issue of legal notification for land acquisition and the cut-off date;
- Verification of Eligible Persons (EPs) and estimation of their types and category of losses;
- Preparation of Photo Identity Card, issue and distribution to EPs;
- Disbursing Compensation Money;
- Monitoring Physical and Financial Progress of Resettlement Action Plan.

General Activities

In order to carry out the above activities, the NHAI has to carry out institutional strengthening and certain administrative responsibilities in terms of: Contracting of NGOs; Setting up of District Level Committees (DLC) and the Grievance Redressal Cell (GRC); Verification of EPs; Updating of the census data to include the disputed cases or left out cases to be included in the list of PAPs; Distribution of Identity Cards (see at the end of the chapter, a format for ID Card); Opening of joint accounts in the name of the EPs, representatives of the NGOs and RRO; Special emphasis on the vulnerable groups for helping enroll the PAPs from this group in Governmental welfare schemes operating in the region; Monitoring physical and financial progress; and Prepare monthly reports of the progress made.

Specific Activities

Permanent Land Acquisition: It will be carried out under National Highway Act of 1956.

The following steps will have to be carried out for land acquisition: Appointment of the competent authority; Identification of Villages Along the Project Corridor; Preparing land plans for acquisition with details about the total land holdings and the area affected; Issue of notices as per the National Highway Act 1956 for the purpose of acquisition; Announcement of compensation awards as per the NH Act; Issue of cheques in public places prior to taking of possessions: PAPs will be allowed to salvage their materials from the demolished structures.

Payment of Compensation

Ensure the amount of compensation is appropriate to PAPs; Verification of EPs for compensation; Ensure

the receipt of cheques by owner of the affected unit; Ensure that cheques are issued in public during meetings; Inform about acquisition or transfer of land to other authorities whose land is being taken (Forest; Defense etc).

Grievance Redressal Mechanism

The objective of the mechanism is to provide a platform to the affected people to address their grievance that are sought by meaningful solutions. Thus, reflecting continued participation and justification to design, economic returns and the PAPs themselves. The grievances addressed in this manner have community approval and the redressal is appropriated through stakeholders' participation. The committee thus formed for this purpose will continue to function for the benefit of the PAPs during the entire life of the project so that the PAPs grievances are redressed at the right time. The GRC will have to be formed at every District Head Quarter consisting of the following members:

- The Project Director;
- RRO;
- District Collector;
- NGO and Monitoring Implementation of Resettlement Action Plan

It is important to consider setting up an early system for monitoring project objectives and social accountability. Monitoring involves tracking the progress of process and implementation (as measured by indicators on inputs, outputs and outcomes) associated with the project. This is done to ensure that the desired targets are achieved. Indicators for monitoring will be designed to capture physical and financial progress of the project. Promote Social Accountability

Monitoring and evaluation system can also be implemented to promote social accountability during the process of implementation of the project leading to sustainability. Participatory public review and perception surveys would be used for social accountability in the monitoring and evaluation process.

4.9 THE RAP BUDGET

The RAP budget includes the cost of land and compensation for private structures. The details are listed in the Table 4-29.

Table 4-29: Preliminary Social Cost Details

Sr.	Details of Affected Structures	Area in Sq. M/No	Unit Rate/Sq. M	Amount (Rs)
A	**Titleholder**			
1	Pucca	6094 (61)	5757	3,50,83,158.00
2	Semi-Pucca	4666 (64)	2913	1,35,92,058.00
3	Kutcha	467 (10)	1590	7,42,530.00
4	Compound Wall	100 (M)	1500/ Running Meter	150,000.00
			Sub Total	**49567,746.00**
B	**Government**			**18,95,550.00**
C	**Proposed Land Acquisition**	**for 142.48 Ha**		**13,09,171,765.00**
D	**Rehabilitation & Resettlement Assistance**			
1	Shifting Allowance	57	10000	5,70,000.00
2	Construction of Working Shed	76	25000	19,00,000.00
3	Subsistence Allowance	76	24000	18,24,000.00
4	Annuity Policies	92	6000	5,52,000.00
5	Ex-Gratia	133	20000	26,60,000.00
6	Assistance to Vulnerable Groups	35	40000	14,00,000.00
7	Construction of Cattle Shed	6	15000	90,000.00
			Sub Total	**89,96,000.00**
	TOTAL SOCIAL COST (A+B+C+D)			**1,36,96,31,081.00**

*Minimum Agricultural Wage calculated at an average of Rs.80/day

The social cost has been estimated at Rs. 1,36,96,31,081.00. This cost is Including Land Acquisition cost, Structure Cost and Resettlement and Rehabilitation Cost.

5. *Alternative Options*

5.1 PROPOSED OPTIONS

To develop the NH-21 highway section from Kiratpur (Km. 73.300/0.000) to Bilaspur (Km 134.500/26.462) into 4-lane capacity with paved shoulders configuration various options were studied. The different options of study are as follow:

1. The widening of existing road with paved shoulders;
   The first option was opted to widen the existing road from Kiratpur (Km. 73.300) to Bilaspur (Km 134.500). Total length is 61.200 Km (Excluding Realignment from Kainchi More to Noni More Section)
2. New four lane alignment with paved shoulders.
   a) 4-lane new construction of New alignment taking off from existing NH-21 near Kiratpur to Kainchi More (Km.73.300/0.000 to Km. 85.935/12.732) - Length is 12.732 Km.
   b) Proposed Realignment from Kainchi More to Noni More Section (Km. 85.935/12.732 to Km. 26.462) - Length is 13.730 Km.
   c) Total design length is 26.462 Km (including the Realignment).

5.2 ENVIRONMENTAL ANALYSIS OF BOTH THE OPTIONS

The existing alignment and proposed new alignment have been analyzed in order to identify Environmental issues of both the alignment. The detail survey was carried out to identify the various environmental issues along the existing alignment; and of proposed new alignment. The comparative analysis of both the options for various Valued Environmental Components (VEC) was carried out, which is given in **Table 5.1**. Figure 5.1 showing pictoral image of both options on google image.

Table 5.1: Environmental Issues in Options

Environmental Issues	Option-1: Improvement of Existing Alignment	Option-2: Proposed Alignment	Remarks
Forest	In order to widen the existing road we have to acquire forest land along the road.	We have to acquire forest land (comparatively less)	As per the survey and consultations with the forest officials it has been made clear that around 8.82 ha. of forest land will be diverted for the new alignment
Wildlife	No wildlife is coming across the existing alignment. However one bird sanctuary and one wildlife sanctuary is very near to the existing alignment. There will be impact on wild animals during construction and operation phase.	The new alignment is not passing through any wildlife sanctuary but passing through Gobind Sagar, a Bird Sanctuary called as Lake. There will be very insignificant impact on wild animals during construction phase and operation phase.	Clearance required for Gobind Sagar Sanctuary and others falling within 10 km from the alignment
Tree felling	There are approximately 5000 trees which may be fell down due to road widening.	There are approximately 2035 trees in which dense tree plantation have been observed.	Detailed tree counting not done

Environmental Issues	Option-1: Improvement of Existing Alignment	Option-2: Proposed Alignment	Remarks
Siltation of Gobind Sagar Lake	The Gobind Sagar lake is receiving significant amount of silt, which will drastically increase during construction and operation phase.	Most of the hilly sections will be avoided in this option also there is provision of tunnel to minimize the siltation.	Option II recommended
Impact on Sutluj River	The existing alignment is close to Sutlej River in particularly in Bilaspur district. There will be adverse impacts on Sutlej River particularly during construction phase.	The new alignment is not close to Sutlej River and crossing the river at two locations.	--
Air pollution	Along the existing alignment there are many residential and commercial establishments which will be affected by air pollution during construction and operation phase of the project.	In case of new alignment we can avoid air pollution impact on society as the alignment crosses less no. of settlements.	Option II recommended
Noise Pollution	Along the existing alignment there are many residential and commercial establishments which will be affected by Noise pollution during construction and operation phase of the project.	In case of new alignment we can avoid Noise pollution impact on society.	Option II recommended
Water Resources	Along the existing alignment few natural water resources and significant no. of manmade hand pumps may be affected	Not many natural water resources and hand pumps found along the project road may be affected.	Option II recommended
Geology	The 70% of the road section is passing through hilly area. In order to improve the existing road into four lane capacity there will be large amount of cut and fill operation, which may lead to instability of local geology.	The new alignment will be mostly in plain section, hence there will be very less cut and fill operation.	--
Land	The land acquisition will be only for additional land requirement to keep the ROW 30 meters. In this option there will be	In this option we have to acquire land for entire alignment. The impacts will be adverse irreversible of larger	--

Environmental Issues	Option-1: Improvement of Existing Alignment	Option-2: Proposed Alignment	Remarks
	adverse irreversible impact of less volume as compared to impacts of selecting new alignment.	magnitude as compared to impacts of selecting existing alignment.	
R&R Issues	There are 253 structures which will be affected due to widening of the existing road.	Approximately 156 structures will be affected in opting the new alignment.	Option II recommended
Religious Property	The 12 temples, 16 shrines, 1 Pirbaba and 1 Boundary of Gurudwara and 1 Swami Bease will be affected to improve the existing road into four lane capacity.	3 temples, 3 shrine, 1 Pir Baba and 1 boundary of Gurudwara may be affected in opting the new alignment	Option II recommended
Community/Public property	The 20 public properties will be affected to improve the existing road into four lane capacity.	8 public properties will be affected	Option II recommended
Geometry	The existing alignment is having very poor geometry which leads to frequent accidents	The new alignment will be designed in order to keep better geometry.	Option II recommended
Settlements	The existing road passes Kiratpur, Messawal, Maura, Swarghat, Gambhar, Gambhrola, Nauni and Bilaspur.	The new alignment passes through Kiratpur, Kainchimore, Mehla, Jakatkhana, Tunnu & Bharadi	New alignment passes through lesser no. of small settlements. Option II recommended.

The comparative chart is as follow:

S. No	Features	Option 1	Option 2
1.	Length	61.300 Km.	26.500 Km.
2.	Terrain	Plain (Punjab) & Hilly in HP	Plain (Punjab) & Hilly in HP
3	Landuse	Predominantly Agriculture	Predominantly Agriculture
4.	Forest	3	2
5.	Tree Cutting	3916	2035
6.	Structure	47	99
7.	Khud (Tributery)	2 (Gambhar & Gambhrola)	2 (Gambhar & Gambhrola)
8.	Affected Families	352	127
9.	No. Villages	53	26
10.	Cost	768.75 Cr	743.9 Cr

Figure 5.1: Figure Showing Option Study

6. *Public Consultation*

Community consultation has been taken up as an integral part of environmental assessment process throughout the project preparation stage of this project.

6.1 INTRODUCTION

Public consultation is a continuous two way communication process which involves promoting full public understanding of the project; its benefits, problems and solutions. Public consultation or participation is essentially a part of environmental and social assessment process.

The process benefits both the project proponent and potentially affected communities. The significance of the Public Consultation process is discussed below:

Educates the potentially impacted communities about the proposed course of action, the alternatives to it, the costs and benefits associated.

Solicits the views of the potentially affected communities regarding impact on environmental components due to the project and their significance.

Allow potentially affected communities to provide input into such matters as project design and selection of mitigation measures before irrevocable decisions are taken.

Serves as an important tool for collecting information about the natural, social and cultural environment as certain information are only available through these interactive grass root level discussions.

Since the residents have a much better knowledge of their circumstances, environment and living conditions, they sometimes contribute to the identification of new alternatives to the proposed alignment.

Provides insight into public acceptance of the project within the Corridor of Impact.

Helps in lessening public resistance to change by involving them in decision making.

Consultation with community and their involvement at the project planning stage helped in informing and educating the stakeholders about the proposed action before the finalization of design. It assisted in identifying the problems associated with the proposed project and the needs and values of the population likely to be impacted by the project.

6.2 THE APPROACH TO CONSULTATION

Consultation with the community was carried out with the intention of informing and educating the Project-Affected-People (PAP's) and stakeholders about the proposed action before the finalization of design so as to include their inputs. Consultation was also carried out to identify the problems associated with the proposed project and the needs and values of the population likely to be impacted by the project.

A multi –Method research design consisting of personal contacts, group discussions, observation both participatory and non-participatory, survey techniques have been applied for conducting Consultation / Public Consultation (C/PC). Thus the process is divided into the following 4 levels.

Level 1: Consultation with officials through letter, followed by consultations/discussions by explaining the purpose and convincing them about the need for orderly consultation process from top to bottom approach.

Level 2: Consultation with Corridor village people. A few selected corridor villages /Habitations /Road side settlements, both residential and commercial, had been identified for finding out their knowledge, attitude and perception about the proposed project.

Level 3: Consultation with representatives of Gram panchayat. The Gram panchayat representatives were contacted or their presence and opinion during the consultation process.

Level 4: Consultation with division / District level officials. All the senior level Government officials such as district collector, sub collector, district revenue officer, tahsildars, revenue inspectors etc, were contacted for appraising about the proposed project and also seek their cooperation in getting relevant primary and secondary data on the project.

6.2.1 Key Social Issues

The key social issues along the project corridor have been described in this section. At certain locations along the alignment residential, commercial and community structures are likely to be affected. Key social impacts include displacement of some commercial and residential properties close to the corridor. In addition, the proposed project shall result in disruption of road-side commercial activities related to repair of cycles and vehicles and some other temporary tea-shops.

Land acquisition of commercial, residential, agricultural and forest lands will be required for the proposed project. Resettlement and Rehabilitation measures need to be suitably worked out for the identified impacts in a Resettlement and Rehabilitation Action Plan.

Details of the Consultations along the project corridor

Date	*Type of Stakeholder*	Issues Discussed
11th – 15th June 2012	Affected Local Peoples	• Demolition of structures • Livelihood of affected persons • Relocation of temples • Noise & dust impacts during construction • Drainage, water logging & flooding problem • Road accident & safety issues • Siltation of Sutluj River and Gobind Sagar lake • Geometry of the proposed alignment • Air pollution due to cement industry • Change in topography of the area • Debris generated due to the hill cutting and their disposal • Blasting during hill cutting
6th – 7th June 2012	Forest / Wild life Officials	• Felling of trees • Status for forest land and Forest clearance • Compensatory plantation • Animal migration routes and occurrence of rare & endangered species • Details of affected Trees, shrubs and Herbs • Affect on Wildlife due to noise pollution
7th June 2012	State Pollution Control Board	• Location of air, water, noise monitoring stations • Involvement of SPCB staff during Environmental Monitoring • No objection Certificate from SPCB • Impact on ground water • Impacts on water bodies • Roadside Automobile workshops
	H.P Fisheries Department	• Name of fish species in Gobind Sagar lake and Satluj river • Impact of fishes at the time of construction

A wide range of people including local people, private groups, forest officials, wildlife officials, State Pollution Control Board staff, community people, transport union representatives and local leaders were consulted. The main points of discussions with various agencies were concentrated on environmental awareness, environmental pollution, impact on wildlife afforestation, and shifting of religious structures associated with project. People's perceptions about environment were also recorded. Based on the findings of the public consultation held during the project preparation stage following recommendation/suggestion were made to improve/enhance the existing environment**:**

- Compensatory plantation in consultation with communities and the Department of Forests; as per state policy for each tree removed ten trees are to be planted.

- Stringent Pollution Control Measures during construction phase to relieve the affected people of high levels of air and noise pollution
- Adequate mitigation measures to mitigate anticipated impacts on surface water quality during construction of bridges on backwaters and rivers
- Proper traffic management during construction phase
- Health and safety of construction workers
- Installation of highway facilities and safety features for all types of road users
- Proper maintenance of roads after decommissioning
- Monitoring of environmental components like air, water, sound and survival percentage of planted trees during the construction and operation phase

6.3 PROJECT BENEFITS

Highways have varied embedded connotations, like the backbone of modern economy, the philosophy of life signifying the 'voyage unremitting' from birth till death, the history of mankind and its endeavor, the passion for speed and dart non-episodically etc. Highways projects promote access to markets, materials and opportunities by facilitating movement of persons and goods and improve earning and thereby level of living. This in turn enhances the demand for transport. This two-way interactions works through a host of inter-sectoral forward and backward linkages effects and dynamic externalities tends to relocate industries, services and labors thus help the shape the economic geography of the region.

The ultimate aim of the developmental activities, such as NH-21 is to promote societal welfare of the Kiratpur to Bilaspur area of Punjab & Himachal Pradesh state. The developments of above widening project play a significant roll in changing the socio-economic condition of the living of people of a region through dynamic externalities that such development often generates.

The benefit of proposed widening of NH-21 may also be seen from a different angle, viz., the local benefit and the wider regional or national level benefit. The entire regional and national economy lying beyond this neighborhood should also be benefitted from the development; such effect may be called the regional or national level benefits. Further the benefit may be direct or indirect in nature.

All these should have a bearing on the level of well being of the households, although some of them may not themselves necessarily use more of the highway facility created. These would in turn lead to changes in the level of well-being and human development, through their benefit on consumption level, educational attainment, health status etc.

6.3.1 Tourism Development

India is a multi-destination country with a variety of tourist attractions and facilities. It hosts a number of wildlife parks, bird sanctuaries, museums and hundreds of historical monuments. All in all, India has in abundance what a tourist desires. The tourist places are accessed and reached also serves the comfort travel benefits to the people. Kulu-Manali is an important tourist destination in India The road construction will provide better transportation facility for tourists visiting Manali-Rohtang Pass from different parts of India and abroad.

6.3.2 Economic Development

Highways Development program can contribute to economic development by encouraging the attraction of businesses to sites equipped with good access and by improving the travel efficiencies of existing businesses and to start a new avenues. They also help for:

- The development of new project sites;

- The development of industrial parks;
- Infrastructure projects;
- Development of IT parks

6.3.3 Employment Opportunity

Highway development project serves as an important employment generator and provide employment opportunity during construction period.

6.3.4 Reductions in Accidents, Morbidity and Mortality

Development of highway projects, especially 2/4 lanes divided carriageway of NH-21 projects in reducing the number of accidents through the following developments. Improved crossing and alternatives access routes by use of signage, junctions, & alternate arrangement for local traffic circulation has been provided. Installation of proper road safety system through signage, barricades, crash barriers, edge posts / parapets will add to be safety of the vehicular traffic on the stretch of the road.

Sharp turns and curves of the roads have been realigned to improve public safety in operational stage. Proper lighting/ illumination will be provided in tunnels in order to avoid accidents during night as well as adverse climatologically conditions. Reduces loss of life by avoiding head to head direct collision and also reduces damages to vehicles etc.

6.3.5 Reduction in Operation Cost

Vehicle operating cost (VOC) will be reduced when a road is improved. Fuel consumption, wear and tear of tyres, suspension will be benefited when a geometric design is improved and the road surface is made more even. The savings are perceived by the road user in the form of lower expenditure, VOC consist of the following components:

- Fuel Consumption
- Lubricating oil consumption
- Spare part consumption
- Tyre consumption
- Vehicle depreciation

6.3.6 Indirect Benefit

In addition to direct impacts, a number of indirect benefits are also attributed to highway projects. Lowering transportation cost for users and improving access to goods and services enables new and increased economic and social activity. Over time individuals, households and firms adjusts to take the advantage of those benefits, leading to several indirect impacts. These indirect impacts include changes in Landuse and development, changes in decision to locate houses and business in areas where houses and land are less expensive or more desirable, and changes in warehouse and delivery procedure for businesses in order to take advantage of improved speed and reliability in the transportation system. These impacts then lead to increased property values, increased productivity, employment and economic growth.

The indirect benefit of proposed widening would work through the dynamic developmental externalities generated through the forward and backward linkages. The change in Landuse pattern in the areas that are greater connectivity due the highway, since there will be a change in the patterns of settlement, agricultural land use and location of industries, trading and other services and non-farm unorganized sector activities. All the above would reflect in the changes in

the pattern of economic activities, income generation, price evolution, employment condition and ground rent prevailing in the region of Bilaspur and Nerchowk area.

A new Landuse pattern may in turn induce greater accessibility to job market, health and educational facilities etc. Attract investment for development of feeder roads, power distribution networks, telecommunication facilities and other modes of connectivity among other, leading to a greater access to the local people to markets and infrastructure facilities.

6.3.7 Environmental Benefits

Reductions in adverse environmental impacts of transportations – Reduced emissions, noise and other impacts are also the direct benefits of highways projects. However, these benefits are difficult to quantify and value them; as a result, they are less often included in benefit cost analysis of transportation investment.

7. Assessment of Impacts

This Chapter assesses the likely impacts of the project on the identified environmental and social parameters. The assessment of impacts is based on the primary information collected during field surveys supplemented with additional data collated from various secondary sources. Possible mitigation measures have also been discussed to formulate mitigation costs.

7.1 POTENTIAL IMPACTS

The potential impacts due to the project implementation can be classified in to three groups. These are impacts on physical environment, ecological environment and socio-economic environment. The above mentioned impacts on three groups of environment can be taken care of during design stage, construction stage and during operation stage. In the present EIA study, the following impacts were taken into consideration for the said project.

7.1.1 Impacts during design stage

During design stage as described earlier it is necessary to foresee the impacts after careful ground surveys and analysis. All information collected must be accurately transferred to design drawings and plans, so that this will also lead to a design that is most acceptable to the people for whom the highway is being planned. The major issue is land availability for the new alignment. The proposal involves three tunnels on the alignment which will have severe geological impacts and excavated material disposal problem. Also blasting will lead to air and noise pollution.

The other major impacts will be on forest land and on wild animals as this area is rich in floral and faunal diversity. The existing road geometry is a big issue related to safety. There is very less scope of improving the road geometry, hence the new alignment option is recommended.
The new alignment is having good tree plantation along the proposed road side and in order to develop the road significant numbers of trees will be removed.

All along the proposed alignment there are few business establishments and residential structures which will be affected due to the upcoming alignment. The alignment has been finalized keeping in view the above said environmental impacts. Though all the above said impacts could not be avoided in any design, but may be selected in such a manner that the impacts are reduced to an acceptable level by adopting appropriate mitigation measures and compensate other impacts in order to follow the philosophy of sustainable development.

7.1.2 Impacts during construction stage (Impacts on Physical Environment)

7.1.2.1 Topography

The construction stage impacts are the most critical in highway construction projects. In present case the new 2/4 lane alignment of National Highway 21, is located mostly in plain terrain in Punjab section and some part being mountainous in Himachal Pradesh section hence construction of three tunnels are proposed. The formation between the portals of the tunnels will raise/ change the topography.

The dumping of construction waste including tunnel construction/ excavation will generate large volume of solid waste which may also alter the topography of the area, most of this could be utilized for construction for filling purpose, while part of this will have to be properly disposed off. This is not an easy job as it is difficult to find disposal sites to dispose all these excavated material in an environment friendly manner. Thus the overall impact of the project activities on

topography of the area is not having any negative impact rather it will help in overcoming the flood situations.

The associated soil erosion is a very serious issue as it would lead large scale siltation in Sutluj River; also excavation will lead to air and water quality deterioration in the area. The establishment of labor camps including hot mix plants, WMM plants etc will lead to temporary impacts on air, water, noise and soil quality. Disposal of construction material and oil spillage from the construction zones are also expected impacts.

