NATIONAL HIGHWAYS & INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.
(MINISTRY OF ROAD TRANSPORT & HIGHWAYS, GOVT. OF INDIA)
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NHIDCL
BUILDING INFRASTRUCTURE - BUILDING THE NATION

Consultancy Services for Feasibility Study, Preparation of Detailed Project Report and providing Pre-Construction Services for upgradation to 2 lane with paved shoulder from (i) Km 44.500 to Km 142.000 of Chattroo Village & (ii) Km 235.000 (Vailoo Village) to Km 269.000 (Khanabal) of Khellani – Kishtwar – Chattroo - Khanabal Section of NH 244 in the state of Jammu and Kashmir.

DETAILED PROJECT REPORT

KHELLANI TO CHATTROO SECTION

Volume – I : Main Report

Package-I from Design CH. Km 31+449 to Km 51+700 =20.251 km

December 2020

Rodic Consultants Pvt. Ltd.
In JV with
Monarch Surveyors and Engineering Consultants Pvt. Ltd

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Detailed Project Report

Main Report

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0.0 Executive Summary

0.1 Introduction

National Highways & Infrastructure Development Corporation Limited (NHIDCL), Ministry of Road, Transport & Highways, Govt. of India has been assigned **M/S Rodic Consultants Pvt. Ltd., New Delhi** in joint venture with **M/S Monarch Surveyors and Engineering Consultant Pvt. Ltd.** as Consultants to carry out the "Consultancy Services for Feasibility Study, Preparation of Detailed Project Report and providing Pre-Construction Services for upgradation to 2 lane with paved shoulder from (i) Km 44.500 to Km 142.000 of Chattroo Village & (ii) Km 235.000 (Vailoo Village) to Km 269.000 (Khanabal) of Khellani – Kishtwar – Chattroo - Khanabal Section of NH 244 in the state of Jammu and Kashmir.

The agreement was signed on 4th June 2019.

This report deals with Khellani- Kishtwar – Chattroo section, where according to contract the stretch of project road is from Ex. Km. 44.500 (i.e. End of Goha -Khellani Section) to Km. 140+870 (i.e. Start of the Vailoo Tunnel section) with total existing length of 96.370 Km. The project road starts from Khellani and passes through Pul Doda, Premnagar, New Thatri, Kishtwar and terminates near Chattroo on NH-244.

The project has been divided into five packages which are as follows:

Package-I from Design CH. Km 31+449 to Km 51+700 =20.251 km

Package-II from Design CH. Km 51+700 to Km 66+535 =14.835 km

Package-III from Design CH. Km 67+805 to Km 80+675=12.870 km

Package-IV from Design CH. Km 80+675 to Km 95+550 (Kishtwar Bypass) =14.875 km

A Link Road (To connect the Kishtwar town) of length 1.871 Km.

Package-V from Design CH. Km 95+550 to Km 111+066 =15.516 km

NOTE : This report deals with the details of Package-I from Design Ch. Km 31+449 to Km 51+700 =20.251 km.

0.2 Project Overview

The project road lies on NH-244 (previously NH-1B) and connects Khellani to Chhatroo in the Union Territory of Jammu & Kashmir. The proposed alignment of project road passes through Khellani, Pul Doda, Kishtwar and Chhatroo with a total existing length of 96.370 kms. This project road passes through Puldoda, Premnagar, Thathri, Kisthwar, Poochal and Chattroo village. Location of project road is shown in the **Fig. 0.1** below.