7.1.2.2 Geology

The area is very fragile geology. All rock formations in the project area are of recent origin. The proposed tunnels may lead to severe disturbances at the proposed locations that could trigger landslides, landslips, mud flow either instantaneously or at later stages. Therefore careful planning coupled with modern engineering practices for slope stabilization need to be implemented to avoid earth movements, which could lead to loss of life and property also. Tunnel excavation will require extraction of geological resources consisting of sedimentatries i.e. sandstones, shales, limestone and conglomerates and metamorphic (panjalvolcanics) i.e. basalts and andesites. Such extraction/ removal are not likely to result in loss of mineral resources as no mineralized zone is present along the axis of the tunnel. The blasting operations will lead to rock movement, minor fragmentations and vibrations. Likely impact on the geological resources will occur from the extraction of materials (borrow of earth, stone metals, granular sub base and aggregates for base courses and bridges).

Seismically also the area is highly fragile with active tectonic movements leading to build up of high energy zones ultimately breaking the earth surfaces in the form of earth quakes. Therefore the development of highway especially the bridges and other structures must be of high standards to withstand the seismic vibrations of higher magnitude.

7.1.2.3 Climatic Parameters

Climatic parameters like temperature, rainfall, snowfall and humidity will not be impacted by the project execution. During construction phase there will be minor rise in temperature in areas adjoining the portals of the tunnels. Temperatures may also rise inside the tunnel both during the construction and the operation phase.

Such impacts will be imperceptible as far as the environment outside the tunnel is concerned. For such areas no mitigation measure is necessary. But for the tunnel environment there will be rise in temperature both during the construction and the operation phase. This will be attributable to the emission of gases and pollutants by construction plant and machinery and operation of a fleet of vehicles for supplies and muck disposal. The increase in temperature may raise the level of risk of fire.

7.1.3 Air quality

During construction stage air quality is to be impacted by dust generation and construction vehicle emissions. The potential impacts for air quality from construction activities will arise from:

- Raising of dust from open construction areas by wind, vehicle movements and other activities
- Demolition of built up structures along the road will lead to temporary increase in particulate matter.

- Spill of construction material during transportation, loading, unloading & materials transfer operations of construction material.
- Haulage roads used for transportation of material and for disposal of debris generated due to various construction activities.
- Gaseous emissions from installed asphalt hot mix plants can pose a problem to environment due to dust produced. Dust is not only a threat to lungs and eyes, but may contribute to poor visibility, especially when trucks, front-end loaders, or other equipment are working around the stockpiles.
- Fugitive emissions from construction machinery / vehicles involved in construction.
- Vehicles working at the surface construction site, including earth/ debris moving equipment, concrete trucks, material delivery trucks, truck-mounted cranes etc.
- Stationary plant emissions like mobile generators, dewatering pumps, concrete pumps etc.
- Vehicles and equipment within the underground excavation area or within the enclosed work shed including the front-end loaders, trucks, mobile generators and the like.
- The blasting operations will also lead to air pollution of large scale.

7.1.4 Water quality

7.1.4.1 Surface water

Satluj River drains the project corridor. There are two Khud they are Gambharola Khud and Ghambhar khud and number of streams and *nallas* feature in which the present project is aligned. Factors which will have potential impacts on surface water quality are:

- Tunnel construction and operation – including seepage, wash-down water and spillage
- Portal areas, worksites and spoil placement areas
- Construction of five major bridges on the Gambhar Khud, Gambhrola Khud and Satluj River and several minor bridges on streams and distributaries.

The sources of water pollution from the construction activities include the following:

- Leachates from stored bitumen and emulsion will pollute the nearby surface water source.
- Oil spill from the operation of the mechanical workshop, diesel pumps, diesel storage, transportation and transfer
- From the foundation work of bridges and culverts such as piling and excavation for open / well foundation
- Operation of construction camps will require a well developed drainage system to manage the sewage generated and avoiding its mixing with nearby surface water.
- Water flow from scarified bitumen material
- Operation of emulsion sprayer and laying of hot-mix
- Soil erosion during the construction phase of the road embankment and the bridges can contribute large amounts of sediments and silt to run-off waters and this can affect surface water quality adversely.
- Heavy metals, oils, and other toxic substances and debris from construction traffic and spillage can be absorbed by soil at construction site and carried with run-of water to the water courses, which can thus lead to increase in turbidity and alkalinity & impact aquatic flora and fauna adversely.

7.1.4.2 Ground Water

Impacts on ground water due to other activities: Few hand pumps are coming within ROW from Kalyanpur to Bharadi village which is used by local villagers for drinking purposes. Apart from that no ground water resource is being impacted. Impacts on ground water due to tunneling.

Water table will be affected due to tunneling but it will be temporary impact as aquifers affected will be recharged gradually. Ground water conditions are indicative that the jointed and sheared rock masses, will lead to water seepage in the tunnel.

It is clear that the likely impacts of ground water during tunneling in different stretches of the alignment may be of varying degrees, duration and this will call for specific management measure both during the construction and the operation phase.

7.1.5 Noise and Vibration

The project involves improvement of existing road and construction of new alignment. There are some small settlements along the project corridor. There are very few noise sensitive receivers along the project corridor. These are schools at Km. 4.600 in village Massewal, at Km. 8.600 at village Maura and at Km. 9.700 at village Gara Maura and only one Primary Health Center located at Km. 4.600 in village Massewal. The sites of portals of three tunnels are located away from the settlements.

As per geological formation all tunnels will be constructed upper shivalik formation that is represented by a sequence of argillaceous and arenaceous rocks, forming a series of alternate of sandstones, siltstone/clay stone beds. The field mapping revealed in chapter four several shear zones roughly parallel to the bedding. The tunnel project crosses the syncline structure from south to north i.e. onwards Govind Sagar direction NW/SE with SE dip. In geological consideration the position of the alignment of three tunnels are within the fold structure. The field observations revealed that shear zones developed along the bedding planes especially the weak siltstone and clay stone layers, which have a less competent reologic behavior than sandstone layers. Along the shear planes are present decolorized cataclastic rocks and fault gouges one meter or less thick, showing sometimes inverse movements. Attention must be placed on the fact that normally and in particular along the shear zones, the siltstone and clay stone strata suffer of relevant erosion processes. As a result of these processes, most of the areas with bedrock of clay stone and siltstone are covered by alluvial materials with limited percentage of outcrop. This means that some shear zone (eventually affecting the rock masses at the tunnel level) could be present, masked by these erosion debris. So there is need to cover Rock cover along the tunnel alignment varies between 15m to 140m.

Operation of construction equipment cause ground vibration which spread through ground and diminish the strength with distance. Vibration is generally assessed in terms of peak particle velocity (PPV). As there is no structure along tunnels and settlement so the vibration affect is not anticipated to people or structure. Even there is no sensitive structure is found within close proximity or direct Influence area. As per annexure 7.1 the calculation of vibration has been done by following method:

$$PPV_{equip} = PPV_{ref} \times (25\ ft/D)^{1.5}$$

Where:
PPV (equip) is the peak particle velocity in in/sec of equipment adjusted for the distance
PPV (ref) is the reference vibration level in in/sec at 25 ft from annexure 7.1
D is the distance from equipment to the receiver.

So estimation of the v**ibration level L_v at any distance D** from the following equation
$L_v(D) = L_v(25\ ft)-20 \log (D/25)$

As there is no settlement within Project Impact zone of Tunnel 2 and Tunnel 3 so vibration estimation has not been considered there. So, only vibration estimation is considered in Tunnel 1. The probable distance of settlement from tunnel is 756 mts and 992 mts where tunnel starts at 726 m above msl. So vibration level at particular distance from Tunnel 1 for individual construction equipment use for tunnel constructions are:

Table 7.1: Vibration for Hydromill equipment for rock

D in mts	D in ft	PPV	threshold value for ppv	$L_v(D)$
756-726 =30	98.43	0.002176044	0.1	63.09625
756	2480	1.72061E-05	0.1	35.06977
992	3254	1.14481E-05	0.1	32.71045
992-726= 266	872.7008	1.14481E-05	0.1	44.14149

Table 7.2: Vibration for Caisson Drilling equipment for rock

D in mts	D in ft	PPV	threshold value for ppv	$L_v(D)$
756-726 =30	98.43	0.011392231	0.1	75.09625
756	2480	9.00788E-05	0.1	47.06977
992	3254	5.99341E-05	0.1	44.71045
992-726= 266	872.7008	5.99341E-05	0.1	56.14149

As, here vibration damage threshold criterion is less than 0.1 in/sec, so anticipated adverse impact is minimal although, proper mitigation measure are to be recommended to take precaution for environmental safety which is discussed in mitigation part.

Machinery such as excavators, bulldozers, stabilizers, drills, stone crushers, graders, vibratory rollers, concrete-mixing plants, and screening plants will generate noise during proposed activity in the project corridor. The construction operations using heavy machinery and vehicles could lead to temporary high noise levels. Blasting operations will lead to noise pollution. All these are to disturb the ecosystems temporarily. The traffic congestion due to construction may lead to high noise as a result of honking of horns.

Impacts on different receptors will also vary considerably during the construction stage and these impacts will be localized and limited to stretches where construction work will be under progress, near equipment / vehicle yard, plant sites.

- During construction operation of machineries and equipment including stone crushing, asphalt production and batching plants and diesel generators used in construction will add some significant changes into the noise level
- The duration and time of the day when vibration occurs affects human perception of vibration. The vibration resulting from blasting generally lasts for a few seconds. Such vibrations at night may cause sleep disturbance to population of habitations within 1 km of the site of such blasting. Rock cover along the tunnel alignment varies between 15m to 140m. Therefore it is anticipated that regenerated noise levels from road heading will not likely to result in sleep disturbance of the people in settlements along the alignment of the tunnel.
- Anticipated vibration levels generated by road heading are likely to be low enough to cause any disturbance to structures in settlements along the project corridor.

7.1.6 Safety Measure for Tunnel construction

Tunneling being an underground operation is a hazardous one and measures to protect the workers against accidents, leaves loose or shattered rocks not completely detached. This causes

rock falls, during drilling on account of vibration. In soft soils, huge earth slide take place without warning, trapping the workmen. Fire inside the tunnel is another serious hazard. The principal measures to increase safety are as follows:

- Removal of rock protrusions by hammering immediately in the wake of blasting, known as scaling. The hammer stroke should sound hard and not hollow. Hollow sound indicates loose rock.
- Isolated big blocks, loosened, but temporarily perched should be promptly propped up, and afterwards safely cleared.
- If soft strata are traversed, the roof should be supported in the wake of the excavation.
- Open flames, electrical short circuiting, etc. should be scrupulously avoided inside the tunnel.
- Good first aid facilities and doctors should be available at all times at the site and excellent firefighting equipment with adequate water supply, if possible, should also be made readily available.
- Light and power lines should be properly insulated.
- The floor of the tunnel should be kept clean and water should not be allowed to stand in pools.
- The workers should be provided with hard stiff fabric or metal hat so that they are not injured in case loose rock falls over their heads.
- The explosives should be handled with extreme care and all measures should be taken to avoid misfire, premature explosion and suffocation from gases due to explosion.
- The derailment of loaded cars should be avoided by the installation of proper lights at different places in the tunnel.
- Adequate equipment should be provided for the hoisting of muck.
- For tunnel with wet flooring, boots and stickers of correct size should be used so as to prevent slipping and to result into minimum injury of the foot and toe of the workers.
- The tunnel should be well illuminated by the provision of more lights at the important places along the tunnel. All the lights and light conduits should be so protected that they are not damaged during accidents.
- The concentration of dust should be brought down to the safe hygienic limit by taking suitable measures.
- The safety measures taken should be conveyed to the workers by announcements, posters and individual contacts.
- No unauthorized person should be permitted to enter the tunnel and the authorised visitors should only be allowed to visit the site with the guide meant for this purpose.
- The facility of telephone should be provided inside the tunnel at various places for sending the information of the tunnel position outside at frequent intervals.
- All the tools and equipments should be kept in the best working conditions.
- Double power supply system should be provided so that during failure of one supply, the power from the stand by unit can be resumed.
- Safety sign boards should be provided at various places along the tunnel.
- Sincere efforts should be made for adopting all the possible safety measures by always remembering that lives of workers are more important than the tunnel work.
- In large tunnels, the walkways should be placed to the side of the track and in long tunnels, the shelter places for workmen should be provided at suitable intervals during the hauling operation.
- Free use should be made of safety devices such as portable respirators, explosion-proof

electric motors, reliable gas detective devices, etc.

7.1.6.1 Ventilation & Lighting

There is a provision of ventilation and lighting in tunnel. The Lighting system is specially designed in such a manner that there is more lighting at the entry and gradually reducing inside the tunnel with an increase at the exit point. The ventilation system comprises of unidirectional jet fans with silencers. Though the jet fans are unidirectional, these operate in the reverse direction also in case of emergencies. The motors have been provided with moisture oil and fungus resisting insulation of a type specially designed and constructed to withstand severe humid condition and to operate after a long period of idleness without drying out. Few examples of lighting are shown in below images.

7.1.6.2 Geological Mapping and Documentation

Mapping: The geotechnical instrumentation and monitoring programme may always be subject to alterations if required by the actual conditions Periodical inspection of the tunnel support system and roof areas will be carried out to detect any possible signs of cracks or instability. The face shall be mapped by the geologist and this face mapping shall be shown in a standard sheet. The sketch of the exposed face shall contain:

- Interfaces of different rock types
- Visual features of rock mass
- Major structural discontinuities
- Points of water inflow
- Position and shape of over break

These factors will then be used to determine the support and the drill and blast parameters

Documentation: The engineering geological documentation will be performed according to the following description. The methods may be adjusted during the course of the work if required to accommodate local conditions encountered on site.

- Engineering Geological Mapping (1:100) of the escape tunnel and main tunnel faces, crowns and walls, after each and every blast.
- In the said process all geological and engineering geological features will be recorded manually as much in detail as the scale permits but without avoiding any significant features for the purpose of tunnelling.
- In the above process Rock mass will be classified according to the Classification System jointly with the Engineer, in order to select the support class required.
- Photographic recording (with a digital camera) of the tunnel face, crown and walls, (a Minimum of four numbers of photographs will be shot) and in the event of special engineering geological features are encountered in the process of excavation, invariably they shall be photographed too.
- Simultaneously, where geological over breaks occur, if any, will be marked (rock profile will be surveyed by the tunnel surveyor), on the sheet showing the tunnel profile.
- The causes for the geological over breaks shall be recorded.
- All above documents / work sheets will be in rough form in the field but later (within six hours) the contractor will transform / redraw all said documents to fair / final form. Consequently, will be submitted to the Engineer for approval.
- Photographic records will be kept, in detail, of all the other underground excavations (without any exception), associated with the excavation of the main tunnel and the escape tunnel as pedestrian cross passages, vehicular cross passages, lay bays, emergency call niches, fire fighting niches, electrical installation niches etc.

7.1.6.3 Drilling & Charging

Survey and Profile Marking: Before drilling commences, the surveyor will mark the profile for the tunnel face, providing centre line and bottom level. Marking for fore poling, rock bolting and long for poling will also be done if these are necessary. This is not necessary if Computerised Jumbo is used.

Support Classification: Support classification for the next round would have been determined from the previous round. Then the classification which corresponds to the geological ground conditions shall be applied.

- 3-dimenional deformations of the tunnel lining shall be monitored by means of optical methods.
- The points to be observed are marked by targets or reflectors mounted on standard convergence bolts.
- Borehole extensometers will be used to measure displacements of the surrounding rock where specified.
- These extensometer readings will be used to determine the deformation patterns in the rock environment of the tunnel.

Round length: The round lengths will be as shown on the relevant drawings. However, the pull length of the blast may be as high as 4 to 4.5m depending upon observation for support mass class. This will be decided by Tunnel Managers based on the experience gained as tunnel construction progresses.

Jumbo Movement: The drilling of the tunnel face commences as follows:

- CB – Centre Boom
- LHB – Left Hand Boom
- RHB – Right Hand Boom

Drilling and Charging: Drilling pattern shall adhere to the marked profile. All blast holes shall be drilled according to the pattern and required drill depths for the particular round length in accordance with the rock strata and the respective design requirements.

- The drilling pattern will be determined based on the geological mapping done on the face by the geologist, as well as other parameters, such as excavation profile achieved in previous rounds, explosives, delays, behaviour of rock, support regime etc.
- This will be done for each round and will be based on site conditions.
- After completion of the drilling, the explosives and blasting accessories will be conveyed to the blasting area. Charging the blast holes shall be in accordance with a detailed loading schedule agreed by the Tunnel Engineer / Foreman and Shot-Firer.
- The charging shall be carried out in the agreed holes by the charging personnel at heights utilizing man lift.
- P.V.C. or wood charging rods shall be used to place explosives in the holes. The primer charge shall be

placed at the bottom of the hole and then the remaining explosive cartridges are placed and then the clay stemming is placed at the front of the hole.

7.1.6.4 Blasting

Blasting Pattern:

- The predetermined blasting pattern shall be prepared and downloaded into the Jumbo's computer or can be marked manually on the tunnel face.
- The blast parameters will change according to the geology of the face.
- All predetermined blasting patterns are subject to changes according to rock conditions encountered in the tunnel

Blast Protection

- Once the Shot-Firer has completed the pre-blast checks, the primary blast protection will be installed where it is necessary and all utilities such as water pump and lights etc are shifted from the faces to safe zones.
- When all is ready the Shot-Firer shall connect the lead line and be the last person to evacuate the tunnel or retreat to a safe distance.

Blast Initiation:

- The Shot-Firer shall proceed to the shot-firing location and brief the Tunnel Team members. They shall maintain their position until the all clear is given.
- The Shot-Firer shall connect the initiating detonator to the exploder. Once the Shot-Firer receives confirmation from the Tunnel Supervisor that the exclusion zone is clear and all entries have been secured, the siren shall be set off and then the Shot-Firer shall initiate the round.

Post-blast operation:

- After the blast the Shot-Firer shall check for any misfire within the muck pile and tunnel face, if any misfire is found the same precaution shall be treated as a normal round.
- The tunnel engineer or foreman shall start the ventilation system and when the tunnel is thoroughly ventilated, water shall be sprinkled over the blasted muck to minimize dust and also eliminating any residual toxic fumes.

Blast Powder Factor: The powder factor can only be confirmed after evaluating the results of the first rounds. Hence the preliminary powder factors utilized are estimated. The ignition method for all the drill holes will be as follows: NONEL MS and HS, MS – millisecond, HS – Half second and Series 25 Numbers

Mucking and Scaling after the Blast: Following each blast the following is carried out:

Ventilation:

- Ventilation is turned on to relieve and clear the tunnel area of fumes and to provide fresh air supply to the faces when work cycle is going on at the face.
- Once the fumes from the round have dispersed or have been pushed back out of the tunnel. Tunnel lights are reinstalled. The tunnel safety representative i.e. safety officer or the tunnel supervisor shall enter the tunnel area and declare the area safe to work.

Mucking:

- The muck pile shall be inspected for any misfires.
- Then the muck pile shall be watered, if necessary.
- The removal of the muck spoil is carried out by wheel loaders, excavators and carted away by dump

Scaling:

- Simultaneously the excavator shall be located in a position to facilitate the activity of scaling.
- Any debris or fly rock from the round shall be pushed back to the muck pile, and then floor of the
- round shall be cleared by face shovel or loader.
- Once the floor of the round is cleaned, the safe removal of spoil/ muck can commence.
- Support measures as per defined rock classes will be carried out after scaling which may include bolting.

Excavation: Excavation and support works will be carried out 24 hours, except on days which will be off due to shift days and national public holidays. Before any break, all support measures will be in place where and when required.

Heading Excavation: After completion of pipe roofing the face advancement will be done by opening only in the top heading portion. The excavation will be done using Drill & Blast and tunnel hydraulic excavators. The length of the opening will be as per the design round length for particular support class. The excavated material will be transported to the portals and will be

further carted away to the dump areas. Excavation methods (i.e. drilling and blasting or mechanical) will be decided based on the support class selected. The freshly excavated opening will be immediately supported according to the support measures provided in the design and as per approved drawings.

7.1.6.5 Bench Excavation

- After proceeding with top heading excavation for minimum safe distance shown on drawings bench excavation will continue. Bench excavation will be carried out in the similar as heading excavation and required supports will be provided as per design and Approved drawing depending on the respective support class.
- The bench can be excavated either in cycle or out cycle depending on the encountered rock conditions and cycle times. A ramp is maintained on one half side of the cross section to enable access to the top heading. Ramp dimensions and geometry is based on plant and equipment used and rock conditions at the ramp area.

Invert Excavation:

- After proceeding with the bench excavation for about 75 meters the invert excavation will be started wherever found applicable. Invert excavation will be carried out in similar as benching and heading excavation. Supports will be provided as per design and approved drawings for respective rock class.
- The invert construction is also split in two halves to maintain access to the tunnel face at any time.

Construction traffic on invert level

The invert level will be left above the required finish level to enable grading down to the required level after the completion of excavation and prior to the final pavement works.

Drainage during Construction: Drainage during construction will be carried out using pumps and pipeline systems where necessary and in line with the ground water conditions in the tunnel.

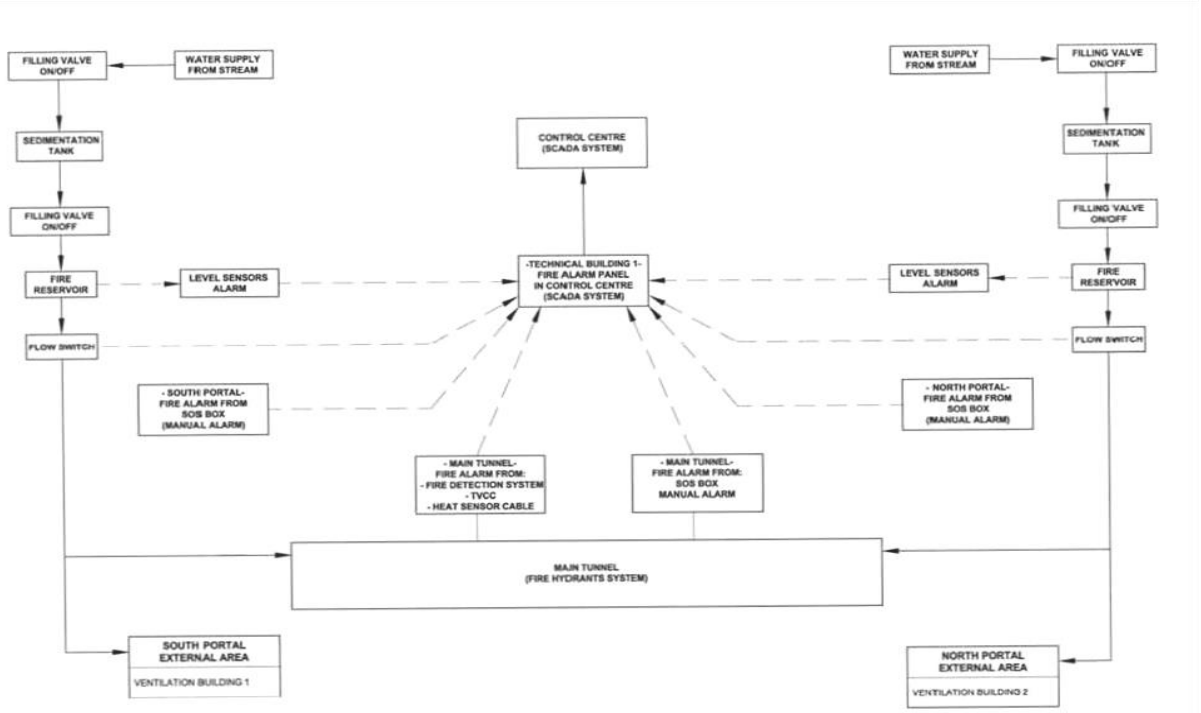
Loading and Transport:

- The face loader shall be located such that it can efficiently load the GHH Dump Trucks and tippers. The GHH dump trucks are loaded to their maximum capacity of 23 m3.
- GHH Dump trucks transports the tunnel muck spoil to the designated dump / spoil area outside of the tunnel portal area.