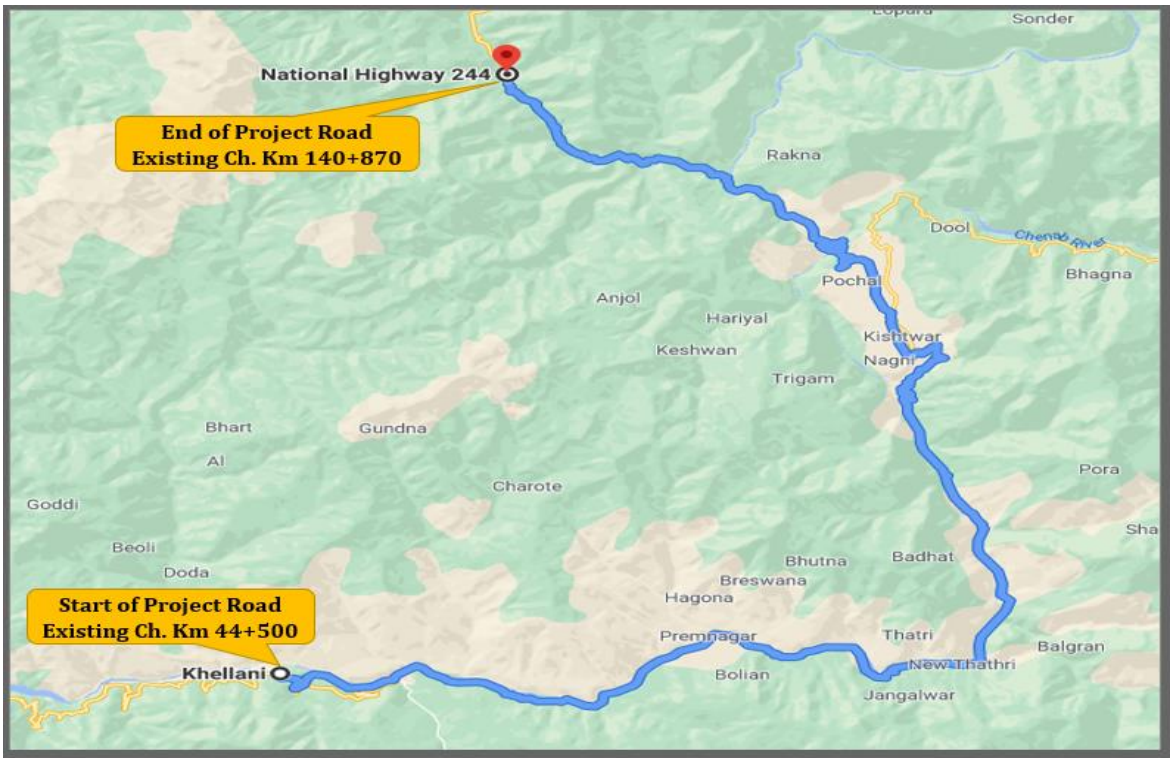


Figure 0.1: Location of Project road

0.3 Key Features of project

Key features of project road are represented in **Table1.**

Attributes	**Details**
NH No.	244
Origin – Destination	Khellani (33° 7.935'N and 75° 31.108'E) - Chhatroo (33° 26.351'N and 75° 36.266'E)
Districts Towns	Doda & Kishtwar Prem Nagar, New Thatri, Kishtwar & Chhatroo
Existing Carriageway	Varying from Single lane, Intermediate Lane, 2 lane to 10 m in Kishtwar town
Service lanes and slip road	Nil
Shoulder	1 m to 2 m
Condition of Existing Pavement	Poor to fair
Right of Way	Varying from 6- 12 m
Land Use along project road	Built up, Agricultural and hilly
Traffic on the stretch	2528 AADT PCU, (Year 2019)
Existing Structures along the stretches	Major Bridge: 1 No Minor Bridge: 3 Nos Culvert: 66 Nos
Terrain	Hilly
Existing Toll Plaza	Nil
Bus Stops	A total of 9 nos. of Bus stops are present along the project stretch.
Key utilities in the proposed ROW	Electric poles & water pipeline etc.
Forest stretches along RoW	Yes
Rail Crossing along RoW	Nil
Other clearance related aspects	Forest Clearance, Utilities.

0.4 Project Description

The entire project road (Khellani - Chhatroo) lies in the UT of Jammu and Kashmir. The project road of Khellani - Chhatroo is part of NH-244 (Old NH-1B) which runs from Batote to Khanabal via Khellani, Thatri, Kishtwar, Sinthan-Top, Vailoo, Achabal and Anantnag. The Project Road is situated in Doda and Kishtwar districts located at southern part of newly formed UT of Jammu and Kashmir. The project road stretch goes towards east from Khellani and turns north from New Thathri and finally ends near Chhatroo traversing through Kishtwar.

As per contract, the Project Road starts from existing Km 44.500 near Khellani and passes through Gangalwar, Bhuta, Suigwari, Nai Basti, Premnagar, Thatri, Darabshalla, Kandiri, Kishtwar, Marwah, Kodia, Dhadhpeth, Mughal Maidan, and Udil Gurjan and terminates at existing Km 142.000 near Chhatroo in the UT of Jammu & Kashmir.

The project road of Khellani – Chhatroo coincides with the other two DPRs. One is at its starting and another at the end point. The project's starting point coincides with the end point of Goha – Khellani tunnel project i.e. Ex Ch. 44+500 and the project's end point coincides with the starting point of approach of Vailoo tunnel project i.e. Ex Ch. 140+870. So, we have considered these two locations as our starting and End Chainages, respectively.

In future these three projects will work as a single stretch, and will facilitate the traffic going towards Vailoo/Anantnag side, instead of Sinthan Pass route which is closes for almost 3-4 months during winter season, so the traffic will divert from Chhatroo and reach Vailoo/Anantnag via Vailoo Tunnel.

DPRs of Goha - Khellani Tunnel project and Vailoo Tunnel project are under preparation and the project stretch of Khellani - Chhatroo will cater as link between these two tunnel projects.