7.1.6.6 Safety and Emergency Response

GENERAL NOTES

1) Water tank as per IS 9668:1990, with capacity equal to 150m³ equipped with maximum level sensor, minimum level sensor, alarm level sensor to provide alarm signal to control centre.
2) Fire main pipe, internal to tunnel, have to be 200mm diameter as per Concession Agreement "Electro-Mechanical Report"), iron steel and against corrosion painted, located below the walkway, inside duct and painted fire-red of shade no.536 as per IS 5:197. Fire pipe from main to fire each fire hydrant have to be 100mm diameter.
3) Fire main pipe, external to tunnel, have to be 200mm diameter, Iron steel and against corrosion painted, located inside duct and painted fire-red of shade no.536 as per IS 5:197
4) All pipes fixing, support structures and valves shall be designed to take into account water pressure
5) Fire hydrants, internal to tunnel with average spacing of 150m, as per Concession Agreement "Electro-Mechanical Report" and as per PIARC Committee on Road Tunnels report "Fire and Smoke control in road tunnel", 1999, ref. 05.05.B) shall be of type "B" with double outlet, as per IS 5714:1981 and made of leaded-tin-bronze, conform to grade II as per IS 318:1962. The head and stand-pipe shaft shall be painted fire-red of shade no.536 as per IS 5:1978. The paint shall be conform to IS 2932:1974
6) Fire hydrants, external to tunnel, as per Concession Agreement IS 908:1975, with landing valves as per IS 5290:1993 and 3 way suction collecting heads for fire fighting purpose as per IS 904:1983, shall be located at distance of 10m from each portal. They shall be made of leaded-tin-bronze, conform to grade II as per IS 318:1962. The head and stand-pipe shaft shall be painted fire-red of shade no.536 as per IS 5:1978. The paint shall be conform to IS 2932:1974
7) Portable fire extinguishers shall be of carbon dioxide type which is suitable for fires involving electrical equipments, as per IS 2190:1992. Each fire extinguisher have to be of 5kg capacity, as per IS 307:1966 and painted fire-red conforming to shade no.536, as per IS 5:1978. They shall be of "B" class, as per IS 2180:1979
8) Portable fire extinguishers shall be of foam or dry powder type which is suitable for fires involving in tunnels, as per IS 2878:1986. Each fire extinguisher have to be of 5kg capacity, as per IS 307:1966 and painted fire-red conforming to shade no.536, as per IS 5:1978. They shall be of "B" class, as per IS 2180:1979
9) Fire main pipe (internal and external to tunnel) supports, fixing structures and valves shall be characterized by:
   - galvanized fixed points pipe ring
   - with welded joint or grooved coupling joint
   - butterfly valves (see at drawing)
   - welded "T" joint from DN200 to DN100



Fire Fighting System (Block Diagram)

Action	What
Raise	→ the alarm – refer Appendix A4.1 Notification of Emergencies
Danger	→ make the scene safe, if necessary, and ONLY if safe to do so (e.g. turn off electrical power)
If it is believed that the Fire CAN be safely extinguished WITHIN TWO MINUTES →	
Check	→ you have the right extinguisher and that it is charged.
Ensure	→ the fire will not block your exit if you cannot control it. Stand with your back to the exit.
Know	→ how to use the extinguisher → P A S S Pull the pin; Aim at the base of the fire; Squeeze the lever; Sweep from side to side
Never	→ fight a fire if – • it is spreading rapidly, • you don't know what is burning • you don't have the right extinguisher • there is too much smoke • exits are blocked or locked
Report	→ the fire after it is out
If it is believed that the Fire CANNOT be safely extinguished WITHIN TWO MINUTES →	
Evacuate	→ to the nominated Muster Point and do not leave until permitted.
Conduct	A headcount to determine if all are present.
Advise	→ the Emergency Service on arrival – • what is on fire • the extent of the fire • any missing persons & their possible location.
If persons are missing & are believed to be in danger from the fire →	
Attempt	→ to locate & rescue them BUT ONLY if the risk to the rescuers is deemed acceptable.
Render	Assistance to those who need it.
Help	To extinguish or contain the fire, if it is safe to do so using suitable fire extinguishers, hose reels, or other appropriate means as directed by ERT.

7.1.7 Soil Quality

- During construction period loosening of the top soil will take place after removal of vegetation which will be more prone to erosion.
- Near the approaches to the bridges the embankments will be higher by1 m above ground level. During construction if proper drainage is not maintained then soil erosion process may be set in.
- Movement of construction machinery, vehicles during construction especially haul roads will lead to physical disruption of soil.
- The excavates and the construction waste due to tunneling if disposed on land will degrade the soil quality
- Sub soil contamination may also be attributed to:

- Leachates from stripped bitumen waste will directly penetrate the soil profile thus polluting it.
- Maintenance of the machinery and operation of the diesel generator sets on site
- Oil Spill from the operation of the mechanical workshops, diesel pumps and diesel storage, during transportation and transfer, parking places, and diesel generator sets
- Operation of the emulsion sprayer and laying of hot mix plant
- Operation of the residential facilities for the labour and staff
- Storage and stock yards of bitumen and emulsion
- Excess production of hot mix and rejected materials

All impacts relating to air, water, noise and soil quality are largely confined to construction activities that can be controlled and minimized to a lowest level by adopting adequate remedial measures.

7.2 IMPACTS ON ECOLOGICAL ENVIRONMENT

The project road has 3 Tunnels with Length of 1.75 Km, 0.650 Km & 0.394 Km. The project road has also some stretches running over ground. The stretch of the road passing over ground before the long tunnel, between the long and the short tunnel and the stretch beyond the Portal of the short tunnel has vegetation.

- Inventory of the road vegetation in over ground stretches of the project road indicate that approximately 2035 trees will be impacted by the project road. Tress impacted belong to species like Kikar (*Acacia arabica)*, Khair *(Acacia catechu.),* Tuni *(Cedrelatoona*), Kangu (*Flacouritaxylosma)*, Toot (*Morus alba*), Pipli (*Murraya exotica*), Mango (*Mangiferaindica*), etc.
- Some trees in the areas of the tunnel adjoining the portals may be impacted by vibrations during tunneling operation.
- Due to Construction activities in these stretches no fragmentation of any wildlife habitat or shrinkage of such habitat is anticipated.
- The possibility of poaching and forest resource exploitation by the workers in the close proximity is anticipated

All the three tunnels have more than 50m cover of rock for most part of the tunnel. As such the vegetation and the wildlife on ground will not be impacted by the tunneling operations. So far various surveys have been carried out in the project area in order to identify faunal presence in the study area.

Two notified wildlife sanctuaries are situated in the project area. The first notified sanctuary is Govind Sagar Bird sanctuary is running either parallel or in close vicinity of existing highway from Bilaspur to Bilaspur-Mandi Border, and Naina Devi wildlife sanctuary is approximately 10.500 km from the new alignment in Kiratpur-Balaspur Section. The details of these two sanctuaries are given in baseline environment chapter of this report.

All meetings and consultation with the forest officials and the local people indicates that large scale faunal presence in the area irrespective of type of forest available in the area. No wildlife sanctuary, national park or any such sensitive locations are impacted due to the project road. Also during construction stage adequate mitigation measures shall be adopted in order to avoid adverse impacts on wildlife nearby the project area.

There is no direct impact on this sanctuary as there is no land acquisition in the sanctuary area. However, there will be direct or indirect impact on wild animals, pheasants and birds present in the sanctuary area or in surrounding area. The probable impacts on these wild animals are as follows:

- Disturbance due to presence of labor;
- Air pollution during construction activities;
- Hunting by working force;
- Cutting of forest trees for firewood by work force;
- Noise due to blasting or due to other construction activities;
- Accident while crossing road;

- Increase in poaching activities due to improved road condition;

The Gobind Sagar Lake is a bird sanctuary and there may be direct and indirect impacts on this bird sanctuary. As discussed in baseline environment chapter there are approximately 2035 trees which may be fell down during development of new alignment. Also some trees or vegetation may be removed due to establishment of construction camp and other related activities. The felling of trees will lead to change in micro-climate of the area. As discussed above the area is hilly at few locations and fragile the tree cutting and vegetation removal from the project area will induce landslides and land slips activities in the area. Also there are other impacts associated with tree cutting and vegetation removal like change in land use, change in drainage pattern, reduction in ground water recharge capacity.

7.2.1 Impacts on Socio-Economic Environment

The major social impacts associated with the proposed development is loss of agricultural land, loss of commercial properties, loss of business, loss of livelihood and loss of residential properties. Also loss of water man made water resources, loss of access to buildings and properties and agricultural land. The other social impact could be impact on cultural properties, such as temples, shrines monuments and other archeological properties. All the social impacts in quantities terms are given in R&R report of the project.

7.2.2 Impacts during operation stage

It is envisaged that during operation stage impacts are mostly positive in nature. The major impacts during operation stage are explained in following sections. The likelihood of soil erosion during operation phase in the regions of high embankments is anticipated due to heavy vehicular movement. During this stage there is a possibility of soil contamination by spills from accidents or leakage from vehicles carrying hazardous chemicals. The probability of incidents is low and such impacts will depend to a great extent on how such situations are handled on ground.

Emissions from vehicles running on road and discharge from tunnels to the open environment may deteriorate the ambient air quality in the immediate corridor of impact. The ambient air quality of the area, as a whole will improve because of saving of fuel in the vehicular traffic riding on smooth and improved roads with much less distance. Dust dispersion also will be substantially reduced. The overall impact will be positive.

During operation stage noise levels will considerably come down due to smooth riding pavement, improvement in junctions etc. Good quality strip plantations coming up along stretches of the project corridor will also attenuate noise level during this phase. The road geometry will improve after upgradation of road which will reduce the accidents cases in the project area.

There are chances of surface water quality degradation due to construction activities. It is envisaged that there is possibility of positive impacts. The extent of vehicles going on to the berms causing dust would be reduced and the drainage system along the raised embankments will be improved. This will reduce adverse effects of soil erosion.

There will be only beneficial impact during this stage on ecological resources. With the removal of causative factors the ground vegetation will reappear in areas not sealed off during the up-gradation process, as most of these species are colonizers. Compensatory afforestation will be raised along the stretch of the road and this will cover a much larger area. There will be cautious signs like no honking, speed limits, wildlife etc all along the project road. All these measure will reduce the accidents of animals and noise impacts on animals.

7.3 AIR QUALITY MODELING

Air quality modeling for CO have been done using CALINE 4 line source model developed by California Transport Department considering 2012 as base year and 2040 as the future year of prediction. The model use the conditions prevalent to the Project such as site conditions, metrological conditions, traffic data as predicted for the project as well as the emission factors as prevalent in India. CALINE-4 is the fourth generation simple line source Gaussian plume dispersion model (Benson, 1984). It employs a mixing zone concept to characterize pollutant dispersion over the roadway. The model has been run for "worst one hour condition" with roughness coefficient of suburban area (100cm) with mixing zone width of 13.5 m for 2010 and 21 m for 2015 (opening year) & 2036.

Box 7-1: Description of CALINE – 4

CALINE-4 is a dispersion model based on Gaussian equation. It is developed by the California Department of Transportation for the prediction of concentrations of critical atmospheric pollutants (CO, NOx and SPM) along the highways. This model employs a mixing zone concept to characterise pollutant dispersion over the highway and can be used to predict the pollutant concentrations for receptors upto 500 m of the corridor.

The various input parameters for the prediction of pollutant concentrations are discussed in the following sections:

(a) Site Geometry: The input parameters regarding the site conditions as the carriageway width, road height, mixing zone width, surface roughness and topographic conditions have been taken up from the pavement condition and road inventory surveys conducted along the project corridor.

(b) Emission factors: The emission factors for the various vehicle categories vary for different speeds. The emission factors adopted for the various vehicle speeds for the various pollutants are given in the following table.

Speed Corrected Emission factors

Pollutant Parameter	Emission factors g/mile		
	Light	Medium	Heavy
	(Irrespective of speed)		60 Kmph
SO2	13.97	7.70	6.95
SPM	2.86	0.60	0.22
NOx	14.28	2.48	8.94

Source: Vehicle Emissions and Control Perspective in India, IIP, Dehradun.

Based on the traffic composition, a composite emission factor has been derived for application in the model for the various sensitive receptors and links. The composite emission factor has been derived as a sum of the ratio of light, medium and heavy vehicles to the total volume and their corresponding emission factors.

(c) Meteorological Conditions: The various meteorological input parameters required for modeling as the wind speed, wind direction, mixing height, stability class have been collected from secondary sources as IMD, for the nearest meteorological station, viz, Jabalpur

(d) Traffic volume: The through traffic volume and composition along the sensitive receptors have been derived from the traffic volume counts carried out at various locations along the project corridor.

(e) Links: Links are homogenous sections of the project corridor, of length not greater than 10 km, with similar traffic, site geometrics and meteorological characteristics. For calculating the emissions, worst-case scenario is assumed and concentrations are obtained for worst wind direction.

(f) Receptors: Receptors are specific locations within a link, which is likely to be impacted by vehicular emissions. For the purposes of assessing air impacts, sensitive receptors have been identified over an immediate influence area on either side of the project corridor.

The concentrations of the various pollutants due to the project have been estimated applying the various input parameters to the CALINE 4 model.

7.3.1 Meteorological Conditions

Worst case ambient temperature of 1^0C, mean annual wind speed of 1.5 m/s with direction deviation of 10 degrees have been considered along with stability class of D (neutral) with mixing height of 40m with slight day time insolation and thin overcast conditions.

7.3.2 Traffic & Location

24 hourly mode wise traffic counts have been considered to compute emission factor for the mentioned years for two representative locations in Homogenous section (HS) I & II. Peak hour traffic count (**Table 7.3**) has been considered for running "worst one hour condition". First location are:

Table 7-3: Homogonous Section

Section	Section Name	Chainage (Km)		Length (Km)
		From	To	
Section: I	HS-I (Kiratpur to Swarghat)	73.200	95.000	22
Section: II	HS-II (Swarghat to Nauni chowk)	95.000	126.800	32

Table 7-4: Average daily Peak hour traffic count in HS I & HS II

Year	HS-I		HS-II	
	Vehicles	PCUs	Vehicles	PCUs
2011	5940	15069	8008	20075
2016	7549	19163	10181	25539
2021	9604	24393	12954	32514
2026	12224	31062	16497	41421
2031	15569	39572	21015	52787
2036	19841	50439	26784	67288

7.3.3 Links & Receptors

For the purpose of the model two HS have been considered and based on the representative locations Group- links have been taken (each link is supposed to be less than 10 kms) with grid receptors with X & Y spacing of 7 and 8 m respectively. The division of sections into links has been done in such way, so that the link can be fairly considered as straight stretch of road having homogenous geometry with uniform width, height, and traffic volume and vehicle emission factors. The coordinates of end points of links specify the location of the links in the model. The model uses Gaussian dispersion parameters (σ_y and σ_z) that are fairly accurate up to 100m distance.

7.3.4 Emission Factor

One of the important requirements for Caline-4 modeling is the input for emission factor for vehicles. In the present study, the emission factors specified by the Automotive Research Association of India (ARAI), 2007 have been used for calculation of weighted emission factors. These emission factors have been expressed for various pollutants and vehicle types in terms vintage year (i.e., year of manufacture), type of fuel used (petrol or diesel) & deterioration factor specified by CPCB. The improvement in engine technology, resulting in reduced emission factors are reflected in these emission factors. Since, there is only one input requirement for total no. of vehicles in the CALINE 4 model, whereas, there are different categories of vehicles (viz., Cars, Bus and trucks) with different year of manufacture and fuel used, it is essential that a single value representing an equivalent or weighted emission factor for all the vehicles is provided into the model. Thus, WEF expressed in g/mile (converted from gm/km) has been calculated for the present study. The formula used for composite emission factor is as below:

Composite Emission Factor = $\sum$fixi/$\sum$fi

Where, fi= no. of vehicles

& xi= CO emission factor

Emission factor computed and considered for this study is given below in gm/mile.

Table 7-5: Composite Emission Factor

HS I			
Year	2011	2016	2036
Traffic	5940	7549	19841
Emission Factor	5.03	4.9	5.1
HS II			
Year	2011	2016	2035
Traffic	8008	10181	26784
Emission Factor	5.02	5.01	5.4

The ARAI Emission Factors & CPCB deterioration factors used for modeling are given in **Table 7.6 & 7.7** below.

Table 7.6 ARAI Emission Factor (gm/km) for different Category of Vehicles by year

Pollutant (CO) Year	Car		Multy Utility Vehicles	3-Wheeler		2-Wheeler		LGV	MGV
	Petrol	Diesel		2 Stroke	4 Stroke (D)	2 Stroke	4 Stroke		
1992	4.75	1.2	2.49	0	0	6	3.12	3.07	13.06
1993	4.75	1.2	2.49	0	0	6	3.12	3.07	13.06
1994	4.75	1.2	2.49	0	0	6	3.12	3.07	13.06
1995	4.75	1.2	2.49	0	0	6	3.12	3.07	13.06
1996	4.825	0.87	2.49	3.15	0	5.1	1.58	3	4.48
1997	4.825	0.87	1.38	3.15	0	5.1	1.58	3	4.48
1998	4.825	0.87	1.38	3.15	0	5.1	1.58	3	4.48
1999	4.825	0.87	1.38	3.15	0	5.1	1.58	3	4.48
2000	4.825	0.87	1.38	3.15	0	5.1	1.58	3	4.48
2001	3.01	0.72	0.39	1.37	2.09	3.435	1.48	3.66	12.14
2002	3.01	0.72	0.39	1.37	2.09	3.435	1.48	3.66	12.14
2003	3.01	0.72	0.39	1.37	2.09	3.435	1.48	3.66	12.14
2004	3.01	0.72	0.39	1.37	2.09	3.435	1.48	3.66	12.14
2005	3.01	0.72	0.39	1.37	2.09	3.435	1.48	3.66	12.14
2006	3.01	0.06	0.25	1.15	0.41	0.16	0.72	3.66	3.92
2007	3.01	0.06	0.25	1.15	0.41	0.16	0.72	3.66	3.92
2008	3.01	0.06	0.25	1.15	0.41	0.16	0.72	3.66	3.92
2009	3.01	0.06	0.25	1.15	0.41	0.16	0.72	3.66	3.92
2010	3.01	0.06	0.25	1.15	0.41	0.16	0.72	3.66	3.92

Source: Air Quality Monitoring Project-Indian Clean Air Program (ICAP) Draft Report on 'Emission Factor Development for Indian Vehicles' CPCB ARAI Pune, August 2007

Table 7.7 CPCB deterioration factor for different Category of Vehicles by year

Pollutant (CO)	Car		Multy Utility vehicles	3-Wheeler		2-Wheeler	LGV	MGV
Year	Petrol	Diesel		2 Stroke	4 stroke Diesel			
1992	1.355	1.18	0	0	0	1.5	-	-
1993	1.355	1.18	0	0	0	1.5	-	-
1994	1.355	1.18	0	0	0	1.5	-	-
1995	1.355	1.18	0	0	0	1.5	-	-
1996	1.17	1.085	1.1	0	0	1.4	1.1	1.475
1997	1.17	1.085	1.1	0	0	1.4	1.1	1.475
1998	1.17	1.085	1.1	0	0	1.4	1.1	1.475
1999	1.17	1.085	1.1	0	0	1.4	1.1	1.475
2000	1.17	1.085	1.1	0	0	1.4	1.1	1.475

Pollutant (CO)	Car		Multy Utility vehicles	3-Wheeler		2-Wheeler	LGV	MGV
Year	Petrol	Diesel		2 Stroke	4 stroke Diesel			
2001	1.28	1.14	1.125	1.7	1.133	1.3	1.125	1.33
2002	1.28	1.14	1.125	1.7	1.133	1.3	1.125	1.33
2003	1.28	1.14	1.125	1.7	1.133	1.3	1.125	1.33
2004	1.28	1.14	1.125	1.7	1.133	1.3	1.125	1.33
2005	1.28	1.14	1.125	1.7	1.133	1.3	1.125	1.33
2006	1.097	1.05	1.095	1.475	1.095	1.2	1.095	1.17
2007	1.097	1.05	1.095	1.475	1.095	1.2	1.095	1.17
2008	1.097	1.05	1.095	1.475	1.095	1.2	1.095	1.17
2009	1.097	1.05	1.095	1.475	1.095	1.2	1.095	1.17
2010	1.097	1.05	1.095	1.475	1.095	1.2	1.095	1.17

7.3.5 Interpretation

For HS I the model generated no output in the form of contours for CO for the base year and Opening year indicating no incremental GLC. Contours were generated for projected year 2036 for HS I & HS II as given in **Figure 7.1 to 7.4.** No concentration observed for the base year i.e., 2011 and opening year 2016 whereas for 2036 is between 0.2 - 0.2 ppm **(Table 7.4)** however there is increase in spatial coverage and change in spatial pattern observed over the years. Maximum concentration is 0.2 ppm within 20m from CL on either side as there is an increase in peak hour traffic count. In HS I the school will be impacted by an incremental GLC of 0.2 ppm in the year 2036 whereas no impact during the years 2011 and 2016 as there is four sensative areas along the project corridor :

- **Receptor 1:** School 1 at LHS & Hospital at RHS in village Massewal
- **Receptor 2:** School 2 at RHS
- **Receptor 3:** School at LHS
- **Receptor 4:** School at LHS at Bypass

The location of three sensitive receptors along project corridor has shown in adjusant diagramme.

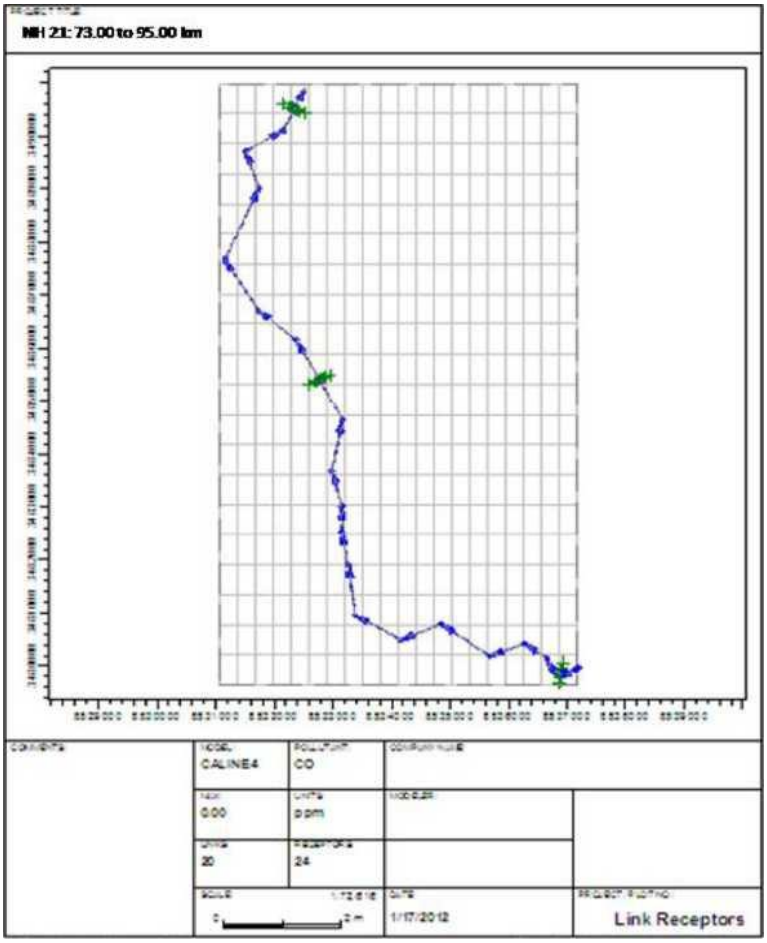


Figure 7.1 Dispersion of CO along the project road in 2036 HS I

Table 7-8: *Variation* of Concentration of CO on either side of Centre line

S. No	Year 2036	L.H.S					R.H.S			
	Distance (m)	200	100	50	20	C.L.	20	50	100	200
1.	Receptor (Km 4+600)	0	0.2	0.2	0.2		0.2	0.1	0.1	0.0
2.	Receptor (Km 8+600)	0	0	0.1	0.2		0.3	0.2	0.1	0.1
3.	Receptor (Km 9+700)	0	0	0.1	0.2		0.2	0.1	0.1	0
4.	Receptor (Km 22+400)	0.1	0.2	0.3	0.3		0.3	0.3	0.2	0.1

As the maximum concentration is higher i.e 0.2 ppm within 20 m from CL on either side around chainage km for higher peak hour traffic Increase in spatial extent is well depicted through the point receptors marked on the figures below. There is an increase in the pollutant concentration over the years and space with higher values in HSIII because of relatively higher traffic count. The concentration of Co in ppm is shown in three receptors have been tabulated in following table as 4th receptor is almost adjacent to highway the concentration too high.

. CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
JOB: Voyents
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide
I. SITE VARIABLES
U= 1.0 M/S Z0= 100. CM ALT= 0. (M)
BRG= WORST CASE VD= .0 CM/S
CLAS= 4 (D) VS= .0 CM/S
MIXH= 40. M AMB= **** PPM
SIGTH= 10. DEGREES TEMP= 1.0 DEGREE (C)
II. LINK VARIABLES

LINK DESCRIPTION	* LINK COORDINATES (M) * X1	Y1	X2	Y2	* TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. Link A	* -707	-707	0	0	* AG	177	5.0	.0	10.0
B. Link B	* 0	0	120	125	* AG	346	5.0	.0	10.0
C. Link C	* 120	176	150	350	* AG	1060	5.0	.0	10.0
D. Link D	* 150	165	150	150	* AG	232	5.0	.0	10.0
E. Link E	* 150	350	175	250	* AG	426	5.1	.0	10.0
F. Link F	* 150	180	180	320	* AG	1331	5.0	.0	10.0

III. RECEPTOR LOCATIONS

RECEPTOR	* COORDINATES (M) * X	Y	Z
1. Recpt 1	* 100	150	1.8
2. Recpt 2	* 150	175	1.8
3. Recpt 3	* 0	120	1.8
4. Recpt 4	* 0	110	1.8

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	* PRED * BRG (DEG)	* CONC (PPM) *	CONC/LINK (PPM) A	B	C	D	E	F

1.	Recpt 1	*	27.*	200.3	*	.0	.0	.2	.2	.0	.0
2.	Recpt 2	*	10.*	200.7	*	.0	.0	.2	.3	.0	.0
3.	Recpt 3	*	49.*	200.1	*	.0	.1	.2	.1	.0	.0
4.	Recpt 4	*	45.*	200.4	*	.0	.3	.2	.3	.0	.0

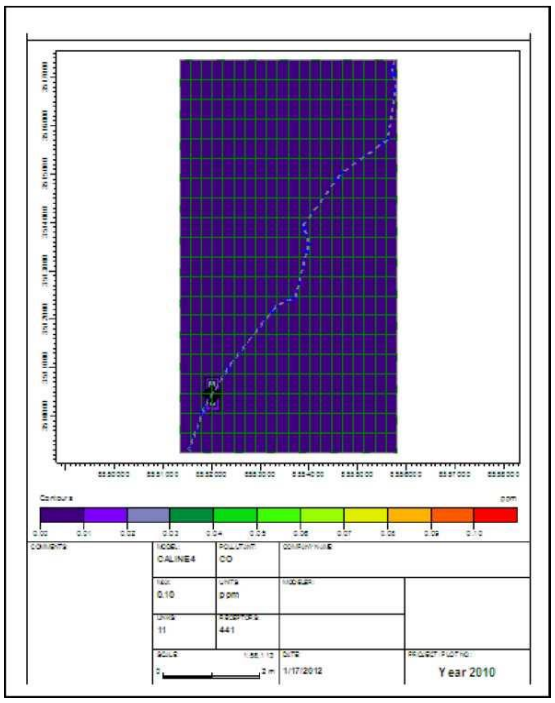


Figure 7-2: Dispersion of CO along the project road in 2011 (base year) HS II

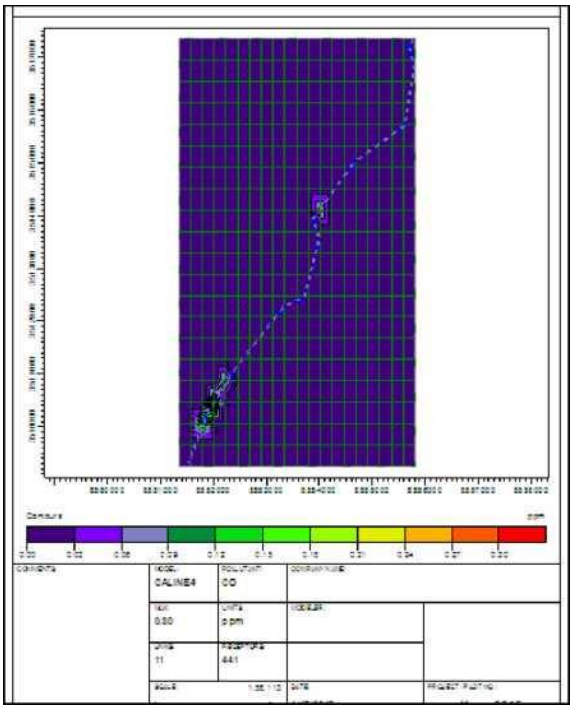


Figure 7.3: Disperson of CO in 2015 (Opening year) – HS II

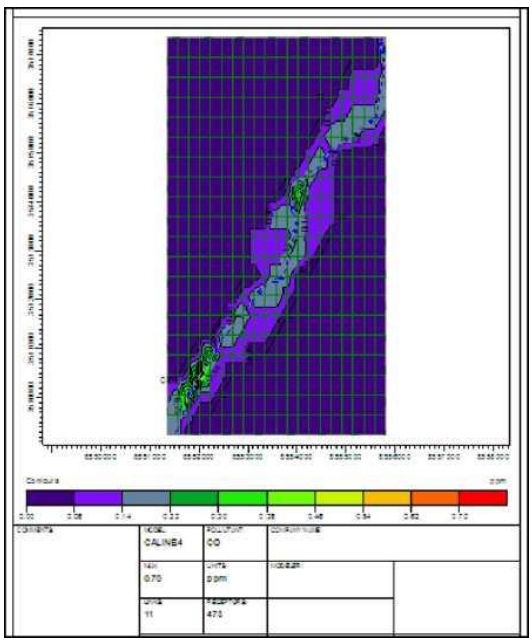


Figure 7-4: Dispersion of CO in 2036- HS II

Interpretation: For CO, concentrations exceed the standards by year 2036 onwards in at NH 21 there is need to do bypass for project alignment to reduce the concentration CO level.

7.3.6 Noise Modeling

Noise levels had been modeled using Traffic Noise Model, FHWA (Federal Highway Administration) for base year of 2012, opening year of 2015 and future years 2036 Average daily hourly traffic count has been considered for all the years mentioned. Modeling has been done for two representative sections viz. homogenous section I (free flow on new alignment both on base and projected years) and homogenous section II (existing alignment in base year & projected year). This model takes into account noise recorded at 1m distance from road edge at both side i.e. near and far end. The impacts due to noise during operations will be due to increased vehicular activity. This will be due to increase in vehicular flow.

Noise Modeling & Prediction of Noise Impacts: Noise impacts can be predicted at various receptors by application of available simulation models for Highway noise. However, this is applicable only for operation stage of the project. Operational noise for the highway is predicted through the model developed by Federal Highway Administration, Department of Transportation of the U.S. The model used is described in Box 7.2.

Box 7-2: FHWA Noise Model

The procedure for prediction of noise levels involves the following steps:

1) Identification of sensitive receptors
2) Determination of land use and activities which may be affected by the noise generated
3) Assemble input parameters
4) Application of the model

a) Sensitive receptors: The locations along the corridor that are sensitive to the anticipated noise impacts are identified as sensitive receptors. These consist of schools, colleges, etc.

b) Land uses: Land use along the corridor is obtained from the topographic drawings, strip maps and consequent site visits. This information provides the range of shielding and absorption factors to be applied at the various receptor locations.

c) Input Parameters: Traffic volume & Speed: Traffic volume for the projected period is obtained from the traffic projections. The total number of vehicles passing per hour by type - light, medium and heavy along with their average speed is used for projections.

Mean Energy level: All the vehicles produce noise, which is taken as the base, and the cumulative noise at the receptor distance due to the whole traffic is estimated. The mean energy level varies depending on the type of vehicle. A mean energy level for the light, medium vehicles is 70 dB and for heavy vehicles it is 80 dB.

Shielding & Absorption factors: This depends on the landuse prevailing along the corridor. The range of shielding provided for the noise and absorption of the noise is 3.5 to 4 and 0.3 to 0.5 respectively.

d) Application of Model: Equivalent noise levels due to traffic, at the receptor locations is estimated using Federal Highway Noise model,

$$Leq(h)i = Loe + 10Log (Ni/SiT) + 10Log (15/d)1+b + Ds - 13$$

Where,

Leq(h)i	=	Equivalent noise level of ith vehicle (h indicates vehicle type- light, medium, heavy).
Loe	=	Reference mean energy level.
Ni	=	Number of class i vehicles passing during time T.
Si	=	Average speed for i th vehicle class in km/hr.
T	=	Duration for which Leq is desired corresponding to Ni.
d	=	Perpendicular distance in meters from the center line of the traffic lane to the receptor location.
b	=	Factor related to the absorption characteristics of the ground cover between the roadways and observer.
Ds	=	Shielding factor to account for the decrease in noise due to obstructions between source and receptor.

The preceding equation is used thrice, for light, medium and heavy vehicles respectively to obtain three values of Leq. The total Leq can be calculated by logarithmic addition of the three Leq values as follows,

$$Leq(Total) = 10 Leq (10 Leq(L)/10 + 10 Leq(M)/10 + 10 Leq(H)/10)$$

The total equivalent noise levels at the receptor, at a distance 'd' m from the center of the traffic lane is given by the above equation.

Predicted Noise Levels: For the prediction of noise levels, it is assumed that all the traffic is in well-defined lanes and flow of traffic in both the directions is same. There is no sensitive receptor within project corridor. So the junction point on project site and sensitive receptor point has been taken for assessment i.e. at Panagar section where maximum traffic is noticed the max value of noise prediction has been computed. Details of noise prediction for subsequent year has been shown in shown in table 7.9.

Table no. 7.9: Predicted Noise Levels dB(A)

Year	Unit	Standard	Gara-Maura (Near Toll Plaza P.H.		Masewal (Near School)		Village Bharadi (Near Crane)	
			Without Noise Barrier	With noise barrier within ROW	Without Noise Barrier	With noise barrier within RoW	Without Noise Barrier	With noise barrier within RoW
2015	**Leq db(A)**	**55**	**57**	**51**	**58**	**52**	**57**	**51**
2036	**Leq db(A)**	**55**	**61**	**55**	**62**	**56**	**61**	**55**

Observations

Projected noise levels (L_{eq}) near two main junctions i.e. near toll plaza and Massewal school these two locations at presently higher than desirable limit. But after widening and improvement of road noise level will be within limit. Whereas near Bharadi after taking noise barrier provision noise level will be within prescribed limit. So mitigation measure for this entire stretch should be landuse control and with the provision of widening project stretch will be less noisy. Based on above suitable mitigation measures in form of physical barriers have been recommended based on factors such as:

1. Required Attentation
2. Space Availability
3. Maintenance Requirements
4. Cost Effectiveness

The base year speed limits as observed are 25 km/hr for passenger vehicles, 20 for medium and 15 for heavy vehicles and (LO)Ei or reference energy mean emission level of vehicle is computed in the chapter earlier. The average Leq (hi) (equivalent noise level at point of receipt) is computed as above. Similarly, it has been computed for all the projected years using increased speed value of 65 km/hr, 55km/hr and 45 km/hr for small, medium and heavy vehicles as there is decrease in noise level with increase in distance.

8. Mitigation Measures and Cost

This chapter presents the mitigation and management measures to address the likely impacts on identified environmental components due to the proposed project development. The Chapter finally presents the environmental costs for mitigating adverse impacts.

The following subsections detail the mitigation measures that need to be undertaken during different project stages. They are required to minimize the negative impacts and enhance the positive impacts of the project on the surrounding environment. The mitigation measures revolve around various alternatives during the design phase, pre-construction, construction and operation phase of the road project; incorporating the following:

- The "standard design" of various road sections is arrived at based on detailed deliberations between highway design and social-environmental team.
- "General measures" to mitigate negative impacts on the natural, socio-economic and cultural environment, based on the characteristic features (existing environmental settings and assessment of probable impacts) of the project corridor.
- Specific design solutions in the section that is found to be sensitive including formulation of special provisions to ensure environmentally sensitive construction methods that take place in critical sections or areas.

8.1 MITIGATION OF IMPACTS

8.1.1 Land Resources

Requirement of materials shall necessitate creation of new borrow areas and quarry pits. Rehabilitation of such sites after use, by smoothening the steep slopes and covering them with vegetation or converting them into water body shall form a part of this project. Similarly, fresh embankments created at the site shall be covered with dredged earth for turfing of the slopes, in order to prevent erosion of the murram casing, for minimizing the runoff and stabilizing the embankment.

8.1.2 Soil Resources

Impact on soil due to widening and new alignment of project corridor includes: loss of topsoil, increase in soil erosion, soil instability, tipping of spoils generated from construction work and contamination of soil. Following are the measures needed to minimize the adverse impacts:

8.1.2.1 Conservation of Topsoil

The topsoil shall be stripped upto a depth of 15 cm at all locations opened up for construction. The stripped topsoil should be carefully stockpiled at suitable accessible locations approved by the PIU. At least 10% of the temporarily acquired area shall be earmarked for storing topsoil. The stockpiles for storing the topsoil shall be designed such that the slope does not exceed 1:2 (vertical to horizontal), and the height of the pile is restricted to 2m. A minimum distance of 1m is required between stockpiles of different materials.

In the cases where the topsoil has to be preserved for more than a month, the stockpile is to be stabilized within 7 days of forming. The stabilization shall be carried out through temporary seeding. It consists of planting rapid-growing annual grasses or small grains, to provide initial, temporary cover for erosion control. After spreading the topsoil on disturbed areas, topsoil must be seeded, and mulched within 30 days of final grading (Annexure 8.1).

During construction, if erosion occurs from stockpiles due to their location in small drainage paths, the sediment-laden runoff should be prevented from entering nearby watercourses.

Preservation of Stockpiles: The contractor shall preserve the stockpile material for later use on slopes or shoulders as instructed by the engineer.

8.1.2.2 Spreading back of topsoil

The area to be covered with vegetation shall be prepared to the required levels and slope. The stockpile material shall be spread evenly to a depth of 5-15cm to the designed slopes and watering the same as required. The growth of the vegetation shall be monitored at frequent intervals. All temporary arrangements made for stockpile preservation and erosion control are to be removed after reusing the stockpile material.

8.1.2.3 Erosion Control Protection

Stabilization of High Embankment Slopes: Slope of the road embankment shall be fixed within the range of 1:2 to 1:3, which will reduce the possibilities of slope failure. Further to stabilize the slope, vegetative cover as per Box 8-1 shall be done.

Box 8-1: Detailed specifications for Vegetative cover

Description:
The vegetative cover should be planted in the region where the soil has capacity to support plantation and at locations where meteorological conditions favour vegetative growth.
Site Preparation:
To prevent the seeds from washing away subsequent to sowing, area should be protected with surface roughening and diversions and
Soil samples should be taken from the site and analysed for fertiliser and lime requirements.
Seed Application:
The seed should be sown uniformly as soon as preparation of the seedbed has been completed and
No seed should be sown during windy weather, or when the ground surface is wet, or when not tillable.
Maintenance:
During first six weeks, the planting should inspected by the PIU, to check if the growth is uniform and dense. Appropriate moisture levels shall be maintained. There may be requirement of watering the plantings regularly during the dry seasons. Fertiliser and pest control applications may also be needed from time to time.

In case slope is steeper than 1:2, stone pitching will be done. Stones will be fixed on slopes by gentle hammering. A.P.C.C. anchor will be provided at the base, which will prevent sliding of stones on slope. The gaps between adjacent stones allow grass to grow which will hold the soil firmly together. To check the slope stabilisation of borrow pits adjacent to the embankment, the depth of the pit will be so regulated that the bottom edge of pit shall not intersect the imaginary line of slope 1:4 drawn from the top edge of the nearest embankment .

8.1.2.4 Measures to Minimise Soil Contamination

Construction activities may generate a lot of spoil; if the cut and fill quantities are not balanced, often the old road base is excavated and disposed off on account of its unsuitability to be used in the new fill.

Construction Stage: Cut and fill works are to be carried out strictly in accordance to the design drawings. Earth, if required, is to be disposed in selected areas approved by the PIU. The spoils can be used to reclaim borrow pits and quarries, low-lying areas in barren lands and in settlements along the project corridors. All spoils are to be disposed off as desired and the site is to be fully cleaned before handing over. The construction wastes will be disposed in selected pits, developed on infertile land. Non-bituminous wastes from construction activities will be disposed in borrow pits and covered with a layer of the conserved topsoil. Bituminous wastes will be disposed off in an identified dumping site approved by the PIU.

Contamination of soil from fuel and lubricants: At the various construction sites, the vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. It will be ensured that the fuel storage and refueling sites are kept at least 300m away from drainage channels and important water bodies. In all fuel storage and refueling areas located on agricultural lands or productive lands, the topsoil preservation shall be carried out. At the two construction sites that will be set up for the project road, "oil interceptors" should be provided. The oil interceptor works on the principle: the grease and oil being lighter in weight float on the top surface of the wastewater. Hence, oil and grease can be scum and disposed in environmentally sound fashion.

Operation Stage: Probability of contamination of soil being only from the road runoff, which is regulated by well-designed drains, no impact on the soil during operation stage except in case of accidents, is anticipated. Contamination of soil from Construction wastes and quarry materials

Pre-construction Stage: Cut and fill areas should be designed to be balanced. Thus generation of spoil materials will be minimized. For the disposal of spoils, low-lying areas or quarries with extra storage capacity have been proposed for storage.

8.2 WATER RESOURCES

8.2.1 Surface Water Body

Mitigation measures as suggested below are to be undertaken at the locations near surface waters. While working around or near the water body, following measures should be undertaken: Silt fencing and/or brush barrier shall be installed for collecting the sediments before letting them into the water body Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes for re vegetation. Alternate drain inlets and outlets shall be provided in the event of closure of existing drainage channels of the water body Movement of machinery, workforce shall be restricted around the water body and no waste from construction camps or sites shall be disposed into it.

8.2.2 Run off Control / Drainage

To ensure efficient drainage system and to prevent water logging along the sides, adequate size and number of cross-drainage structures have been provided. All cross-drainage structures have been designed to handle a 50-year peak flood level as per IRC: 5-1998 (*Standard Specifications and Code of Practice for Road Bridges Section I),* IRC**:** SP-13-1973 (*Guidelines for the Design of Small Bridges and Culverts*), IRC: 78-2000, (*Standard Specifications and Code of Practice for Road Bridges Section VII*).

At locations of high embankment or bridge approaches, Chute Drains shall be provided to drain the surface runoff and prevent erosion from the slopes. (Refer IRC SP: 50-1999, *Guidelines on Urban Drainage;* IRC SP: 42-1994, *Guidelines on Road Drainage* for detailed drainage design). During the progress of work, the contractor will remove obstructions that may cause any temporary flooding of local drainage channels during construction. No spoil or construction material will be stored outside the proposed right of way or at places obstructing the natural drainage system.

In sections along watercourses, and locations close to cross-drainage channels, the contractor will ensure that earth, stone or any other construction material shall be disposed off immediately at the designated landfill site so as to avoid blocking the flow of water along those channels. Silt fencing (Box 8-2) shall be provided at the construction sites (2 construction sites considered during construction phase) in proximity to water bodies. Warning posts for notice of public against entry into the stream channels while construction shall be erected.

During the operation phase following measures need to be undertaken:

Inspection *(as per IRC SP: 18-1978, Manual for Highway Bridge Maintenance Inspection)* and cleaning of drains / culverts shall be done as they get choked with silt/debris and growth of vegetative cover over the accumulated debris.

Box 8-2: Detailed Specifications For Silt Fencing

Description: Silt fencing is a temporary sediment barrier made of woven, synthetic filtration fabric supported by steel or wood post. The purpose of the silt fence is to prevent sediment carried by sheet flow from leaving the site and entering to natural drainage or any other water body located near the construction site. Silt fencing encourages the sheet flow and reduces the potential for development of rills and gullies. Care should be taken that silt fences are not installed across streams, ditches, waterways or other concentrated flow areas.

Construction Specification: Silt fencing consists of 1.0 m wide filter fabric and should be placed on the contour. Incase runoff flow or velocities are very high or where slope exceed vertical height of 3.0 m, silt fencing should be wire reinforced. The contractor should purchase silt fencing in a continuous role to the length of the barrier to avoid the use of joint. Incase of joints, filter cloth should be spliced together only at supporting post, with minimum 15 cm overlap and securely sealed. The pile is drive to the depth of 300 mm into the ground by pressing from the top. The frame will be installed at the edge of stockpiles and at the water bodies along which construction is in progress.

Inspection: The PIU will inspect location as well as efficiency of silt fencing. The inspection should be done after every 15 days and incase of storm water, within 24 hours after the end of rain.

Maintenance: The contractor should remove sediments, once it has accumulated to one-half the original height of the fence. Filter fabric should be replaced whenever it has deteriorated to such an extent that the effectiveness of the fabric is reduced. Silt fence should remain in place until disturbed areas have been permanently stabilized. All the sediments accumulated and properly disposed off before the fence is removed. The operation of removing and disposing have to be monitored by the PIU or Engineer In-charge.

8.2.3 Prevention of Water Quality Degradation

Following are the measures that need to be undertaken to prevent contamination of water body during the progress of work and also during the operation phase of the project corridor:

- To prevent the entry of the surface run-off from fuel and other contaminants into the wells and other surface water bodies along the corridor, construction of settling ponds and the installation of oil receptors shall be undertaken.
- All the diversion and bunds shall be removed such that there is minimum amount of sediment generation.
- All wastes arising from the project shall be disposed off at identified disposal sites in environmentally sound manner.
- No vehicles or equipment shall be parked or refuelled near the water-body, so as to avoid contamination from fuel and lubricants.
- At the construction camps, the sewage system shall be designed and built so that no water pollution takes place in any water body or watercourse.
- Surface water monitoring is to be conducted during the construction phase to monitor and control the quality of surface water. Monitoring is to be carried out for 2 seasons (pre and post monsoons) for 3 years (construction period). The monitoring locations are on surface water along corridor.

Ground water: Wells, hand pumps and taps falling within the direct impact zone need to be relocated to clear the RoW. Ground water monitoring is to be conducted during construction phase (twice a year for 3 years) to monitor and control the quality of ground water. The monitoring locations are hand pumps of settlements.