Hence, the project of Khellani-Chhatroo starts from Ex Km. 44+500 near Khellani and ends at Ex Km 140+870 near Chhatroo and has a total existing length of 96.370 Km.

The proposed stretch of Khellani – Chattroo starts near Khellani from design Ch. 31+449 (At ex. Km. 44+500) and ends near Chhatroo at design. Ch. 111+066 (At ex. Km. 140+870). Project length is 78.347 Km {79.637-1.270} Excluding Ch. 83 Tunnel Length of 1.270 Km i.e. under execution stage.

This stretch of 78.347 Km have been divided into five packages. This report deals with the details of package I only i.e. Khellani to Premnagar.

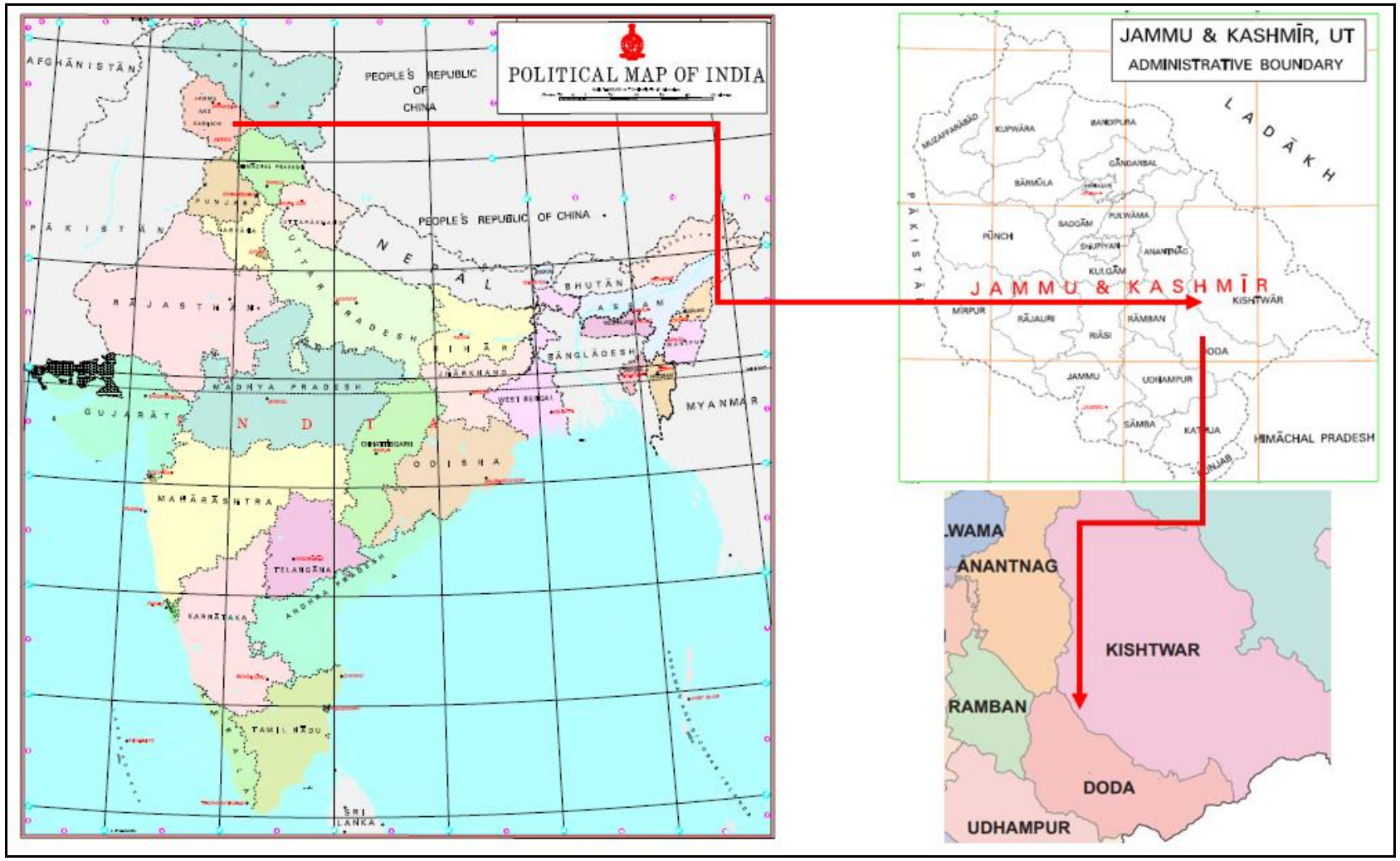


Figure 0.2: Project Key Map: Khellani-Chhatroo

0.5 Existing Road Features

The entire length of project road having a carriageway width varying from 3.75m – 10.0m and roadway width varies between 5.0 m to 12 m. There are no Bus bays/ Truck lay bye in the project stretches.

The project road traverses through mountainous to rolling terrain.

Built-up locations in the project road are as under:

Sl. No.	Existing Chainage in Km		Location
1	44.500	45.100	Thatri
2	45.100	50.150	Pul Doda (up to Jun. of Bhadarwah)
3	63.500	64.750	Prem Nagar
4	79.500	81.000	New Thatri
5	82.500	83.650	Tunnel Km 83
6	84.400	84.900	Darabshalla
7	91.500	106.00	Kishtwar
8	136.800	137.600	Udil Gojran

0.5.1 Existing condition of project road

The major portions of the project road are in fair to good condition.

0.5.2 Road Junctions

There are number of earthen, gravel and bituminous roads meeting/crossing the project highway. The important junctions along the project road are Badherwa junction, Thatri Gandoh Junction, Pul Doda and Kishtwar Junction on NH-244. The project road has 7nos. of Major junctions and about 30 nos. of minor junctions in the project stretch. The intersection details are given in Chapter 4 of this report.

0.5.3 Existing Bridge & Cross Drainage Structures

There are existing 1 no. of Major Bridge, 3 minor bridges, and 66 nos. of culverts on the project road (Khellani to Premnagar). Existing structures details are described in the engineering survey & investigation chapter (Chapter 4) and their improvement proposals are given in **Chapter 8** of this report.

0.6 Traffic Survey Analysis and Forecast

It is very important, that the existing information on traffic flow, commodity movement and traffic pattern is required to assess the traffic behaviour on a project road. To collect such information to satisfy the Terms of Reference (TOR) and project requirements, following various types of traffic surveys were carried out:

- Classified Traffic Volume Count Survey
- Intersection Volume Count Survey
- Axle Load Spectrum Survey

- Origin – Destination (OD) Survey and commodity movement Surveys
- Speed and Delay Survey
- Truck Terminal Survey

0.6.1 Classified Volume Count Survey

A comprehensive traffic survey plan has been prepared for the project road after considering traffic intensity on homogeneous sections and travel characteristics. Traffic surveys were conducted between 20th July 2019 to 27th July 2019. Traffic survey locations were finalised by consultation with client officials.

Table2 : Summary of Classified Volume Count Survey at all count stations

Type of Survey	Location	Survey Date		Duration
		From	To	
Classified Traffic Volume Count Survey / Axle Load	Ex. Km 80.650	20-7-2019	27-07-2019	7 days (24 Hrs)

0.6.1.1 ADT (Average Daily Traffic)

The Average Daily Traffic (ADT) for all traffic survey locations is presented vide Table below and detail analysis is provided in **Chapter 3** of main report.

Table 3: Summary of Average Daily Traffic (ADT)

Sr. No.	Location	Total ADT (No.)	Total ADT (PCU)	Fast Moving Vehicles (PCU)	Slow Moving Vehicles (PCU)
1	Near Pull Doda	2528	2866	2844	22

0.6.1.2 AADT (Annual Average Daily Traffic)

The seasonal correction factors are used to convert Average Daily Traffic (ADT) to Annual Average Daily Traffic (AADT). The Annual Average Daily Traffic for all traffic survey locations is presented vide Table below and detail analysis is provided in Chapter 3 of main report.

Table 4: Summary of Annual Average Daily Traffic (AADT)

Sr. No.	Location	Total AADT (Nos.)	Total AADT (PCU)	Fast Moving Vehicles (PCU)	Slow Moving Vehicles (PCU)
1	Near Pull Doda	2307	2604	2582	22

0.6.2 Projected Traffic

Table 5: Summary of Projected Total AADT Traffic PCU Volume / day

Homogeneous Section	Locations	Year 2019	Year 2024	Year 2030	Year 2031	Year 2036	Year 2040	Year 2049
Khellani (Km 44+500) to Gandoh Junction (Km 82+710)	Doda at Ex 80+650	2603	3783	5743	6112	8300	10377	17532

0.6.3 Turning Movement Count

TMC survey count are conducted near Pul-Doda on the project road on NH-244 on the project road. The intersection volume count surveys at these intersections have been carried out during identified peak periods for 12 hours. The category-wise traffic is counted for all direction in a 15 - minute interval. The counts were recorded in the specified survey formats.

The survey data have been analysed to obtain the morning and evening peak hours with flow of vehicles in each direction. The detail summary of peak hour traffic flow through intersections are provided in **Chapter 3** and **Annexure 3.6 (a-c)** of main report.