8.3 AIR

8.3.1 Air Pollution Control Measures

During the progress of work, construction equipments and plants always have an impact on the environment. The impact can be due to the emissions, dust, noise and oil spills that concern the

safety and health of the workers, surrounding settlements and environment as a whole. Following are the measures that need to be undertaken to address air pollution during the progress of work:

8.3.1.1 Measures during Construction Stage

Selecting the site for plant area and parking lot for equipments and vehicles as per Box 8.3.

Box 8-3: Siting of Plant Area / Parking Lot	
Avoid the following …	**Prefer the following …**
• Lands within 1000m of habitations • Irrigated agricultural lands • Lands within 1000m of community water bodies and water sources as rivers • Lands within 1000m of watercourses • Grazing lands and lands with tenure rights	• Waste lands • Community lands not used for beneficial purposes • Lands with an existing access road

Acquiring "No Objection Certificate (NoC)" from the Punjab and Himachal Pradesh Pollution Control Boards before setting up crusher, hot-mix plant and generator.

Ensuring all vehicles must possess Pollution under Control (PUC) Certificate and shall be renewed accordingly.

During the progress of work to minimize the dust generation, emissions as per Table 8.2 shall be undertaken.

Table 8.2: Measures to minimise air pollution during the progress of work

Concern	Causes	Measures
Dust Generation	Vehicle Movement	Water sprinkling, Fine Materials shall be Transported in Bags or Covered by Tarpaulin during Transportation, Tail board shall be properly closed & sealed
	Crushers	Water Sprinkling
	Concrete-mix Plant	Educate the workers for following good practices while material handling
Emissions	Hot-Mix Plant	Site Selection as per Clause 6.5.2, Section 6.5, IRC Manual for Construction & Supervision of Bitumen Work, Regular maintenance of Dust Collector as per manufacture schedule
	Vehicles	Regular maintenance as per manufacture schedule
	Generators	Exhaust vent of long length
Noise	Heavy load vehicles	Exhaust silencer, Regular maintenance as per manufacture schedule
	Crushers	Sitting as per Box 8.3
	Generators	Shall be kept in closed room and regular maintenance as per manufacture schedule

Air Quality Monitoring should be carried out during the construction stage (construction period considered to be 3 years) to monitor the level of air pollutants and keep a check on the concentration. Monitoring should be carried out at the following sites for all 3 seasons except monsoons:

- Location of Hot Mix Plant (to be decided by the contractor- 2 locations considered in the budget)
- At critical locations / villages along the project road covering various land use
    - Jungle Fathepur & Jungle Dadnal (Forest),
    - Kiratpur & Maura (Commercial),

- Mehla, Dhaliya, Jol, Patta, Bharadi (Residential)

8.3.1.2 Measures during Operation Stage

During the operation stage, emissions due to vehicle movement can be effectively reduced if they conform to vehicular emission norms. However, enforcement of such measures and formulation of a regulatory framework for this purpose is beyond scope for this study.

Air quality monitoring for parameters SPM, RSPM, CO, SO_2, NO_x, at sites where monitoring has been carried out during the construction phase (except the hot mix plant site) is to be done once a year for every 2 years for 20 years.

Vehicular emissions of critical pollutants will be monitored with regular maintenance of roadside tree plantation. Monitoring of the effectiveness of the pollution attenuating vegetative barriers will be taken up after 5 years. Based on the results, recommendation for any changes in the mitigation measures or suggestion of additional measures shall be made.

8.3.2 Noise Control Measures

8.3.2.1 Measures during Construction Stage

The plants and equipment used for construction shall strictly conform to existing noise norms. Vehicles and equipments used shall be fitted with exhaust silencers. During routine servicing operations (as per manufacture schedule), the effectiveness of exhaust silencers shall be checked and incase of any defect, shall be replaced immediately.

The noise level from any item of plants (measured at one meter from the edge of the equipment in free field) such as compactors, rollers, front loaders, concrete mixers, cranes, vibrators and saws shall not exceed 75 dB (A), as specified in the Environmental Protection Rules, 1986. Construction sites located within 150m of the nearest habitation, noisy construction work such as crushing, concrete mixing, batching will be stopped during the night time between 10:00 p.m. and 6:00 a.m. No noisy construction activities will be permitted around the silence zones, a distance of 100m from the sensitive receptors as hospitals, educational institutions etc. Blasting will be carried out as per The Explosives Rules, 1983. Prior intimation of operational hours of the blasting will be given to the people living near such blasting sites.

Blasting will not be undertaken in night hours. To protect construction workers from severe noise impacts, noise standards of industrial enterprises will be strictly enforced, and workers shall be provided with protective devices such as earplugs. Noise level Monitoring shall be carried out to monitor and keep a check on noise levels during construction phase. Monitoring is to be carried out for all 3 seasons a year (except monsoons) for 3 years (construction period).

8.4 MITIGATION DURING OPERATION PHASE

8.4.1 Noise Barriers

Noise barriers have been proposed at specific receptor locations along the corridor based on the receptor, number of users, availability of space for the barrier and predicted noise levels. The following types of noise barriers have been considered for noise attenuation.

Physical barriers in the form of walls: An evaluation of the various types of noise barriers have been made and based on their suitability and extent of noise attenuation, feasible noise barriers have been proposed for the project.

Physical Barriers: attenuate noise level up to a maximum of 20dB(A). As they do not require any large space, they can be easily constructed. However, there are a few drawbacks. High cost

involved in the construction of the barriers. Such barriers may cause severance on either side of the highway. Such barrier facilitates opportunistic encroachment for urban squatters. Vegetative Barriers: attenuate noise level up to a maximum of 10dB(A). These barriers require a considerable area and for attenuation of 10dB(A) they require a depth of 40m.

8.4.2 Proposed Locations of Noise Barriers

Almost all the educational institutes along the project road have the main gate opening on the project road. After the main gate there is usually a playground & the school building is usually located behind the playground. Some schools do not have a playground; in that case the school building is located adjacent to the road. Some schools do not have any boundary wall, either there is a fence or vegetation to demarcate the school boundary. Structural barriers have been proposed for all the schools, these will serve a dual purpose; a boundary wall as well as noise barrier. A masonry wall of 5m height and length depending on the school length adjacent to the road is proposed to be constructed. Detailed costs for provision of the noise barriers is worked out and presented in the environmental budget. This report suggests noise barriers primarily at all educational institutes, health centres, community spaces & religious places. The suggested locations of noise barriers are list our in Table 8.2 below. Eventually, if any addition or deletion of noise barrier locations are required at the time of construction, that can be done in consultions with local gram panchayat, PIU-NHAI and respective district administration.

Table 8-2: Suggested Locations of Noise Barriers

Sr.	Chainage	Description	Barriers Suggested
1.	4.600	Government High School, Massewal	Boundary wall of height 5m
2.	8.700	Government Elementary Primary School, Maura	Boundary wall of height 5m
3.	9.800	Government High School, Gara	Boundary wall of height 5m
4.	24.900	Government High School, Patta	Boundary wall of height 5m

8.4.3 Vegetative Noise Barrier:

Wherever space is available inside the school premises, after the proposed boundary walls 2-3 rows of plantation is proposed for further noise attenuation & aesthetic enhancement of the school. Besides the plantation/construction of vegetative/structural barriers, noise monitoring is to be carried out at the following locations during Operation Phase to monitor and check noise levels. At critical locations**:**

- Jungle Dadnal & Jungle Fathepur (Forest)
- Kiratpur & Maura (Commercial)
- Massewal, Mehla, Bhated, Patta & Bharadi (Residential)

Two additional locations as deemed necessary at that point of time. Monitoring at these locations should be carried out once a year for every 2 years. Besides, provision has been kept for monitoring at certain additional locations, 2 such locations have been considered in the budget.

8.4.4 Flora & Forests

The forest land that required to be diverted is minimum. As per the Forest Conservation Act, 1980, for the diverted forest land, Net Present Value will be paid by the User Agency (NHAI) to the Forest Dept. For the forest trees, a joint enumeration will be conducted along with forest officials to determine the exact number of trees to be cut. A Compensatory Afforestation scheme will be prepared by the forest Dept and land has to be identified for implementing the Afforestation scheme. Land for Compensatory Afforestation will be provided by the District Collector (for non forest land) on concerned DFO (for degraded forest land). The cost of Compensatory Afforestation will be borne by the User Agency (NHAI).

For roadside (non forest) trees to be cut, joint tree enumeration will be conducted along with the Revenue officials to determine the exact number of trees to be cut. Compensatory plantation will be carried out for the trees that will be cut. For every tree cut, at least two trees will be planted.

8.5 SAFETY MEASURES

8.5.1 Measures during Construction

The contractor must educate the workers to undertake the health and safety precautions. The contractor shall prepare traffic control plan and drawings containing detailed specifications for diversion, signage as well as location specific traffic detour plan. Other safety requirements that need to be undertaken are as follows:

Educate the workers regarding…

- Personal safety measures (such as helmet, footwear, noise mask, ear plug, etc.) and location of safety devices.
- Interaction with host community
- Protection of environment with respect to:
  - Trampling of vegetation and cutting of trees for cooking
  - Water body protection
  - Storage and handling of materials
  - Disposal of construction waste

- Adequate lighting arrangement.
- Adequate drainage system to avoid any stagnation of water.
- Lined surface with slope 1:40 and provision of lined pit at the bottom end, at the storage and handling of bitumen and oil as well as at the location of generator.
- Facilities for provision of First Aid.

8.5.2 Safety Measure during Tunnel Construction:

Theoretically the excavation could be done full face. In reality a subdivision in the heading and bench will generally be maintained in case of large excavation profiles. Drill and blast will be required for excavation. The smooth blasting requirement and practice construction reasons limit the length of round to a range between 2.5-3.5 meters top heading and 4.0 meters in beaching. From practical safety and construction reasons in tender design s stage support is to be derived as per need with wre mesh, rock bolts etc.

All electrical supply and distribution equipment shall comply with the recommendation standard. There will be no use of oil filled switchgear underground, not to be used mineral or filled transformer underground, operating and light system at low voltage.

All exposed electrical cables installed within the tunnel shall comply with non flammable, low toxix, less smoke density equipment. Illumination should be provided in working place. The contractor shall also permit nearer than 40 m to the heading face while charging explosives. The ventilating system shall be kept in operation also after breakthrough in tunnels in order to maintain the fresh air volume requirements stated hereinafter. Careful and proper scaling after each blast is imperative. The support elements are considered to be sufficient for the overall stability of the tunnels. There is need to install pumps at nearby tunnel work. Periodically there is need to remove all accumulated slurry, silt and other debris from the underground works as required.

8.5.3 Safety Measures for Road Users

Avoid planting vegetation at inner curves having access roads so that adequate sight distances are available to the driver. Depending on the speed in that section, a sight distance corresponding to 8 seconds reaction time shall be provided. All major junctions shall be designed adhering to the standards of adequate sight distances and facilities for the local traffic, parking areas, service roads, pedestrian sidewalks and zebra crossings.

Trees that have been saved and are very close to the pavement shall be marked in white paint or have reflective hazard signage on them to alert the driver. Guardrails shall be provided close to

religious structures adjacent to the corridor so that there is no spillage of activities on the carriageway. Refer annexure 8.1 which provides more information on Safety Requirements.

8.5.4 Accidents Involving Hazardous Materials

Accidents involving hazardous chemicals will generally be catastrophic to the environment, though the probability of occurrence is low. The Hazardous Wastes (Management and Handling) rules, 1989 shall be compiled to minimize the risk of accident involving transportation of hazardous material. For delivery of hazardous substances, three certificates issued by transportation department, viz., permit license, driving license and guarding license shall be required. These shall be issued and checked thoroughly. Vehicles delivering hazardous substances will be printed with appropriate signs. In case of spillage, the report to relevant departments will be made and instructions followed in taking up the contingency measures immediately.

8.5.4 Safety Measures for Local Traffic & Through Traffic

The widening of the existing 2-lane road to 2/4 lane with paved shoulders will increase in traffic speed will result in severance problem on pedestrian and cattle crossing and cross traffic. To avoid this severance problem all measures like junction improvement, service roads, median cuts etc. have been proposed to segregate local and through traffic and also to facilitate safe pedestrian movement. These proposed features have been discussed in detail in Chapter 1 of this report.

8.5.5 Bus Shelters / Bus Bays

Bus Shelter locations on the project corridor have been identified on basis of several criteria, namely:

- Location of Existing Facility
- Need for the facility, and
- Special Locations such as schools and settlements

In general bus-shelter facilities have been proposed for all villages along the Project Road. In total, there are 34 bus shelters along project road. Total 26 Bus bays with bus shelter have proposed. Further due considerations are given to locating these in a staggered way and to site conditions that exist therein.

8.5.6 Measures for Cultural Properties

In situations when significant cultural properties are likely to be impacted, either the project corridor needs to be realigned to save the property in question or the property needs to be relocated in case realignment is not possible due to either engineering or other constraints. There are 15 religious structures along the road stretch. In which 3 temples, 3 small temples, 1 *Peer Baba* Temple, 1 boundary wall of *Gurudwara* and 1 boundary wall of *Radha Swami Satsang Bayas* will be affected by the proposed development other then these most of the religious structures are unaffected. This issue has discussed with the locals during community consultation. The probable place issue of relocation has been discussed with the temple trustees.

8.5.7 Highway Landscaping

Trees are to be planted along the proposed road within available right of way. The design has been proposed such that trees present on either side of the road will be saved. Number of rows of plantation will depend on the space available. At junctions and in the median different varieties

of shurbs are planted. The species of shurbs is selected based on the local climate, so that it grow easily and at fast rate. Landscaping at junctions, toll locaions, rest area, bus shelters is one of the mantatory items, which adds beautification of corridor and its suppliments natural environment.

8.6 MITIGATION MEASURES

The probable impacts of proposed development and their mitigation measures are given in Table 8.3.

Table 8.3: Impacts and Mitigation Measures

Subject	Potential Impact	Mitigation Measures
Physical Environment		
Topography	• The portals of the tunnels will change the topography • Dumping of tunnel construction/excavation will generate large vol. of solid waste which may alter the topography • Significant Impacts	• No mitigation measure.
Geology	• Blasting operations will lead to rock movement, minor fragmentation and vibrations • Significant impact on hilly environment which will induce landslides and land slips.	• Adequate mitigation measures like breast wall etc will be provided. • Controlled blasting will be preferred and all other efforts and measures will be taken to minimize vibrations
Soils	• Loss of productivity due to acquisition • Physical & chemical contamination of soil. • Compaction and structural damage. • Soil erosion.	• Dumping of construction waste at approved locations protected firms. • Reuse of construction waste. • Storage of construction material in accordance with the IRC norms. • Avoiding work during periods of heavy rainfall. • Rehabilitation of borrow areas for productive use. • Conservation of topsoil for reuse in planting pits and rehabilitation of borrow areas, sodding /grass turfing and implementation of soil erosion control plan.
Climate		
Temperature	• Minor rise in temperature in areas	• No mitigation measure is required
Rainfall / Humidity	• Adjoining the portals of the tunnels during construction phase. • Minor rise in temperature inside the tunnels during operation phase • Change in micro climate.	• Adequate measure will be taken incase increase in temperature may raise the level of risk of fire inside the tunnels.
Land		
Land Acquisition	• 142.48 Ha will be acquired for the proposed project road	• Compensation as per NHAI Act will be given to the affected persons.
Induced Development	• Development along the proposed bypass.	• Civil authorities to control any induced development using the prevailing regulatory framework.

Subject	Potential Impact	Mitigation Measures
Water Environment		
Surface Water	• Impact on springs in Bilaspur. • Ghamber Khud and Ghambharola Khud and Gobind Sagar Lake are located along the road. • Degradation of some water quality due to siltation. • Tunnel construction and operation including seepage, wash-down water and spillage • Portal areas, worksites and spoil placement areas • Short term, moderate and irreversible impact	• The Ghamber Khud, Ghambharola Khud and springs will be channelized in order to maintain its natural flow before construction. • Providing appropriate measures to minimize impacts on these water resources during construction • Use of sediment traps, silt fencing, sodding/ grass turfing etc. for minimization of soil movement; • Use of cofferdams for construction of abutments and bridge pier. Cofferdams to be made of such material that cannot be brought into suspension by flowing water • Stream substrate only to be disturbed for construction of abutments and piers • Tarpaulins or other catchment devices will be slung under the bridge to prevent debris, wastes and toxic compounds from entering the stream • Avoidance of lead-based paints in painting components of bridges • Provision of adequate cross drainage structures. • Implementation of a protocol for storage of topsoil, construction waste away from water course etc. • Location of onsite refueling stations away from water resource. • Use of oil/water separators to extract floating. • Monitoring of water quality during construction and operation.
Ground water	• Some hand pumps are located along the new alignment road within ROW of the project road. • No Impact on availability. • Temporary impact on ground water due to tunneling	• Out of these water sources some hand pumps are likely to be impacted due to widening of the road. • Relocation of ground water facility in consultation with communities. • Provision of separate water facilities for construction camp. • Recharge of aquifers gradually if any impacted during tunneling
Air Environment		

Subject	Potential Impact	Mitigation Measures
Air	• Increased gaseous pollution along with fugitive dust emissions.	• Asphalt plant, Crusher, Batching Plant, will be sited 1000 m in down wind direction from nearest settlements. • Vehicles and construction equipments to be maintained properly. • Construction materials & waste will be properly covered during transportation to avoid spillage & dispersion. • Water will be sprayed during construction phase, in earth handling sites, asphalt mixing sites and other excavation areas for suppression of dust. • Dust emission from piles of excavated material should also be controlled by spraying water on the piles. • Special care should be taken when working near schools and medical facilities. • To ensure that stone crushers supplying materials for this project implement air pollution control and workers are provided with masks. • Provision of new alignment will relieve population of congested settlements at Swarghat and Bilaspur.
Noise	• Construction phase impact low to moderate, spatially restricted and reversible. • During operation phase beneficial impact in the initial phase persistence of such beneficial impact will depends on the future traffic volume & quality of maintenance of road.	• Construction plant & machinery to be located 1 Km away from settlements. • Construction vehicles and equipments fixed or mobile to be equipped and maintained with effective muffler system. • One bypass has been proposed to avoid settlements, this will save settlements from increased levels of noise during construction. • Proper traffic management near sensitive receptors. • Putting up “no horn” signage near sensitive receptors. • Provision of earplugs to workers. • Noisy construction to be restricted during the hours by 7 am- 7 pm. • Provision of sound screens near sensitive • Receptors during construction phase • Noise attenuation measures e.g. planting of trees, noise attenuation structures to be erected as required.
Ecology		
Flora	• Approximately 2035 trees are found within ROW which will be impacted due to new alignment and proposed widening.	• Compensatory plantation, along roadside; as per state/central government guidelines for each tree removed.
Fauna	• There will be direct/indirect impact on wild animals.	• All appropriate mitigation measures will be taken during construction and operation phase of the project. The construction during breeding season i.e. April to early June of the year will be avoided. Also construction during night time will be avoided.

Subject	Potential Impact	Mitigation Measures
Socio Environment		
Socio Environment	• Approximately 156 households comprising of about 1039 PAPs will be affected along the new alignment	• Resettlement of people as per provisions of RAP. • New road alignment has been proposed to minimize displacement of people and demolition of structures at congested settlements. • Compensation for loss of structures private, community and public. • Compensation for loss of land under agriculture.
Religious Structures / cultural property	• Total 8 religious structures, 4 community structures and 3 Government structure are located within the right of way.	• Many religious structures have been saved by proposed new alignment and bypasses. • Relocation of Impacted structures in consultation with community.
Public Health and Road Safety		
Public health and road safety	• Psychological impacts of project affected people. • Migration of worker may lead to sanitation problem creating congenial condition for disease vectors. • Discomfort arising of air, noise pollution. Hazards of accident.	• Continued consultation with PAPs and the competent authority for speedier settlements of appropriate compensation package and resettlement. • Ensure sanitary measures at construction camp to prevent water borne disease and vector borne disease. • Provide appropriate personal protective equipments like earplugs, gloves gumboot, and mask to the work force. • Safe traffic management at construction area.

8.7 ENVIRONMENTAL COST

The total environmental mitigation costs for the project is Rupees 7.43 Crore approximately. The detailed cost is given in Table 8.4.

Table 8.4: Summary of Environmental Costs (INR.)

Sr.	Item	Unit	Rate (in INR)	Quantity	Amount (in INR)
A	**CONSTRUCTION STAGE**				
1	**Mitigation Measures other than Good Engineering practices**				
1.1	Silt fencing	Number	7,400.00	4	29,600.00
1.2	Oil interceptors	Number	2,000.00	4	8,000.00
2	**Roadside Landscaping**				
2.1	Tree Plantation (non forest)	Number	800.00	30000	2,40,00,000.00
2.2	Barbed Wire Fencing, height 1.2 m (covering 10% trees)	No.	500.00	1200	6,00,000.00
2.3	Tree Cutting	No.	1200.00	2035	24,42,000.00
3	**Forest**				
3.1	Diversion of forest land (Net present Value)	Area (ha)	9,50,000.00	17.31	1,64,44,500.00
3.2	Trees to be cut	No.	1,200.00	8000	96,00,000.00
3.3	Compensatory Afforestation	No.	500.00	20000	1,00,00,000.00
					6,31,24,100.00
4	**Monitoring of Environmental Attributes during Construction Activity**				
4.1	**Air**				
4.1.1	Monitoring of Air Quality near Hot mix plants (2locations)	No. of Samples	8000/ Sample	2*3*3=18	1,44,000.00

Sr.	Item	Unit	Rate (in INR)	Quantity	Amount (in INR)
4.1.2	Monitoring of Air Quality at Critical Locations (6 locations)	No. of Samples	8000/ Sample	6*3*3=54	4,32,000.00
4.2	**Noise**				
4.2.1	Monitoring of Noise Level at Equipment Yards (at 5 locations within equipment yard)	No. of Samples	4,000.00	2*3*3=18	72,000.00
4.2.2	Monitoring of Noise Levels at Critical Locations (6 locations)	No. of Samples	4,000.00	6*3*3=54	2,16,000.00
4.3	**Water**				
4.3.1	Monitoring of Surface Water Quality (3 locations)	No. of Samples	8,000.00	3*2*3=18	1,44,000.00
4.3.2	Monitoring of Ground Water Quality (2 locations)	No. of Samples	8,000.00	2*2*3=12	96,000.00
4.3.3	Median Plantation	-	30 per plant	66670	20,00,100.00
					3,104,100.00
5	**Noise Barrier**				
5.1	(a) Noise Barrier (Vegetative with trees Guard)	No.	1100/trees	215	2,36,500.00
6	(b) Noise Barrier (Wall)	Length	11500	3	34,500.00
6.1.2	Enhancement of Cultural Properties				2,00,000.00
					4,48,000.00
	Total Cost Of Environmental Measures During Construction Stage Excluding Costs Under Good Engineering Practices (A)				**7,62,34,200**
B	**GOOD ENGINEERING PRACTICES**				
1	Dust Suppression	**COVERED UNDER ENGINEERING COSTS**			
2	Turfing/Pitching/Seeding & Mulching				
3	Provision of Informatory Signs				
4	Bus bays				
5	Construction of Speed Humps				
6	Cattle Crossings				
7	Borrow area redevelopment				
8	Partial filling of ponds, deepening and new embankment construction (ponds)				
C	**OPERATION STAGE**				
1	Monitoring of Environmental Attributes during Operation Stage				
1.1	**Air**				
1.1.1	Monitoring of Air Quality at Critical Locations (3)-up to 20 years, once in every 2 years	No. of Samples	8,000.00	3*1*10=30	2,40,000.00
1.2	**Noise**				
1.2.1	Monitoring of Noise Levels at Critical Locations (3) upto 20 years, once in every 2 years	No. of Samples	4,000.00	3*1*10=30	1,20,000.00
1.2.2	Monitoring at additional locations (2) up to 20 years, once in every 2 years	No. of Samples	4,000.00	2*1*10=20	80,000.00
	Total Cost Of Environmental Measures During Operation Stage ©				**4,40,000.00**
	SUB TOTAL (A+B+C) Rs.				**6,71,16,200.00**
	Contingency @ 10%				**67,11,620.00**
	Grand Total INR. (Environmental Budget exclusive Of Cost Of Measures Included Under Good Engineering Practices)				**7,42,67,820.00**

9. Environmental Management Plan

The Environmental Management Measures shall be implemented during the various stages of the project viz: Pre-construction stage, Construction Stage and Operation Stage. The Environmental Management Plan is described below.

9.1 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

9.1.1 Objectives of EMP

The Environmental Management Plan (EMP) consists of a set of mitigation, monitoring and institutional measures to be taken during the design, construction and operation phases of the project to eliminate adverse environmental impacts, to offset them, or to reduce them to acceptable levels. The main aim of the Environmental Management Plan is to ensure that the various adverse impacts are mitigated and the positive impacts are enhanced.

The objectives of the EMP at various stages of project planning and implementation are descrided below. A description of the various management measures suggested during different stages of construction is provided in Table 9.1 and Table 9.2 respectively.

9.2 PRE-CONSTRUCTION STAGE

9.2.1 Pre-construction activities by PIU/ Supervision Consultant

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

- Removal and felling of trees,
- Relocation of common property resources and utilities like telephone poles, electric poles and hand pumps will be impacted.
- Formal arrangements for maintenance of enhancement sites. This includes plantation of trees and barricades along the road.

9.2.2 Pre-construction activities by Concessionare / Contractor

Pre-construction stage involves mobilisation of the Concessionare / EPC Contractor and the activities undertaken by the Contractor pertaining to the planning of logistics and site preparation necessary for commencing construction activities. The activities include:

- Joint field verification of EMP by the Environment Specialist of the Supervision Consultant and Contractor.
- Identification and selection of material sources (quarry and borrow material, water, sand etc).
- Procurement of construction equipment / machinery such as crushers, hot mix plants, batching plants and other construction equipment and machinery.
- Selection, design and layout of construction areas, hot mix and batching plants, labour camps etc.
- Apply for and obtain all the necessary clearances/ NOCs/ consents from the agencies concerned.
- Planning traffic diversions and detours including arrangements for temporary land acquisition.

9.3 EMP DURING CONSTRUCTION STAGE

9.3.1 Construction activities by the Contractor

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

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

9.3.2 Construction activities by the PIU / Independent Consultants

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

- Monitoring and guiding the Contractor on adopting good environmental and engineering practices.
- Arrangement of plantation through the Forest Department.
- Arranging training to the Contractor and other stakeholders according to the needs arising.

9.4 OPERATION STAGE

The operation stage involves the following activities by PIU:

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

Table 9.1: Generic Environmental Management Plan

Sr. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning & Execution	Supervision/ Monitoring
PRE-CONSTRUCTION STAGE						
Pre-construction activities by PIU						
P.1	Alignment, Width of the road and religious structures	The existing alignment was selected by shifting / adjusting the centerline of the road, adopting of suitable cross-sections and adjustment of the median width to minimize land acquisition, loss of settlements and to avoid environmentally sensitive features like religious structures etc. compatible with project activities.	Design Report, LA Act and its amendments	Throughout Corridor	PIU, Revenue Dept., NGOs, Collaborating Agencies	Supervision Consultant
P.2	Land Acquisition	The acquisition of land and private properties will be carried out in accordance with the RAP and entitlement framework for the project. It will be ensured that all R & R activities including implementation of Environment Management Plan are completed before the start of work. PIU has to ascertain that any additional environmental impacts resulting from acquisition of land are addressed and integrated into the EMP and other relevant documents.	LA Act and its amendments	Throughout Corridor	PIU, Revenue Dept., NGOs, Collaborating Agencies	Supervision Consultant
P.3	Preservation of Trees	Tree cutting is to proceed only after all the legal requirements including attaining of In-principle and Formal Clearances from the Forest Dept./ DoEF/ MoEF are completed and subsequently a written order is issued to the Consessionaire / Contractor . Particular species declared as 'protected' by the State's Forest Dept. in the private land will be felled only after due clearance from the Forest Dept./ concerned agencies is obtained. Stacking, transport and storage of the wood will be done as per the relevant norms. Systematic corridor level documentation for the trees cut and those saved will be maintained with Supervision Consultants.	Clause No. 201.2 MORT&H Specifications for Road and Bridge works	Throughout Corridor	PIU, Forest Department, Contractor	Supervision Consultant
P.4	Relocation of Community Utilities and Common Property Resources	All community utilities and properties i.e., water supply lines, sewer lines, hand pumps will be relocated before construction starts, on any section of the project corridor. The PIU will relocate these properties in consultation and written agreement with the agency/ owner/community. Environmental considerations with suitable/required actions including health and hygiene aspects will be kept in mind while relocating all community utilities and resources.	As in RAP	Throughout Corridor	PIU, Concerned Agencies, Consessionaire / Contractor	Supervision Consultant
P.5	Orientation of Implementing Agency and Consessionaire / Contractors	The PIU shall organize orientation sessions and regular training sessions during all stages of the project. This shall include on-site training (general as well as in the specific context of a sub-project). These sessions shall involve all staff of Independent Consultants, field level implementation staff of PIU and Contractor, Environmental Experts. The Contractor will ensure that his staff including engineers, supervisors and operators attend the training sessions.	Project Requirements	Throughout Corridor	Consessionaire / Contractor	Supervision Consultant

Sr. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning & Execution	Supervision/ Monitoring
P.6						
P.6.1	Joint Field Verification	The Environmental Expert of IC and the Contractor will carry out joint field verification to ascertain any additional possibility to saving trees, environmental and community resources. The verification exercise should assess the need for additional protection measures or changes in design/ scale/ nature of protection measures including the efficacy of enhancement measures suggested in the EMP. Proper documentation and justifications/reasons shall be maintained in all such cases where deviation from the original EMP is proposed.	Project Requirements	Throughout Corridor	Consessionaire / Contractor / Environmental Expert of Supervision Consultants	PIU, NHAI
P.6.2	Assessment of Impacts due to Changes/ Revisions/ Additions in the Project Work	The Environmental Expert of IC will assess impacts and revise/ modify the EMP and other required sections of the project documents in the event of changes/ revisions (including addition or deletion) in the project's scope of work.	Project Requirements	Throughout Corridor	Consessionaire / Contractor/ Environmental Expert of Supervision Consultants	PIU, NHAI
P.6.3	Crushers, hot-mix plants and Batching Plants Location	Hot mix plants and batching plants will be sited sufficiently away from settlements and agricultural operations or any commercial establishments. Such plants will be located at least 1000 m away from the nearest village/ settlement preferably in the downwind direction. The Consessionaire / Contractor shall submit a detailed layout plan for all such sites and approval of Environmental Expert of IC shall be necessary prior to their establishment. Arrangements to control dust pollution through provision of windscreens, sprinklers, and dust encapsulation will have to be provided at all such sites. Specifications of crushers, hot mix plants and batching plants will comply with the requirements of the relevant current emission control legislations and Consent/NOC for all such plants shall be submitted to the "PIU through Independent Consultant. The Consessionaire / Contractor shall not initiate plant/s operation till the required legal clearances are obtained and submitted. The engineer will ensure that the regulatory and legal requirements are being complied with.	Clause No 111.1 MoRT&H Air (P&CP) Act 1981	Throughout Corridor	Consessionaire / Contractor	Engineer, Supervision Consultant
P.6.4	Other Construction Vehicles, Equipment and Machinery	All vehicles, equipment and machinery to be procured for construction will confirm to the relevant Indian Standard (IS) norms. The discharge standards promulgated under the Environment Protection Act, 1986 will be strictly adhered to. Noise limits for construction equipments to be procured such as compactors, rollers, front loaders concrete mixers, cranes (moveable), vibrators and saws will not exceed 75 dB (A), measured at one meter	Project Requirement	Throughout out Corridor	Consessionaire / Contractor	Engineer, Supervision Consultant

Sr. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning & Execution	Supervision/ Monitoring
		from the edge of the equipment in free field, as specified in the Environment (Protection) Rules, 1986. The Consessionaire / Contractor shall maintain a record of PUC for all vehicles and machinery used during the contract period, which shall be produced for EO - IC and NHAI verification whenever required. Mobile equipment shall be placed at least 100metres away from the nearest dwelling.				
P.7						
P.7.1	Borrow Areas	Finalizing borrows areas for borrowing earth and all logistic arrangements as well as compliance to environmental requirements, as applicable, will be the sole responsibility of the Consessionaire / Contractor . The Consessionaire / Contractor will not start borrowing earth from select borrow area until the formal agreement is signed between landowner and Consessionaire / Contractor and a copy is submitted to the "SUPERVISION CONSULTANTS/PIU through the Engineer. Locations finalized by the Consessionaire / Contractor shall be reported to the Environmental Expert of IC and who will in turn report to PIU. Planning of haul roads for accessing borrow materials will be undertaken during this stage. The haul roads shall be routed to avoid agricultural areas as far as possible (in case such a land is disturbed, the Consessionaire / Contractor will rehabilitate it as per Borrow Area Rehabilitation Guidelines) and will use the existing village roads wherever available. In addition to testing for the quality of borrow materials by the IC, the environmental personnel of the IC will be required to inspect every borrow area location prior to approval The IC will make sure that each such site is in line with IRC and other Project Guidelines. (annexure 9.2)	Clause No. 111.2 & 305.2.2 MORT&H Specifications for Road and Bridge works Guideline II (Guidelines for Borrow Area Management).	Along the Project Influence Area	Consessionaire / Contractor	Supervision Consultant, PIU
P.7.2	Quarry	Consessionaire / Contractor will finalize the quarry for procurement of construction materials after assessment of the availability of sufficient materials, quality and other logistic arrangements. In case the Consessionaire / Contractor decides to use quarries other than recommended by DPR consultants, then it will be selected based on the suitability of the materials and as per established law. The Consessionaire / Contractor will procure necessary permission for procurement of materials from Mining Department, District Administration and State Pollution Control Board and shall submit a copy of the approval and the rehabilitation plan to the "PIU through Engineer.	Clause No. 111.3 & MORT&H Specifications for Road and Bridge works	Along the Project Influence Area	Consessionaire / Contractor	Supervision Consultant, PIU

Sr. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning & Execution	Supervision/ Monitoring
		Consessionaire / Contractor will also work out haul road network and report to Environmental Expert of IC and IC will inspect and in turn report to PIU before approval.				
P.7.3	Arrangement for Construction Water	The Consessionaire / Contractor will use ground water as a source of water for the construction and can set up the own bore well facility for construction work. Consessionaire / Contractor can use the ponds with written agreement of owner, but in this case since ponds are not present along the road hence not applicable. To avoid disruption/disturbance to other water users, the Consessionaire / Contractor will extract water from fixed locations and consult the Environmental Expert of IC before finalizing the locations. The Consessionaire / Contractor will provide a list of locations and type of sources from where water for construction will be used. The Consessionaire / Contractor will seek approval from the SUPERVISION CONSULTANTS prior to the finalization of these locations The Consessionaire / Contractor will not be allowed to pump from any irrigation canal and surface water bodies used by community. The Consessionaire / Contractor will need to comply with the requirements of the State Ground Water Department and seek their approval for doing so and submit copies of the permission to IC and PIU prior to initiation of any construction work.	Clause No. 1010 MORT&H Specifications for Road and Bridge works EP Act 1986	Along the Project Road	Consessionaire / Contractor	Supervision Consultant, PIU
P.7.4	Labor Requirements	The Consessionaire / Contractor preferably will use unskilled labor drawn from local communities to give the maximum benefit to the local community.	Special Conditions of Contract	Along the Project Area	Consessionaire / Contractor	Supervision Consultant, PIU
P.7.5	Construction Camp Locations – Selection, Design and Lay-out	Siting of the construction camps will be selected by the Consessionaire / Contractor as per the guidelines. Construction camps will not be proposed within 500 m from the nearest settlements to avoid conflicts and stress over the infrastructure facilities with the local community applies only in case where a construction camp doesn't house plant sites. Location for stockyards for construction materials will be identified at least 1000 m from watercourses. The waste disposal and sewage system for the camp will be designed, built and operated such that no odor is generated.	Guideline I (Guidelines for Siting and Layout of Construction Camp)	Along the Project Road	Consessionaire / Contractor	Environmental Expert- Supervision Consultant , PIU
P.7.6	Arrangements for Temporary Land Requirement	The Consessionaire / Contractor as per prevalent rules will carry out negotiations with the landowners for obtaining their consent for temporary use of lands for construction sites/hot mix plants/traffic detours/borrow areas etc.	Project Requirements	Along the Project Road	Consessionaire / Contractor	Environmental Expert- Supervision Consultant ,

Sr. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning & Execution	Supervision/ Monitoring
		The Consessionaire / Contractor will submit a copy of agreement to the Environment Expert of Independent Consultant. The Environmental Expert of IC will be required to ensure that the clearing up of the site prior to handing over to the owner (after construction or completion of the activity) is included in the contract.				PIU
P.7.7	Implementation - Information Meetings	The Consessionaire / Contractor will organize at least 2 implementation information meetings in the vicinity of Project Site (minimum one in each section) for general public to consult and inform people about his plans covering overall construction schedule, safety, use of local resources (such as earth, water), traffic safety and management plans of debris disposal, drainage protection, canal training work during construction, pollution abetment and other plans, measures to minimize disruption, damage and in convenience to roadside users and people along the road. The first Implementation information meeting be conducted within four weeks of mobilization. The people should be informed about the date, time and venue atleast 7 days prior to meetings. Public shall be informed about the meeting through display of posters at prominent public places (panchayat offices, offices of Market committees, Notice board of religious places etc.) and distribution of pamphlets along roadside communities or in any manner deemed fit. The Consessionaire / Contractor will maintain a channel of communication with the communities through his designated Environment and Safety Officer to address any concern or grievances. Periodic meetings will also be conducted during the construction period to take feedback from communities or their representatives to ensure minimum disturbance. The mechanism and contents for disclosure shall be approved by PIU prior to the meetings.	Project Requirements	Along the Project Road	Consessionaire / Contractor	Environmental Expert- Supervision Consultant , PIU
CONSTRUCTION STAGE						
C.1						
C.1.1	Clearing and Grubbing	Vegetation will be removed from the construction zone before commencement of construction. All works will be carried out such that the damage or disruption to flora other than those identified for cutting is minimum. Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works will be removed with prior approval from the Environmental Expert of IC. The Consessionaire / Contractor under any circumstances will not cut trees other than those identified for cutting and for which he has written instructions from the PIU. The PIU will issue these instructions only after receiving all stages of clearances from the Forest Department/	Clause No. 201 MORT&H Specifications for Road and Bridge works	Along the work in progress	Consessionaire / Contractor	Supervision Consultant, PIU

Sr. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning & Execution	Supervision/ Monitoring
		MoEF. Vegetation only with girth of over 30 cm will be considered as trees and shall be compensated, in the event of PIU's instruction to undertake tree cutting. The sub grade of the existing pavement shall be used as embankment fill material. The existing base and sub-base material shall be recycled as sub-base of the haul road or access roads. • The existing bitumen surface may be utilized for the paving of cross roads, access roads and paving works in construction sites and campus, temporary traffic diversions, haulage routes etc.				
C.1.2	Disposal of debris from dismantling structures and road surface	The Consessionaire / Contractor shall identify disposal sites. The identified locations will be reported to the Environmental Expert of Supervision Consultants. These locations will be checked on site and accordingly approved by Environmental Expert of IC prior to any disposal of waste materials. All arrangements for transportation during construction including provision, maintenance, dismantling and clearing debris, will be considered incidental to the work and will be planned and implemented by the Consessionaire / Contractor as approved and directed by the Environmental Expert of Supervision Consultants. The pre-designed disposal locations will be a part of Comprehensive Solid Waste Management Plan to be prepared by Consessionaire / Contractor in consultation and with approval of Environmental Expert of Supervision Consultants. Debris generated from pile driving or other construction activities shall be disposed such that it does not flow into the surface water bodies or form mud puddles in the area. (annexure 9.1)	Clause No. 201.4 MORT&H Specifications for Road and Bridge works	Along the work in progress	Consessionaire / Contractor	Supervision Consultant, PIU
C.1.3	Other Construction Wastes Disposal	The pre-identified disposal locations will be a part of Comprehensive Waste Disposal Management Plan to be prepared by the Consessionaire / Contractor in consultation and with approval of Environmental Expert of Supervision Consultants. Location of disposal sites will be finalized prior to initiation of works on any particular section of the road. The Environmental Expert of Supervision Consultants will approve these disposal sites after conducting a joint inspection on the site with the Consessionaire / Contractor . Consessionaire / Contractor will ensure that any spoils of material unsuitable for embankment fill will not be disposed off near any water course, agricultural land, and natural habitat like grass lands or pastures. Such spoils from excavation can be used to reclaim borrow	Clause No. 301.3.2 MORT&H Specifications for Road and Bridge works	Along the Road	Consessionaire / Contractor	Supervision Consultant, PIU

Sr. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning & Execution	Supervision/ Monitoring
		pits and low-lying areas located in barren lands along the project corridors (if so desired by the owner/community and approved by the Environment Expert). Non-bituminous wastes other than fly ash may be dumped in borrow pits (preferably located in barren lands) covered with a layer of the soil. No new disposal site shall be created as part of the project, except with prior approval of the Environmental Expert of Supervision Consultants. All waste materials will be completely disposed and the site will be fully cleaned and certified by Environmental Expert of Supervision Consultants before handing over. The Consessionaire / Contractor at its cost shall resolve any claim, arising out of waste disposal or any non-compliance that may arise on account of lack of action on his part.				
C.1.4	Stripping, stocking and preservation of top soil	The topsoil from all areas of cutting and all areas to be permanently covered will be stripped to a specified depth of 150 mm and stored in stockpiles. A portion of the temporarily acquired area and/or Right of Way will be earmarked for storing topsoil. The locations for stock piling will be pre-identified in consultation and with approval of Environmental Expert of IC. The following precautionary measures will be taken to preserve them till they are used: (a) Stockpile will be designed such that the slope does not exceed 1:2 (vertical to horizontal), and height of the pile is restricted to 2 m. To retain soil and to allow percolation of water, silt fencing will protect the edges of the pile. (b) Stockpiles will not be surcharged or otherwise loaded and multiple handling will be kept to a minimum to ensure that no compaction will occur. The stockpiles shall be covered with gunny bags or vegetation. (c) It will be ensured by the Consessionaire / Contractor that the topsoil will not be unnecessarily trafficked either before stripping or when in stockpiles. Such stockpiled topsoil will be utilized for - • covering all disturbed areas including borrow areas only in case where these are to be rehabilitated as farm lands (not those in barren areas) • top dressing of the road embankment and fill slopes • filling up of tree pits, in the median and • in the agricultural fields of farmers, acquired temporarily. Residual topsoil, if there is any will be utilized for the plantation at median and side of the main carriageway.	Clause No. 301.2.2 MORT&H Specifications for Road and Bridge works	Along the Road	Consessionaire / Contractor	Supervision Consultant, PIU
C.1.5	Accessibility	The Consessionaire / Contractor will provide safe and convenient	Community	Along the	Consessionaire /	Supervision

Sr. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning & Execution	Supervision/ Monitoring
		passage for vehicles, pedestrians and livestock to and from roadsides and property accesses connecting the project road, providing temporary connecting road. The Consessionaire / Contractor will take care that Schools and religious places are accessible to Public. The Consessionaire / Contractor will also ensure that the work on / at existing accesses will not be undertaken without providing adequate provisions and to the prior satisfaction of Environmental Expert of Supervision Consultants. The Consessionaire / Contractor will take care that the cross roads are constructed in such a sequence that construction work over the adjacent cross roads are taken up one after one so that traffic movement in any given area not get affected much.	Properties (Educational institutes & Religious properties)	Road	Contractor	Consultant, PIU
C.1.6	Planning for Traffic Diversions and Detours	Temporary diversions will be constructed with the approval of the Resident Engineer and Environmental Expert of Supervision Consultants for which Consessionaire / Contractor will seek prior approval for such plans. Detailed Traffic Control Plans will be prepared and submitted to the Resident Engineer for approval, seven days prior to commencement of works on any section of road. The traffic control plans shall contain details diversions; traffic safety arrangement during construction; safety measures for night – time traffic and precautions for transportation of hazardous materials. Traffic control plans shall be prepared in line with requirements of IRC's SP- 55 document and The Consessionaire / Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. The Consessionaire / Contractor will also inform local community of changes to traffic routes, conditions and pedestrian access arrangements with assistance from Supervision Consultants and PIU. The temporary traffic detours will be kept free of dust by sprinkling of water three times a day and as required under specific conditions (depending on weather conditions, construction in the settlement areas and volume of traffic).	Clause No. 112 MORT&H Specifications for Road and Bridge works IRC; SP 55	Along the Road	Consessionaire / Contractor	Supervision Consultant, PIU
C.2						
C.2.1	Earth from Borrow Areas for Construction	No borrow area will be opened without permission of the Environmental Expert of Supervision Consultants. The location, shape and size of the designated borrow areas will be as approved by the Environmental Expert of IC and in accordance to the IRC recommended practice for borrow pits for road embankments (IRC 10: 1961). The borrowing operations will be carried out as specified in the	Clause No. 305.2.2 MORT&H Specifications for Road and Bridge works Guideline-II	Borrow Areas	Consessionaire / Contractor	Supervision Consultant, PIU

Sr. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning & Execution	Supervision/ Monitoring
		guidelines for siting and operation of borrow areas. The unpaved surfaces used for the haulage of borrow materials, if passing through the settlement areas or habitations; will be maintained dust free by the Consessionaire / Contractor . Sprinkling of water will be carried out twice a day to control dust along such roads during their period of use. During dry seasons (winter and summer) frequency of water sprinkling will be increased in the settlement areas and Environmental Expert of Supervision Consultants will decide the numbers of sprinkling depending on the local requirements. Consessionaire / Contractor will rehabilitate the borrow areas as soon as borrowing is over from a particular borrow area in accordance with the Guidelines for Redevelopment of Borrow Areas or as suggested by Environmental Expert of Supervision Consultants. The final rehabilitation plans will be approved by the EO from the Supervision Consultants.	(Guidelines for Borrow area management)			
C.2.2	Quarry Operations	The Consessionaire / Contractor shall obtain materials from quarries only after the consent of the Department of Mining / SPCB (both the states) / District Administration or will use existing approved sources of such materials. Copies of consent/ approval/ rehabilitation plan for opening a new quarry or use of an existing quarry source will be submitted to Environment Expert of Supervision Consultants and the Resident Engineer. The Consessionaire / Contractor will develop a Comprehensive Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy to PIU and Supervision Consultants prior to opening of the quarry site. The quarry operations will be undertaken within the rules and regulations in force in the state.	Clause No. 111.3 MORT&H Specifications for Road and Bridge works Guideline III (Guideline for Quarry Management)	Quarry Areas	Consessionaire / Contractor	Supervision Consultant, PIU
C.2.3	Transporting Construction Materials and Haul Road Management	Consessionaire / Contractor will maintain all roads (existing or built for the project), which are used for transporting construction materials, equipment and machineries as précised. All vehicles delivering fine materials to the site will be covered to avoid spillage of materials. All existing highways and roads used by vehicles of the Consessionaire / Contractor or any of his sub-Consessionaire / Contractor or suppliers of materials and similarly roads, which are part of the works, will be kept clear of all dust/mud or other extraneous materials dropped by such vehicles. Consessionaire / Contractor will arrange for regular water sprinkling as necessary for dust suppression of all such roads and surfaces with specific attention to the settlement areas.	Project Requirement	All Roads Used	Consessionaire / Contractor	Supervision Consultant, PIU