0.6.4 Axle Load Survey

To estimate vehicle loading spectrum on the project road, and to determine vehicle damage factor for the commercial vehicles, the axle load surveys have been carried out at identified location. The survey is analysed to obtain Vehicle Damage Factor (VDF) and is presented below:

Table 6: Adopted VDF

Sr. No.	Vehicle Type	VDF at Doda
1	LCV	1.546
2	BUS	1.385
3	2- Axle	2.929
4	3- Axle	8.247

0.6.5 Speed-Delay Survey

Round trip was made on entire project road during identified peak period using new technology vehicle. The survey vehicle was kept maintaining the speed of existing traffic flow. Start time, delay occurred, distance covered, and end time were recorded on the specified survey format. The data thus obtained is analysed and presented below:

Table 7: Summary of Speed-Delay Survey

Section		Distance (Km)	Average travel Time during off-peak (minutes)	Average speed during off-peak (km/hr)	Travel Time during peak (minutes)	Average speed during peak hours (km/hr)	Delay (minutes)	Reason for delay
From	To							
Khellani	**Chattroo**	96+473	231	25	289	20	57	Delay due to road condition & traffic

0.7 Growth Rate

The various methods specified vide IRC 108: 2015 are taken into consideration for arriving at reasonable growth rate for traffic in future. The results of such methods along with proposed growth rate for each type of vehicle are presented vide Table below and detail analysis is provided in Chapter 5 of main report:

Table 8: Comparative Analysis and Adopted of Growth Rates

S. no.	Description	Two Wheelers	Cars/jeeps	Buses	Trucks	LCV and Mini LCV
1	Trend Growth of Vehicles	9.04	15.56	3.66	4.16	17.62
2	Growth from regression analysis	9.45	14.95	3.31	3.33	17.21
3	Considered for Revenue/Capacity	9.24	15.26	3.49	3.75	17.42

S. no.	Period	Two Wheelers	Cars/jeeps	Buses	Trucks			LCV and Mini LCV
					2 Axle	3 Axle	M Axle	
1	Up to 2020	10.0	10.0	5.0	5.0	5.0	5.0	10.0
2	2021 -2025	9.0	9.0	5.0	5.0	5.0	5.0	9.0
3	2026 – 2030	8.0	8.0	5.0	5.0	5.0	5.0	8.0
4	2031 – 2035	7.0	7.0	5.0	5.0	5.0	5.0	7.0
5	Beyond 2035	6.0	6.0	5.0	5.0	5.0	5.0	6.0

0.8 Improvement Proposals

The existing road shall be widening and reconstruction to a 2-lane carriageway with paved shoulder configuration.

0.8.1 Proposed Alignment

Figure 0.3: Map showing proposed alignment of Project road

The proposed alignment between Khellani- Chhatroo of NH-244 have been chosen from the alignment options plan with bypasses & Realignments. Alignment options has been presented to NHIDCL, HQ on 23rd December 2019 and approval of the same was accorded on 30th December 2019 vide letter no. **NHIDCL/J&K/NH-244/Khellani-Khanabal/DPR /2018-19/471.**

Further a joint meeting with NHIDCL official and DC, Kishtwar and DC, Doda has been done respectively to discuss the alignment of NH-244 on 4th and 5th Feb 2020, wherein some modification was suggested by DC-Doda and DC-Kishtwar. The alignment was corrected/ modified by incorporating DCs comments/ suggestions made during alignment review

meeting by including Premnagar Bypass, Changing is alignment of Kishtwar Bypass and addition of Chhatroo bypass. The proposal was also discussed to the NHIDCL HQ during meeting. On alignment, there is a proposed Ratle HEP Dam near Drabshala Village Design Ch. From Km 71+360 to Km 73+950. **The HFL of Ratle Dam reservoir was reported from competent authority (JKPDCL) is 1029 m**. So, the proposed alignment is realigned and raised about 6-7 m above from the existing road to meet the HFL criteria of the proposed dam reservoir. Also, the alignment of about 3.8 km was changed/raised and proposed above the dam reservoir' HFL.

The project has been divided into five packages which are as follows:

Package Wise distribution	Design Chainage in km		Length (Km)
	From	To	
Package-I	31+449	51+700	20.251
Package-II	51+700	66+535	14.835
Package-III	67+805	80+675	12.870
Package-IV &	80+675	95+550	14.875
A Link Road to Kishtwar City (start at Design Ch 92+070)	0+000	1+871	1.871
Package-V	95+550	111+066	15.516

0.8.2 Proposed Bypass

Keeping in view of increase in traffic along the proposed highway, for improvement of road geometry and to avoid the congestion and due to lack of available ROW in urban area along the project highway realignment/ bypasses has been proposed. A summary of proposed realignment/Bypasses is as under:

Sr. No.	Start Chainage	End Chainage	Length(m)	Name of Bypass/Realignment
Design km 31+449 to Km 51+700 =20.251 km				
1	31900	35340	3440	Realignment (Pul-Doda)
Total Length in m			**3440**	

0.8.3 Road Geometry

The project alignment has been designed to accommodate speed of 40 KMPH minimum as per the provision of the IRC: SP-73-2018.