Sr. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning & Execution	Supervision/ Monitoring
		The unloading of materials at construction sites/close to settlements will be restricted to daytime only.				
C.2.4	Construction Water	Consessionaire / Contractor will arrange adequate supply and storage of water for the whole construction period at his own costs. The Consessionaire / Contractor will submit a list of source/s from where water will be used for the project to 'PIU' through the Engineer. The Consessionaire / Contractor will source the requirement of water preferentially from ground water but with prior permission from the Ground Water Board. A copy of the permission will be submitted to 'PIU' through the Engineer prior to initiation of construction. The Consessionaire / Contractor will take all precaution to minimize the wastage of water in the construction process/ operation.	Clause No. 1010 EP Act 1986 MORT&H Specifications for Road and Bridge works	Along the Project	Consessionaire / Contractor	Supervision Consultant, PIU
C.3						
C.3.1	Disruption to Other Users of Water	While working across or close to any perennial water bodies, Consessionaire / Contractor will not obstruct/ prevent the flow of water. Construction over and close to the non-perennial streams shall be undertaken in the dry season. If construction work is expected to disrupt users of community water bodies, notice shall be served well in advance to the affected community by the Consessionaire / Contractor . The Consessionaire / Contractor will take prior approval of the River Authority or Irrigation Department for any such activity. The PIU and the Engineer will ensure that Consessionaire / Contractor has served the notice to the downstream users of water well in advance.	Water Bodies along the corridor	All Water Bodies Used	Consessionaire / Contractor	Supervision Consultant, PIU
C.3.2	Drainage	Consessionaire / Contractor will ensure that no construction materials like earth, stone, ash or appendage is disposed off in a manner that blocks the flow of water of any water course and cross drainage channels. Consessionaire / Contractor will take all-necessary measures to prevent any blockage to water flow. In addition to the design requirements, the Consessionaire / Contractor will take all required measures as directed by the 'SUPERVISION CONSULTANTS' and the 'Resident Engineer' to prevent temporary or permanent flooding of the site or any adjacent area.	Clause No. 501.8.6 MORT&H Specifications for Road and Bridge works	Drainage line along the road	Consessionaire / Contractor	Supervision Consultant, PIU
C.3.3	Siltation of Water Bodies and Degradation of Water Quality	The Consessionaire / Contractor will not excavate beds of any stream/canals/ any other water body for borrowing earth for embankment construction. Consessionaire / Contractor will construct silt fencing at the base of the embankment construction for the entire perimeter of any water body (including wells) adjacent to the ROW and around the stockpiles at the construction sites close to water bodies. The fencing will be	Clause No. 501.8.6 MORT&H Specifications for Road and Bridge works Water (P & CP) Act 1981	All Surface Water Bodies Along the Road	Consessionaire / Contractor	Supervision Consultant, PIU

Sr. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning & Execution	Supervision/ Monitoring
		provided prior to commencement of earthwork and continue till the stabilization of the embankment slopes, on the particular sub-section of the road. The Consessionaire / Contractor will also put up sedimentation cum grease traps at the outer mouth of the drains located in truck lay byes and bus bays which are ultimately entering into any surface water bodies / water channels with a fall exceeding 1.5 m. in present case three Sedimentation Cum Grease Trap are proposed, However the item has been kept in case need arises during construction. Consessionaire / Contractor will ensure that construction materials containing fine particles are stored in an enclosure such that sediment-laden water does not drain into nearby watercourse.				
C.3.4	Slope Protection and Control of Soil Erosion	The Consessionaire / Contractor will take slope protection measures as per design, or as directed by the Environmental Expert of SC to control soil erosion and sedimentation. All temporary sedimentation, pollution control works and maintenance thereof will be deemed as incidental to the earth work or other items of work and as such as no separate payment will be made for them. Consessionaire / Contractor will ensure the following aspects: • During construction activities on road embankment, the side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and shrub as per design specifications. • Turfing works will be taken up as soon as possible provided the season is favorable for the establishment of grass sods. Other measures of slope stabilization will include mulching netting and seeding of batters and drains immediately on completion of earthworks. • In borrow pits, the depth shall be so regulated that the sides of the excavation will have a slope not steeper than 1 vertical to 2 horizontal, from the edge of the final section of the bank. • Along sections abutting water bodies, stone pitching as per design specification will protect slopes.	Clause No. 306 & 305.2.2 MORT&H Specifications for Road and Bridge works Guideline-IV (Soil Erosion & Sedimentation Control)	Along the Roads	Consessionaire / Contractor	Supervision Consultant, PIU
C.4						
C.4.1						
C.4.1.1	Water Pollution from Construction Wastes	The Consessionaire / Contractor will take all precautionary measures to prevent the wastewater generated during construction from entering into streams, water bodies or the irrigation system. Consessionaire / Contractor will avoid construction works close to the streams or water bodies during monsoon. All waste arising from the project is to be disposed off in the manner that is acceptable and as per norms of the State Pollution Control	Clause No. 501.8.6 MORT&H Specifications for Road and Bridge works Water (P & CP)	Along the road	Consessionaire / Contractor	Supervision Consultant, PIU

Sr. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning & Execution	Supervision/ Monitoring
		Board.	Act 1974			
C.4.1.2	Water Pollution from Fuel and Lubricants	The Consessionaire / Contractor will ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refueling sites will be located at least 500 m from rivers and irrigation canal/ponds. All location and layout plans of such sites will be submitted by the Consessionaire / Contractor prior to their establishment and will be approved by the 'SUPERVISION CONSULTANTS, PIU/ NHAI'. Consessionaire / Contractor will ensure that all vehicle/machinery and equipment operation, maintenance and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. Oil interceptors will be provided for vehicle parking, wash down and refueling areas as per the design provided. In all, fuel storage and refueling areas, if located on agricultural land or areas supporting vegetation, the top soil will be stripped, stockpiled and returned after cessation of such storage. Consessionaire / Contractor will arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites (list to be submitted to SC and PIU) and approved by the Environmental Expert of SC. All spills and collected petroleum products will be disposed off in accordance with MoEF and state PCB guidelines. 'SUPERVISION CONSULTANTS and Resident Engineer' will certify that all arrangements comply with the guidelines of PCB/ MoEF or any other relevant laws.	Clause No. 501.8.6 MORT&H Specifications for Road and Bridge works Water (P & CP) Act 1974	Along the Roads	Consessionaire / Contractor	Supervision Consultant, PIU
C.4.2						
C.4.2.1	Dust Pollution	The Consessionaire / Contractor will take every precaution to reduce the level of dust from crushers/hot mix plants, construction sites involving earthwork by sprinkling of water, encapsulation of dust source and by erection of screen/barriers. All the plants will be sited at least 1 km in the downwind direction from the nearest human settlement. The Consessionaire / Contractor will provide necessary certificates to confirm that all crushers used in construction conform to relevant dust emission control legislation. The suspended particulate matter value at a distance of 40m from a unit located in a cluster should be less than 500 g/m3. The pollution monitoring is to be conducted as per the monitoring plan. Alternatively, only crushers licensed by the SPCB shall be used. Required certificates and consents shall be submitted by the Consessionaire / Contractor in such a case to the 'EO-PIU' through the 'Engineer'.	Clause No. 111 & 501.8.6 MORT&H Specifications for Road and Bridge works Air (P & CP) Act 1981	Along the Roads, Construction Site/ Camps	Consessionaire / Contractor	Supervision Consultant, PIU

Sr. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning & Execution	Supervision/ Monitoring
		Dust screening vegetation will be planted on the edge of the RoW for all existing roadside crushers. Hot mix plant will be fitted with dust extraction units.				
C.4.2.2	Emission from Construction Vehicles, Equipment and Machineries	Consessionaire / Contractor will ensure that all vehicles, equipment and machinery used for construction are regularly maintained and confirm that pollution emission levels comply with the relevant requirements of SPCB. The Consessionaire / Contractor will submit PUC certificates for all vehicles/ equipment/machinery used for the project. Monitoring results will also be submitted to 'PIU' through the 'Engineer'.	Clause No. 501.8.6 MORT&H Specifications for Road and Bridge works Air (P & CP)Act 1981 Central Motor & Vehicle Act 1988	Along the Roads , all vehicles used/ Camps	Consessionaire / Contractor	Supervision Consultant, PIU
C.4.3						
C.4.3.1	Noise Pollution: Noise from Vehicles, Plants and Equipments	The Consessionaire / Contractor will confirm the following: • All plants and equipment used in construction shall strictly conform to the MoEF/CPCB noise standards. • All vehicles and equipment used in construction will be fitted with exhaust silencers. • Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced. • Limits for construction equipment used in the project such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB (A) (measured at one meter from the edge of equipment in the free field), as specified in the Environment (Protection) rules, 1986. • Maintenance of vehicles, equipment and machinery shall be regular to keep noise levels at the minimum. • At the construction sites within 150 m of the nearest habitation, noisy construction work such as crushing, concrete mixing, batching will be stopped during the night time between 9.00 pm to 6.00 am. No construction activities will be permitted around educational institutes/health centers (silence zones) up to a distance of 100 m from the sensitive receptors i.e., school, health centers and hospitals between 9.00 am to 6.00 pm. Monitoring shall be carried out at the construction sites as per the monitoring schedule and results will be submitted to 'EO PIU' through the 'Engineer'.	Clause No. 501.8.6 MORT&H Specifications for Road and Bridge works EP Act 1986 Noise Rules 2002	Along the Roads , all vehicles used/Camps	Consessionaire / Contractor	Supervision Consultant, PIU

Sr. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning & Execution	Supervision/ Monitoring
C.5						
C.5.1	Personal Safety Measures for Labour	Consessionaire / Contractor will provide: • Protective footwear and protective goggles to all workers employed on mixing asphalt materials, cement, lime mortars, concrete etc. • Welder's protective eye-shields to workers who are engaged in welding works • Protective goggles and clothing to workers engaged in stone breaking activities and workers will be seated at sufficiently safe intervals • Earplugs to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation. • Adequate safety measures for workers during handling of materials. • The Consessionaire / Contractor will comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress. The Consessionaire / Contractor will comply with all the precautions as required for ensuring the safety of the workmen as per the International Labor Organization (ILO) Convention No. 62 as far as those are applicable to this contract. The Consessionaire / Contractor will make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to. The Consessionaire / Contractor will not employ any person below the age of 14 years for any work and no woman will be employed on the work of painting with products containing lead in any form. The Consessionaire / Contractor will also ensure that no paint containing lead or lead products is used except in the form of paste or readymade paint. Consessionaire / Contractor will provide facemasks for use to the workers when paint is applied in the form of spray or a surface having lead paint dry is rubbed and scrapped. The Consessionaire / Contractor will mark 'hard hat' and 'no smoking' and other 'high risk' areas and enforce non-compliance of use of PPE with zero tolerance. These will be reflected in the Construction Safety Plan to be prepared by the Consessionaire / Contractor during mobilization and will be approved by 'SC' and 'PIU'.	The Building and Other Construction workers (Regulation of Employment and Conditions of Service) Act 1996 and cess Act of 1996 Factories Act 1948 During construction	Along the Roads , all vehicles used/Camps	Consessionaire / Contractor	Supervision Consultant, PIU
C.5.2	Traffic and Safety	The Consessionaire / Contractor will take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as	IRC: SP: 55	Along the Roads , all vehicles	Consessionaire / Contractor	Supervision Consultant, PIU

Sr. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning & Execution	Supervision/ Monitoring
		proposed in the Traffic Control Plan/Drawings and as required by the 'SUPERVISION CONSULTANTS' and 'Resident Engineer' for the information and protection of traffic approaching or passing through the section of any existing cross roads. The Consessionaire / Contractor will ensure that all signs, barricades, pavement markings are provided as per the MOSRT&H specifications. Before taking up of construction on any section of the existing lanes of the highway, a Traffic Control Plan will be devised and implemented to the satisfaction of 'SUPERVISION CONSULTANTS' and ' Resident Engineer'		used/Camps		
C.5.3	Risk from Electrical Equipment(s)	The Consessionaire / Contractor will take all required precautions to prevent danger from electrical equipment and ensure that - • No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. • All necessary fencing and lights will be provided to protect the public in construction zones. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the 'Resident Engineer'.	The Building and other construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996 Factories Act 1948	Along the Roads	Consessionaire / Contractor	Supervision Consultant, PIU
C.5.4	Risk Force Measure	The Consessionaire / Contractor will take all reasonable precautions to prevent danger to the workers and public from fire, flood etc. resulting due to construction activities. The Consessionaire / Contractor will make required arrangements so that in case of any mishap all necessary steps can be taken for prompt first aid treatment. Construction Safety Plan prepared by the Consessionaire / Contractor will identify necessary actions in the event of an emergency.	The Building and other construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996 Factories Act 1948	Along the Roads, construction Camps	Consessionaire / Contractor	Supervision Consultant, PIU

Sr. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning & Execution	Supervision/ Monitoring
C.5.5	First Aid	The Consessionaire / Contractor will arrange for - • a readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone • availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital • Equipment and trained nursing staff at construction camp.	The Building and other construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996 Factories Act 1948	Along the Roads, construction Camps	Consessionaire / Contractor	Supervision Consultant, PIU
C.5.6	Informatory Signs and Hoardings	The Consessionaire / Contractor will provide, erect and maintain informatory/safety signs, hoardings written in English and local language, wherever required as per IRC and MoSRT&H specifications.	IRC:SP:55	Along the Roads, construction Camps	Consessionaire / Contractor	Supervision Consultant, PIU
C.6						
C.6.1	Road side Plantation Strategy	The Consessionaire / Contractor will do the plantation at median and/or turfing at embankment slopes as per the tree plantation strategy prepared for the project. Minimum 80 percent survival rate of the saplings will be acceptable otherwise the Consessionaire / Contractor will replace dead plants at his own cost. The Consessionaire / Contractor will maintain the plantation till they handover the project site to NHAI. The Environmental Expert of SC will inspect regularly the survival rate of the plants and compliance of tree plantation guidelines.	Forest Conservation Act 1980	Along the Roads	Consessionaire / Contractor	Supervision Consultant, PIU
C.6.2	Flora and Chance found Fauna	The Consessionaire / Contractor will take reasonable precaution to prevent his workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal. If any wild animal is found near the construction site at any point of time, the Consessionaire / Contractor will immediately upon discovery thereof acquaint the Environmental Expert of IC and carry out the IC's instructions for dealing with the same. The Environmental Expert of SC will report to the near by forest office (range office or divisional office) and will take appropriate steps/ measures, if required in consultation with the forest officials.	Forest Conservation Act 1980 Wild Life Act 1972	Along the Roads	Consessionaire / Contractor	Supervision Consultant, PIU
C.6.3	Chance Found Archaeological Property	All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as per provisions of the relevant legislation. The Consessionaire / Contractor will take reasonable precautions to	The Ancient Monument and Archaeological Site Remains Act 1958	Along the Roads, construction sites/Camps	Consessionaire / Contractor	Supervision Consultant, PIU

Sr. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning & Execution	Supervision/ Monitoring
		prevent his workmen or any other persons from removing and damaging any such article or thing. He will, immediately upon discovery thereof and before removal acquaint the Environmental Expert of SC of such discovery and carry out the SC's instructions for dealing with the same, waiting which all work shall be stopped. The SC will seek direction from the Archaeological Survey of India (ASI) before instructing the Consessionaire / Contractor to recommence the work in the site.				
C.7						
C.7.1	Accommodation	Consessionaire / Contractor will follow all relevant provisions of the Factories Act, 1948 and the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labor camp. The location, layout and basic facility provision of each labor camp will be submitted to IC and 'EO-PIU' prior to their construction. The construction will commence only upon the written approval of the Environmental Expert of SC. The Consessionaire / Contractor will maintain necessary living accommodation and ancillary facilities in functional and hygienic manner and as approved by the SC.	The Building and other construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996 Factories Act 1948 Guideline I (Guidelines for Siting and Layout of construction camp)	Along the Roads, construction Camps/site	Consessionaire / Contractor	Supervision Consultant, PIU
C.7.2	Potable Water	The Consessionaire / Contractor will construct and maintain all labour accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing. The Consessionaire / Contractor will also provide potable water facilities within the precincts of every workplace in an accessible place, as per standards set by the Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996. The Consessionaire / Contractor will also guarantee the following: a) Supply of sufficient quantity of potable water (as per IS) in every workplace/labor campsite at suitable and easily accessible places and regular maintenance of such facilities. b) If any water storage tank is provided that will be kept such that the bottom of the tank at least 1mt. from the surrounding ground level. c) If water is drawn from any existing well, which is within 30mt. proximity of any toilet, drain or other source of pollution, the well will be disinfected before water is used for drinking.	The Building and other construction workers (Regulation of Employment and Conditions of Service) Act 1996 and Cess Act of 1996 Factories Act 1948	Along the Roads, construction Camps/construction site	Consessionaire / Contractor	Supervision Consultant, PIU

Sr. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning & Execution	Supervision/ Monitoring
		d) All such wells will be entirely covered and provided with a trap door, which will be dust proof and waterproof. e) A reliable pump will be fitted to each covered well. The trap door will be kept locked and opened only for cleaning or inspection, which will be done at least once in a month. Testing of water will be done as per parameters prescribed in IS 10500:1991.				
C.7.3	Sanitation and Sewage System	The Consessionaire / Contractor will ensure that - • the sewage system for the camp are designed, built and operated in such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place • separate toilets/bathrooms, wherever required, screened from those from men (marked in vernacular) are to be provided for women • adequate water supply is to be provided in all toilets and urinals All toilets in workplaces are with dry-earth system (receptacles) which are to be cleaned and kept in a strict sanitary condition. (annexure 9.3)	Project Specific Requirement	Along the Roads, construction Camps/Construction Sites	Consessionaire / Contractor	Supervision Consultant, PIU
C.7.4	Waste Disposal	The Consessionaire / Contractor will provide garbage bins in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as per the Comprehensive Solid Waste Management Plan approved by the Environmental Expert of SC. Unless otherwise arranged by local sanitary authority, arrangements for disposal of night soils (human excreta) suitably approved by the local medical health or municipal authorities or as directed by Environmental Expert of SC will have to be provided by the Consessionaire / Contractor .	Guidelines I (Guidelines for Siting and Layout of Labor Camp)	Along the Roads, construction Camps	Consessionaire / Contractor	Supervision Consultant, PIU
C.8						
C.8.1	Enhancement	The 'SUPERVISION CONSULTANTS' will contact the responsible people with the enhancement drawing of the site for which enhancement has been proposed and take their consent before the start of work. Accesses to Different Schools along the road will be developed to the satisfaction of 'PIU'.		Along the Roads	Consessionaire / Contractor	Supervision Consultant, PIU
C.9						
C.9.1	Clean-up Operations, Restoration and Rehabilitation	Consessionaire / Contractor will prepare site restoration plans, which will be approved by the Environmental Expert of SC. The clean-up and restoration operations are to be implemented by the Consessionaire / Contractor prior to demobilization. The Consessionaire / Contractor will clear all temporary structures; dispose all garbage, night soils and POL waste as per Comprehensive Waste Management Plan and as approved by SC.		Along the Roads, construction Camps	Consessionaire / Contractor	Supervision Consultant, PIU

Sr. No.	Environmental Issue	Management Measures	Reference	Location	Responsibility	
					Planning & Execution	Supervision/ Monitoring
		All disposal pits or trenches will be filled in and effectively sealed off. Residual topsoil, if any will be distributed in pre identified approved areas or in places suggested by the Environmental expert of Supervision Consultant. All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, at the Consessionaire / Contractor 's expense, to the entire satisfaction to the Environmental Expert of SC.and PIU/ NHAI will certify in this regard.				

Table 9.2: Activities during Operation Stage

Sr. No.	Environmental Issue	Management Measures	Reference	Time Frame	Location	Responsibility	
						Execution/ Civil Work	Supervision/Monitoring
OPERATION STAGE							
Activities to be Carried Out by the PIU							
O.1	Monitoring Operation Performance	The PIU will monitor the operational performance of the various mitigation/ enhancement measures carried out as a part of the project. The indicators selected for monitoring include the survival rate of trees; utility & enhancement provision, status of rehabilitation of borrow areas and disposal sites.	-	Operation Phase	Along the Road	PIU	PIU
O.2	Maintenance of Drainage	PIU will ensure that all drains (side drains, median drain and all cross drainages) are periodically cleared especially before monsoon season to facilitate the quick passage of rainwater and avoid flooding. PIU will ensure that all the sediment and oil and grease traps set up at the water bodies are cleared once in every three months.		Operation Phase	Along the Road	PIU	PIU

Sr. No.	Environmental Issue	Management Measures	Reference	Time Frame	Location	Responsibility	
						Execution/ Civil Work	Supervision/Monitoring
O.3	Pollution Monitoring	The periodic monitoring of the ambient air quality, noise level, water (both ground and surface water) quality, soil pollution/contamination in the selected locations as suggested in pollution monitoring plan will be responsibility of PIU. PIU will either appoint PCB or its approved pollution-monitoring agency for the purpose.		Operation Phase	Along the Road	PIU through Pollution Monitoring Agency	PIU
O.3.1	Atmospheric Pollution	Ambient air concentrations of various pollutants shall be monitored as envisaged in the pollution-monitoring plan	Air (P & CP) Act 1981	Operation Phase	Along the Road	PIU through Pollution Monitoring Agency	PIU
O.3.2	Noise Pollution	Noise pollution will be monitored as per monitoring plan at sensitive locations. Noise control programs are to be enforced strictly. Monitoring the effectiveness of the pollution attenuation barriers.	Noise Rules 2002	Operation Phase	Along the Road	PIU through Pollution Monitoring Agency	PIU
O.3.3	Water Pollution	Water Quality will be monitored as per monitoring plan	Water (P & CP) Act 1974	Operation Phase	Along the Road	PIU through Pollution Monitoring Agency	PIU
O.4.	Soil Erosion and Monitoring of Borrow Areas	Visual monitoring and inspection of soil erosion at borrow areas, quarries (if closed and rehabilitated), embankment > 2m. and other places expected to be affected, will be carried out once in every three months as suggested in monitoring plan.		Operation Phase	Along the Road	PIU	PIU
O.5	Road Safety	Road Safety will be monitored during operation especially at location where traffic-calming measures have been proposed.		Operation Phase	Along the Road	PIU	PIU

10. *Environmental Monitoring Plan*

The purpose of the monitoring programme is to ensure that the envisaged purpose of the project is achieved and results in desired benefits of the target population. To ensure effective implementation of EMP, an effective monitoring program is essential. It provides basis for evaluating the efficiency of mitigation and enhancement measures and suggest further actions that need to be taken to achieve the desired effect.

The monitoring includes: Visual observations; Selection of environmental parameters at specific locations; Sampling and regular testing of these parameters.