0.8.4 Widening Scheme

To meet future traffic requirement, the existing carriageway is proposed to upgrade to 2 lane with paved shoulder to achieve safe and improved alignment. Concentric widening

scheme is followed to minimise land acquisition issues whereas existing sharp bend at various location has been realign. Also, bypasses have been proposed at following locations like Pul Doda, Prem Nagar, New Thatri, Kishtwar and Chhatroo to avoid the congested area along the existing road and also to avoid the hair pin bend at few locations. By providing the improved alignment and including the bypasses, the design length of project corridor is being reduced.

Table 9: Summary of widening scheme

Sr. No.	Start Chainage	End Chainage	Length(m)	Name of Bypass/Realignment
1	31+449	31+900	0.451	Widening with 2- lane with PS
2	31+900	35+340	3.440	New 2-lane with PS
3	35+340	51+700	16.360	Widening with 2- lane with PS
Total Length in m			**20251**	

Basis availability of ROW and land acquisition constraints, a widening scheme has been proposed that makes optimum use of existing ROW and minimises need for land acquisition in urban areas, a summary of which is given below:

Sr. No.	Type of Widening	Length(m)
1	Eccentric/Concentric	16811
2	**Green Field**	**3440**
Total Length		**20251**

0.9 Pavement Design

0.9.1 Design Period, Loading and Pavement type

Using the projected traffic, Calculated VDF value is 8.247, lane and directional distribution factors, the design traffic loading calculated MSA is 6.33 and adopted for the project is 20 MSA. Through preliminary design and lifecycle comparisons, the flexible pavement type of pavement was chosen for construction with a design life of 20 years as per IRC: SP-37-2018 has been considered for design.

0.9.2 Design Sub-grade strength

Considering the soil investigations conducted in the project road area, and the availability of suitable soil in the region, the CBR of the sub-grade is taken 10.

0.9.3 Pavement composition of new carriageway

The proposed pavement composition of flexible pavement for the new carriageway based on standard, subgrade strength and design traffic are as per IRC: 37:2018.

Table 10: Improvement Proposal for New Pavement

Design Chainage in km		CBR %	MSA	Crust in mm				Sub-Grade in mm	Total Thickness
From	To			BC	DBM	WMM	GSB		
31+449	51+700	10	20	40	70	250	200	500	**1060**

0.10 Design of Structure

The improvement proposals for proposed new 2-lane road has been provisioned the following type of structure are along the alignment.

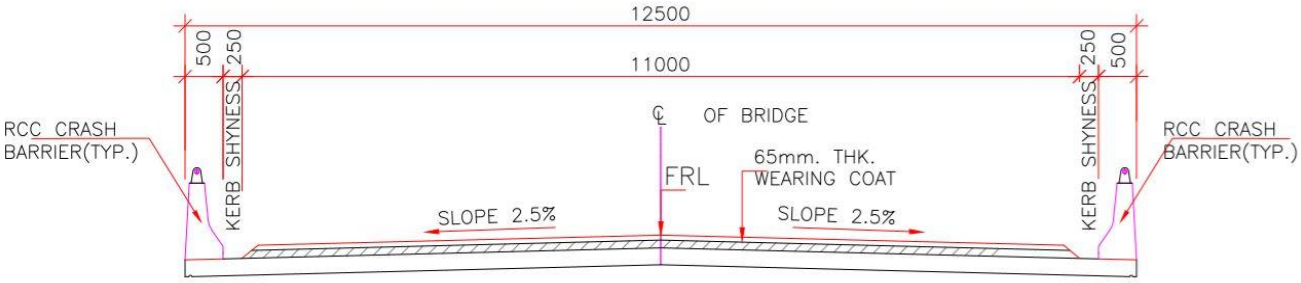


Figure : Typical Cross Section for Bridge

The improvement proposal of structure and bridges are given as under-

Table11: Bridge/Structure details

S. No.	Proposed Chainage	Structure Type	Span arrangement (No.xlength)	Total length in m	Overall Width in m	Type of Superstructure	Recommendation /Observation
1	31+500	Viaduct	1 x 15	15	1 x 12.5	RCC Girder	New 2 Lane Bridge
2	32+445	Minor Bridge	2x25	50	1 x 12.5	PSC I -Girder	New 2 Lane Bridge
3	32+725	Minor Bridge	1x15	15	1 x 12.5	RCC Girder	New 2 Lane Bridge
4	34+235	Bridge Cum Viaduct	3x25	75	1 x 12.5	RCC VOIDED SLAB	New 2 Lane Bridge
5	35+058	Viaduct	3x25+4x40+ 4x20	315	1 x 12.5	RCC VOIDED SLAB & STEEL COMPOSITE GIRDER	New 2 Lane Bridge
6	35+295	Minor Bridge	1x15	15	1 x 12.5	RCC Girder	New 2 Lane Bridge
7	36+230	Minor Bridge	1x20	20	1 x 12.5	RCC Girder	New 2 Lane Bridge
8	37+137	Major Bridge	4x22.5	90	1 x 12.5	RCC Girder	New 2 Lane Bridge
9	43+055	Minor Bridge	1x15	15	1 x 12.5	RCC Girder	New 2 Lane Bridge
10	43+717	Minor Bridge	1x25	25	1 x 12.5	RCC Voided Slab	New 2 Lane Bridge
11	46+110	Minor Bridge	1x15	15	1 x 12.5	RCC Girder	New 2 Lane Bridge

S. No.	Proposed Chainage	Structure Type	Span arrangement (No.xlength)	Total length in m	Overall Width in m	Type of Superstructure	Recommendation /Observation
12	47+669	Minor Bridge	2x25	50	1 x 12.5	PSC Girder	New 2 Lane Bridge
13	51+066	Minor Bridge	1x30	30	1 x 12.5	PSC I Girder	New 2 Lane Bridge

Table12: Culvert details

Sr. No.	Proposed Chainage	Span arrangement (Clear Span x Clear Height)	Structure Type	Recommendation
1	31+455	3x3	RCC BOX	New Construction
2	31+590	2x2	RCC BOX	Reconstruction
3	31+775	2x2	RCC BOX	New Construction
4	32+000	4x4	RCC BOX	New Construction
5	32+205	2x2	RCC BOX	New Construction
6	32+910	3x3	RCC BOX	New Construction
7	33+225	3x3	RCC BOX	New Construction
8	33+715	3x3	RCC BOX	New Construction
9	33+825	3x3	RCC BOX	New Construction
10	34+475	3x3	RCC BOX	New Construction
11	35+480	3x3	RCC BOX	New Construction
12	35+620	3x3	RCC BOX	New Construction
13	35+835	3x3	RCC BOX	New Construction
14	36+010	3x3	RCC BOX	New Construction
15	36+480	3x3	RCC BOX	Reconstruction
16	36+750	3x3	RCC BOX	New Construction
17	37+420	2x2	RCC BOX	Reconstruction
18	37+705	3x3	RCC BOX	New Construction
19	37+805	2x2	RCC BOX	New Construction
20	38+030	2x2	RCC BOX	New Construction
21	38+380	2x2	RCC BOX	New Construction
22	38+665	3x3	RCC BOX	New Construction
23	38+815	2x2	RCC BOX	New Construction
24	39+055	2x2	RCC BOX	New Construction
25	39+180	2x2	RCC BOX	New Construction
26	39+530	3x3	RCC BOX	New Construction
27	39+905	3x3	RCC BOX	New Construction
28	40+035	3x3	RCC BOX	Reconstruction
29	40+220	3x3	RCC BOX	New Construction
30	40+392	3x3	RCC BOX	Reconstruction
31	40+730	3x3	RCC BOX	Reconstruction
32	40+880	3x3	RCC BOX	Reconstruction
33	41+005	3x3	RCC BOX	New Construction
34	41+155	2x2	RCC BOX	New Construction
35	41+280	3x3	RCC BOX	New Construction
36	41+390	2x2	RCC BOX	Reconstruction
37	41+525	2x2	RCC BOX	Reconstruction
38	41+655	2x2	RCC BOX	Reconstruction

Sr. No.	Proposed Chainage	Span arrangement (Clear Span x Clear Height)	Structure Type	Recommendation
39	41+745	2x2	RCC BOX	New Construction
40	41+855	2x2	RCC BOX	New Construction
41	41+965	2x2	RCC BOX	Reconstruction
42	42+193	2x2	RCC BOX	Reconstruction
43	42+365	3x3	RCC BOX	Reconstruction
44	42+680	2x2	RCC BOX	Reconstruction
45	42+920	3x3	RCC BOX	New Construction
46	43+170	2x2	RCC BOX	Reconstruction
47	43+440	2x2	RCC BOX	Reconstruction
48	43+620	3x3	RCC BOX	Reconstruction
49	43+970	2x2	RCC BOX	New Construction
50	44+080	2x2	RCC BOX	New Construction
51	44+195	2x2	RCC BOX	Reconstruction
52	44+355	2x2	RCC BOX	New Construction
53	44+525	3x3	RCC BOX	Reconstruction
54	44+655	3x3	RCC BOX	New Construction
55	44+785	3x3	RCC BOX	New Construction
56	45+170	3x3	RCC BOX	Reconstruction
57	45+505	2x2	RCC BOX	Reconstruction
58	45+730	3x3	RCC BOX	Reconstruction
59	46+245	2x2	RCC BOX	Reconstruction
60	46+573	2x2	RCC BOX	Reconstruction
61	46+645	4x4	RCC BOX	Reconstruction
62	46+740	4x4	RCC BOX	Reconstruction
63	46+915	2x2	RCC BOX	Reconstruction
64	47+255	2x2	RCC BOX	New Construction
65	48+005	3x3	RCC BOX	New Construction
66	48+230	3x3	RCC BOX	New Construction
67	48+390	2x2	RCC BOX	Reconstruction
68	48+473	2x2	RCC BOX	Reconstruction
69	48+745	5x5	RCC BOX	Reconstruction
70	49+025	3X3	RCC BOX	Reconstruction
71	49+130	2x2	RCC BOX	New Construction
72	49+310	3X3	RCC BOX	New Construction
73	49+665	3X3	RCC BOX	Reconstruction
74	49+915	2x2	RCC BOX	New Construction
75	50+195	2x2	RCC BOX	New Construction
76	50+540	3x3	RCC BOX	New Construction
77	50+745	3x3	RCC BOX	New Construction