Objectives: The Objectives of environmental monitoring programme are: Evaluation of the efficiency of mitigation and enhancement measures; Updating of the actions and impacts of baseline data; Adoption of additional mitigation measures if the present measures are insufficient; Generating the data, which may be incorporated in environmental management plan in future projects.

Methodology: Monitoring methodology covers the following key aspects: Components to be monitored; Parameters for monitoring of the above components; Monitoring frequency; Monitoring standards; Responsibilities for monitoring; Monitoring costs.

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

10.1 AMBIENT AIR QUALITY MONITORING (AAQM)

The air quality parameters viz: Sulphur Dioxide (SO_2), Oxides of Nitrogen (NO_X), Carbon Monoxide (CO), Particulate Matter (PM 10) shall be regularly monitored at identified locations from the start of the construction activity. The air quality parameters shall be monitored in accordance with the National Ambient Air Quality Standards as given in Table 10.1. The location, duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan Table 10.5.

Table 10.1: National Ambient Air Quality Standards

Pollutants	Time weighted	Ecological Sensitive Area (Certified by Central Govt.)	Industrial, Residential, Rural & other Area	Method of Measurement
Sulphur Dioxide (SO_2) µg/m3	Annual*	20 µg/m^3	50 µg/m^3	Improved West and Gaeke method
	24 hours**	80 µg/m^3	80 µg/m^3	Ultraviolet fluorescence
Nitrogen Dioxide (NO_x) µg/m3	Annual	30 µg/m^3	40 µg/m^3	Jacob and Hochheiser modified (Na-Arsenite)
	24 hours**	80 µg/m^3	80 µg/m^3	Gas phase chemiluminescence
Carbon Monoxide (CO)	8 hours**	2000 µg/m^3	2000 µg/m^3	Non dispersive infrared spectroscopy
	1 hour	4000 µg/m^3	4000 µg/m^3	
Particulate Matter	Annual*	60 µg/m^3	60 µg/m^3	- Gravimetric
Size less than l0 µm or PM10	24 hours**	100 µg/m^3	100 µg/m^3	- TOEM - Beta attenuation
Particulate Matter	Annual	40 µg/m^3	40 µg/m^3	- Gravimetric
Size less than 2.5 µm or PM2.5	24 hours	60 µg/m^3	60 µg/m^3	- TOEM - Beta attenuation

Source: *National Ambient Air Quality Monitoring Series NAQMS/a/Nov 2009, Central Pollution Control Board, Delhi/ MoEF.*

** Average Arithmetic mean of minimum l04 measurements in a year taken for a week 24 hourly at uniform interval.*

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

10.2 WATER QUALITY MONITORING

Water quality parameters such as pH, BOD, COD, DO, coli form count, total suspended solids, total dissolved solids, lead, Cadmium, Zinc etc. shall be monitored at all identified locations during the construction stage as per standards prescribed by Central Pollution Control Board and Indian Standard Drinking water specifications IS 10500, 1991, presented in Table 10.2 and 10.3 respectively. The location, duration and the pollution parameters to be monitored and the responsible institutional arrangements are detailed out in the Environmental Monitoring Plan Table 10.5.

Table 10.2: Primary Water Quality Standards

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

Refer: *CPCB (l999). Bio-mapping of rivers. Parivesh New Letter, 5 (iv), Central Pollution Control Board, Delhi, PP.20*

Table 10.3: Indian Standard Drinking Water Specifications IS: 10500

Sr.	Substance or Characteristics	Requirement (desirable limit)	Undesirable effect outside the desirable limit	Permissible limit in the absence of alternate source	Methods of test (ref. To IS)	Remarks
Essential Characteristics						
1.	Colour, Hazen Units, Max.	5	Above 5, consumer acceptance decreases	25	3025 (part4) 1983	Extended to 25 only if toxic substances, in absence of alternate sources.
2.	Odour	Unobjectionable	-	-	3025 (parts 5): 1984	A test cold and when heated Test at several dilution
3.	Taste	Agreeable	-	-	3025 (part 8): 1984	Test to be conducted only after safety has been established

Sr.	Substance or Characteristics	Requirement (desirable limit)	Undesirable effect outside the desirable limit	Permissible limit in the absence of alternate source	Methods of test (ref. To IS)	Remarks
4.	Turbidity NTU, Max.	5	Above 5, consumer acceptance decreases	10	3025 (part 7): 1984	
5	P^H value	6.5 to 8.5	Beyond this range the water will affect the mucous membrane and /or water supply system	No relaxation	3025 (part 11): 1984	
6.	Total hardness (as $CaCo_3$) mg/l, Max.	300	Encrustation in water supply structures an adverse effect on domestic use	600	3025 (part 21): 1983	
7.	Iron (as Fe) mg /l Max.	0.3	Beyond this limit taste/appearance are affected has adverse effect on domestic uses and water supply structures and promotes iron bacteria	1.0	3025 (part 21): 1983	
8.	Chlorides (as Cl) mg/l Max.	250	Beyond this limit, taste corrosion and palatability are affected	1000	3025 (part 32): 1988	
	Residual, free chloride, mg/l Min.	0.2			3025 (part 26): 1986	To be applicable only when water is chlorinated. Tested at consumer end. When protection against viral infection is required, it should be Min. 0.5 mg/l
Desirable characteristics						
I.	Dissolved solids mg/l Max.	500	Beyond the palatability decreases and may cause gastro intestinal irritation	2000	3025 (part 16): 1986	
2.	Calcium (as Ca) mg/l Max.	75	Encrustation in water supply structure and adverse effects on domestic use	200	3025 (Part 16) 1986	
3.	Magnesium (as Mg) mg/l, Max.	30	Encrustation in water supply structure and adverse effects on domestic use	1.5	16,33,34 of IS 3025: l964	
4.	Copper (as Cu) mg/l Max.	0.05	Beyond taste, discoloration of pipes, fitting and utensils will be caused beyond this	0.3	35 of 3025: 1964	
5.	Manganese (as Mn) mg/l, Max.		Beyond this limit taste/appearance are affected, has adverse effect on domestic uses and water supply structures.	0.3	35 of 3025: 1964	
6.	Sulphate (as 200 So_2), mg/l, Max.	200	Beyond this causes gastro intestinal irritation when magnesium or sodium are present	400	3025 (part 24):l986	May b extended up to 400 provided (as Mg) does not exceed 30

Sr.	Substance or Characteristics	Requirement (desirable limit)	Undesirable effect outside the desirable limit	Permissible limit in the absence of alternate source	Methods of test (ref. To IS)	Remarks
7.	Nitrate (as No_2) mg/l, Max.	45	Beyond this methamoglobunemia take place	100	3025 (part24): 1988	To be tested when pollution is suspected
8	Fluoride (as F) mg/l, Max.	1.0	Fluoride may be kept as low as possible. High fluoride may cause fluorosis	1.5	23 of 3025:1964	To be tested when pollution is suspected
9	Phenolic compounds (as C_6H_5OH) mg/l, Max.	0.001	Beyond this it may cause objectionable taste and odour	0.002	54 of 3025:1964	To be tested when pollution is suspected
10	Mercury (as Hg) mg/l, Max.	0.001	Beyond this the water becomes toxic	No relaxation	(See not mercury ion analyzes)	To be tested when pollution is suspected
11	Cadmium (as cd), mg/l, Max.	0.01	Beyond this the water becomes toxic	No relaxation	(See note)	To be tested when pollution is suspected
12	Selenium, (as Se). mg/l, Max.	0.01	Beyond this the water becomes toxic	No relaxation	28 of 3025:1964	To be tested when pollution is suspected
13	Arsenic (As) mg/l, Max.	0.05	Beyond this the water becomes toxic	No relaxation	3025 (part 37); 1988	To be tested when pollution is suspected
14	Cyanide (as CN) mg/l, Max.	0.05	Beyond this the water becomes toxic	No relaxation	3025 (part 27) 1988	To be tested when pollution is suspected
15	Lead (as Pb), mg/l, Max.	0.05	Beyond this the water becomes toxic	No relaxation	(See note)	To be tested when pollution is suspected
16	Zinc (as Zn) mg/l, Max.	5	Beyond this limit it can cause astringent taste and an opalescence taste and an opalescence in water	15	39 of 3025:l964	To be tested when pollution is suspected
17	Anionic detergents (as MBAS) mg/l, Max.	0.2	Beyond this it can cause a light froth in water	1.0	Methylene-blue extraction method	To be tested when pollution is suspected
18	Chromium (as Cr^{6}+) mg/l, Max.	0.05	May be carcinogenic above this limit	No relaxation	38 of 3025:l964	To be tested when pollution is suspected
19	Pesticides mg/l, Max.	Absent	Toxic	0.001	-	-
20	Aluminum (as Al) mg/l, Max.	200	Beyond this limit taste becomes unpleasant	600	13of3025: 1964	-
21	Aluminum (as Al) mg/l, Max.	0.03	Cumulate effect is reported to cause dementia	0.2	31of 025: 1964	-
22	Boron mg/l, Max.	1.0	-	5	29of3029: 1964	-

10.3 NOISE QUALITY MONITORING

As with air and water quality, the noise levels shall be monitored at already designated locations in accordance with the Ambient Noise Quality standards given in Table 10.4 below. The location, duration and the noise pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan Table 10.5

Table 10-4: National Ambient Noise Quality Standards

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

** Day Time – 6.00 am – 9.00 pm (l5 hours)*

*** Night Time – 9.00 pm – 6.00 am (9 hours*)

10.4 ENVIRONMENTAL MONITORING PLAN

Monitoring plan for various performance indicators for construction and monitoring stages is summarized in Table 10.5 below:

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Measures	Institutional Responsibility	
									Implimentation	Supervision
Air	Construction	,PM, SPM, RPM, SO_2, NOX, CO & Pb.	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, 2009	Once every season for three seasons (except monsoons) per year for each year of Construction	Continuous 24 hours/ or for 1 full working day	(i) Wherever the contractor decides to locate the Hot mix plant (ii) At critical stretches as indicated in Table 4.10	Wherever air pollution parameters increase above specified standards, additional measures as decided by the Engineer shall be adopted	Consessionaire / Contractor through approved monitoring agency	Engineer / PIU
	Operation	SPM, RPM, SO_2, NOx, CO & HC.	Respirable Dust Sampler / 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	Once every year for winter season for five years after completion of construction activity.	Continuous 24 hours	(i) At critical stretches as indicated in Table 4.10	Wherever air pollution parameters increase above specified standards, additional measures as decided by the Engineer shall be adopted	Consessionaire / Contractor through approved monitoring agency	PIU
Water	Construction	(i) pH, BOD,COD, TDS, Pb, Oil & Grease and Detergents for Surface (ii) Water pH, TDS, Total Hardness, Sulphate, Chloride, Fe, Pb for Ground Water	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)	Twice a year (Pre mons oon and Post monsoon seasons) for each year during the Construction Period	Grab Sampling	At all locations as indicated in Table 4.10	pollution, all inflow channels shall be checked for pollution loads and channel delivering higher pollution load shall be terminated from disposal into the water source and other	Consessionaire / Contractor through approved monitoring agency	Independent Engineer / PIU

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Measures	Institutional Responsibility	
									Implimentation	Supervision
Noise	Construction	Noise levels on dB (A) scale Noise levels on dB (A) scale	Free field at 1 m from the equipment whose noise levels are being determined.	MoEF Noise Rules, 2000	Once every season (except monsoons) for each year of Construction	Readings to be taken at 15 seconds interval for 15 minutes every hour and then averaged.	Wherever the contractor decides to locate the Equipment yard	Incase of noise levels causing disturbance to the sensitive receptors, height of boundary wall of receptor to be increased	Consessionaire / Contractor through approved monitoring agency	Independent Engineer / PIU
		Noise levels on dB (A) scale 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	MoEF Noise Rules, 2000	Once every season (except monsoons) for each year of Construction	Readings to be taken at 15 seconds interval for 15 minutes every hour and then averaged.	At critical stretches as indicated in Table 9.6		Consessionaire / Contractor through approved monitoring agency	Independent Engineer / PIU
	Operation	Noise levels on dB (A) scale 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	MoEF Noise Rules, 2000	Once every season (except monsoons) for five year after completion of construction activity.	Readings to be taken at 15 seconds interval for 15 minutes every hour and then averaged.	At all the critical receptors as mentioned in Table 9.6(ii) Additional sites will be monitored. The location will be decided by the PIU (EC).	Incase of noise levels causing disturbance to the sensitive receptors, double-glazing of openings of the receptor shall be provided.	Consessionaire / Contractor , through an approved monitoring agency	PIU
Soil	Construction	Monitoring after any major accidents / spillage during bulk transport of hazardous material. Depending on the type of spillage/accident the parameters to be monitored will be decided by the Engineer apart from those mentioned above.							Consessionaire / Contractor through approved monitoring agency	Independent Engineer / PIU

Table 10.6: List of Monitoring Stations

A. Ambient Air & Noise Locations -

Sr. No.	Place	Chainage
1	Village- Kalyanpura	0+800
2	Village -Maessewal (Near School)	4+600
3	Village - Gara and Maura (Near Toll plaza, Punjab and Himachal Pradesh Border)	8+800
4	Village - Kanchi More	12+700
5	Village-Mehla	15+100
6	Village-Bharadi (Near Crane)	26+462

B. Ground Water Locations -

Sr. No.	Place	Chainage
1	Village-Kalyanpura near Kiratpur	0+800
2	Village - Kanchi More	12+700
3	Village-Bharadi	26+462

C. Surface Water Locations -

Sr. No.	Place	Chainage
1	Village-Bharadi (Govind Sagar Lake)	26+462
2	Village Tunnu (Gumbhar Khud)	23+200
3	Village Kalyanpur (Bhakra Canal)	0+500

D. Soil Testing Locations -

S. No.	Place	Chainage
1	Village – Bharadi	26+462
2	Village – Kalyanpur	0+800

11. *Compliance of ToR*

In item No. 4.32 the proposal -Finalisation of ToR for 2 lanning with paved shoulder of Kiratpur - Bilaspur Section of NH-21 in the States of Punjab/Himachal Pradesh by M/s NHAI [F.No. 10-118/2011-IA-III], may be read as Finalisation of ToR for widening and improvement of existing 2 lane with paved shoulder to 4 lane.

Comments & Compliances of TOR

Sr. No.	Comments	Compliances
1.	The project required 3 tunnel of 1.75, 0.65 and 0.394 km. The project required 4 tunnels of 2.84 km. examine and submit the stability of slopes, control of soil erosion from embankment, the details of the tunnel and locations of tunneling with geological structural fraction.	Compliance of comments have been incorporated in Chapter four in section 4.3.1.3
2.	Examine and submit the details of Ventilation, drainage, Noise and vibration management measures in the tunnel area.	Details of noise prediction during construction and post construction period have been analysed. The details impact and mitigation measure for noise and vibration have been incorporated in Chapter five and EMP. This points are elaborately discussed in section 7.1.2.2, 7.1.5, 8.6
3.	The proposal requires 17.31 ha Protected forest land. Necessary Stage-I permission for diversion of forest area shall be submitted.	Forest diversion proposal is under preparation
4.	It is indicated that 2035. nos. trees are proposed to be cut, the information should be provided about their species and whether it also involved any protected or endangered species. Necessary green belt shall be provided on both side of the highway with proper central verge and cost provision should be made for regular maintenance.	Points are taken consideration and details are furnished in annexure 4.2
5.	The additional ToR and General Guidelines as per the annexure-I and Annexure-II respectively to this Minutes shall also be considered for preparation of EIA/EMP.	As per Annexure I and Annexure II of WEIA Guidelines EIA has been prepared and EMP has also bee4n prepared
6.	Submit the details of the road safety audit and plans for meeting the IRC safety requirements.	The details are furnished in annexure 9.3
7.	Examine and submit a brief description of the project, project name, nature, size, its importance to the region/state and the country.	Compliance of comments have incorporated in Chapter one
8.	Any litigation(s) pending against the proposed project and/or any directions or orders passed by any court of law/any statutory authority against the project is to be detailed out.	No, there is no any litigation pending in road corridor.

Sr. No.	Comments	Compliances
9.	Submit detailed alignment plan, with details such as nature of terrain (plain, rolling, hilly), land use pattern, habitation, cropping pattern, forest area, environmentally sensitive places, mangroves, notified industrial areas, sand dunes, sea, river, lake, details of villages, tehsils, districts and states, latitude and longitude for important locations falling on the alignment by employing remote sensing techniques followed by ground truthing and also through secondary data sources.	Alignment plan is attached in chapter four. Terrain, landuse, habitation, cropping pattern, forest area and other features are showing in maps in Chapter four.
10.	Describe various alternatives considered, procedures and criteria adopted for selection of the final alternative with reasons.	Total number of two alternatives has been considered to align the project road. Out of total five major alignments has been. Alternative option has been described in chapter five.
11.	Submit Land use map of the study area to a scale of 1: 25,000 based on recent satellite imagery delineating the crop lands (both single and double crop), agricultural plantations, fallow lands, waste lands, water bodies, built-up areas, forest area and other surface features such as railway tracks, ports, airports, roads, and major industries etc. and submit a detailed ground surveyed map on 1:2000 scale showing the existing features falling within the right of way namely trees, structures including archaeological & religious, monuments etc. if any.	Fallow lands, waste lands, water bodies, build up area, forest area, surface features like railways, ports, airports, roads and major industries are also showing in map in chapter five. Descriptions of cropping pattern are dealt in Chapter five. Satellite imagery procurement is under process. after receiving of imagery details land use map will be furnished.
12.	Study regarding the Animal bypasses/underpasses etc. across the habitation areas shall be carried out. Adequate cattle passes for the movement of agriculture material shall be provided at the stretches passing through habitation areas.	Points are taken consideration in chapter one.
13.	The proposed route is passing through a city/ town, with houses and human habitation on the either side of the road, the necessity for provision of bypasses/diversions/under passes shall be examined and submitted. The proposal should also indicate the location of wayside amenities, which should include petrol station/service centre, rest areas including public conveyance etc.	Points are taken in consideration in chapter one.
14.	Submit details about measures taken for the pedestrian safety and construction of underpasses and foot-over bridges along with flyovers and interchanges.	Safety measures are addressed in chapter eight.
15.	Assess whether there is a possibility that the proposed project will adversely affect road traffic in the surrounding areas (e.g. by causing increases in traffic congestion and traffic accidents).	Accident data has been furnished in Chapter One and mitigation measure has been adopted in designing.
16.	Examine and submit the details of sand quarry, borrow area and rehabilitation.	Details of sand quarry and borrow area location is listed in Chapter four and rehabilitation plan is elaborated in EMP.

Sr. No.	Comments	Compliances
17.	Climate and meteorology (max and min temperature, relative humidity, rainfall, frequency of tropical cyclone and snow fall); the nearest IMD meteorological station from which climatological data have been obtained to be indicated.	The detail is furnished in chapter four.
18.	The air quality monitoring should be carried out as per the new notification issued on 16th November, 2009.	Baseline monitoring has been conducted as per notification
19.	Identify project activities during construction and operation phases, which will affect the noise levels and the potential for increased noise resulting from this project. Discuss the effect of noise levels on nearby habitation during the construction and operational phases of the proposed highway. Identify noise reduction measures and traffic management strategies to be deployed for reducing the negative impact if any. Prediction of noise levels should be done by using mathematical modeling at different representative locations.	Noise model has been computed
20.	Examine the impact during construction activities due to generation of fugitive dust from crusher units, air emissions from hot mix plants and vehicles used for transportation of materials and prediction of impact on ambient air quality using appropriate mathematical model, description of model, input requirement and reference of derivation, distribution of major pollutants and presentation in tabular form for easy interpretation shall be carried out.	Air model has been computed
21 .	Also examine and submit the details about the protection to existing habitations from dust, noise, odour etc. during construction stage.	Under Environmental Management Plan these points are elaborately discussed.
22.	If the proposed route involves cutting of earth, the details of area to be cut, depth of cut, locations, soil type, volume and quantity of earth and other materials to be removed with location of disposal/dump site along with necessary permission.	The proposed route is involved the earthwork. The detail quantum of earthwork and, depth, location, soil types and other needful material details are described in chapter four
23.	If the proposed route is passing through low lying areas, details of fill materials and initial and final levels after filling above MSL, should be examined and submit.	Proposed route is not passing any low lying area. There is no involvement of filling.
24.	Examine and submit details of water quantity required and source of water.	The water requirement during construction phase would be met by digging fresh bore wells at or near camp site for drinking purpose The details has been furnished in chapter four.

Sr. No.	Comments	Compliances
25.	Examine and submit the details of measures taken during constructions of bridges across river/canal/major or minor drains keeping in view the flooding of the rivers and the life span of the existing bridges. Provision of speed breakers, safety signals, service lanes and foot paths should be examined at appropriate locations throughout the proposed road to avoid the accidents.	Details is furnished in chapter one and eight
26.	If there will be any change in the drainage pattern after the proposed activity, details of changes shall be examined and submitted.	There is no alteration of drainage.
27.	Rain water harvesting pit should be at least 3 - 5 m. above the highest ground water table. Provision shall be made for oil and grease removal from surface runoff.	The comment is considered in designing.
28.	If there is a possibility that the construction/widening of road will cause impact such as destruction of forest, poaching, reductions in wetland areas, if so, examine the impact and submit details.	There is no reserved forest area. Tree enumeration in forest stretch is under process.
29.	Submit the details of road safety, signage, and service roads, vehicular under passes, accident prone zone and the mitigation measures.	Environmental Management Plan has detailed out the road safety measures, signage and service roads options. The detail plan and cross section on chapter two shows the option of service roads. The details of vehicular underpass, accident prone area and other safety measure address in chapter eight.
30.	IRC guidelines shall be followed for widening & up-gradation of road.	IRC guidelines have been addressed for widening of existing road from Kiratpur to Kanchimore NH 21 road.
31.	Submit details of social impact assessment due to the proposed construction of road.	SIA report is enclosed in chapter four
32.	Examine road design standards, safety equipment specifications and Management System training to ensure that design details take account of safety concerns and submit the traffic management plan. Road safety audit shall be carried out and report shall be submitted to the Ministry.	Lane marking as per IRC 35 guideline. Signage marks as per IRC 67 guideline Provision of bus bays & truck parking areas.
33.	Accident data and geographic distribution should be reviewed and analyzed to predict and identify trends? In-case of expansion of the existing highway and provide Post accident emergency assistance and medical care to accident victims.	There is no accident or fatal injury record in project stretch. Still safety measures are addressed in designing.
34.	If the proposed project involves any land reclamation, details to be provided for which activity land to reclaim and the area of land to be reclaimed.	No land reclamation work is involved.
35.	Details of the properties, houses, businesses etc. activities likely to be effected by land acquisition and their financial loses annually.	Details are furnished in chapter four

Sr. No.	Comments	Compliances
36.	Detailed R&R plan with data on the existing socio-economic status of the population in the study area and broad plan for resettlement of the displaced population, site for the resettlement colony, alternative livelihood concerns/employment and rehabilitation of the displaced people, civil and housing amenities being offered, etc and the schedule of the implementation of the project specific.	The all points are addressed in chapter four
37.	Submit details of Corporate Social Responsibility. Necessary provisions should be made in the budget.	Corporate social responsibility has been considered to the extent possible within project limits. Important religious structures will be relocated in areas proposed by the locals during public consultation. The cost of these measures has been considered in environmental & social aspect.
38.	Estimated cost of the project including environmental monitoring cost and funding agencies, whether governmental or on the basis of BOT etc and provide details of budget provisions (capital & recurring) for	The details environmental budget has been worked out and furnished in EMP report. R&R cost has also been worked out and furnished in also EIA & EMP report