0.11 Drainage

Suitable drainage details have been provided as suitable locations. PCC drainage catch water drainage and RCC cover drainage system have been used accordingly. Detailed description is provided in Chapter 8 and concise details are given below:

Table 12: Drainage Details Summary

	PCC Drain (m)	Catch Drain (m)	Cover Drain (m)
Package 1	19537	19537	0

0.12 Junction

A total of 9 Junctions have been proposed along the project road. Their details are given below. Further details can be found in Chapter 8 of the Main Report.

Table 13: Junction List

	Major Junction (No.)	Minor Junction (No.)	Total (No.)
Package 1	2	7	9

Sr. No.	Location of intersection	Type of intersection	Other features	Remarks
1	31+920	T	Major	NH-1B
2	35+280	Y	Minor	To Khellani
3	36+280	Y	Minor	NH-1B
4	37+080	T	Major	To Baderwah
5	37+220	Y	Minor	To Village
6	37+360	T	Minor	To Doda
7	40+190	Y	Minor	To Duga/Bhala
8	44+740	Y	Minor	To Kandous
9	48+010	Y	Minor	To Himote

0.13 Wayside Amenities Proposed

Local discussion, demand modelling etc. was conducted to locate various way side amenities across the project road. A summary of the improvements proposed is given below:

Table 014: Proposed user amenities along the project stretch

BUS STOP Khellani-Chatroo-NH-244 Package I		
S. NO.	**LHS**	**RHS**
1	031+850	031+850
2	036+400	-
3	036+980	-
4	-	037+220
5	040+160	-
6	044+700	-
7	-	045+280
8	046+560	-
9	048+060	-

0.14 Slope Protection Work

Slope protection measures have been adopted at suitable locations as per IRC and MORT&H guidelines, their concise details have been provided blow. However, for

further details chapter 8 of Main Report can be referred.

Table 15: Details of Slope Protection Works

Breast Wall Details			
	Length on LHS (m)	**Length on RHS (m)**	**Total (m)**
Package 1	900	11800	12700
	Grand Total (m)		**12700**

Retaining Wall Details			
	Length on LHS (m)	**Length on RHS (m)**	**Total (m)**
Package 1	2430	180	2610
	Grand Total		**2610**

Gabion wall Details			
	Length on LHS (m)	**Length on RHS (m)**	**Total (m)**
Package 1	750	50	800
	Grand Total (m)		**800**

Wire Mesh Details			
	Length on LHS (m)	**Length on RHS (m)**	**Total (m)**
Package 1	12640		12640
	Grand Total (m)		**12640**

Barbed Wire Details (m)			
	Length on LHS (m)	**Length on RHS (m)**	**Total (m)**
Package 1	-	10700	10700
	Grand Total (m)		**10700**

0.15 Environmental Impact Assessment

A corridor of 10 km on either side from the project road is considered for study of various environmental attributes. The study is carried out as per the requirements stipulated by the Ministry of Environment and Forests, Government of India for Environmental Impact Assessment of Rail / Roads / Highway Projects. Important features from environmental point of view observed along the project road are as mentioned below.

- From the preliminary inventory, local inquiry and as informed by the forest department, it is revealed there is Protected or reserve forest in the stretch of the Project Road.
- Project Corridor on both sides has significant amount of tree plantation. Different type of trees is existing along the project road. Trees will be impacted due to road widening. Along the project road which lies in toe line on either side of the road edge shall be made to avoid felling of trees which are not falling under corridor of impact. The removal of these trees and the loss of vegetation cover will have some effect on local ecological balance, such as the disruption of habitat for small birds,

mammals, etc., that will be forced to migrate to other areas. With the addition of trees and shrubs, following re-forestation, the short-term impact of construction is expected to be reversed over the long term.

- There are cultural properties, and community properties / facilities exists within the ROW that are likely to be affected due to proposed project.

0.12 Social screening

The project road falls within Anantnag district of Jammu and Kashmir. During the initial social screening period, primary consultations were conducted along the project road.

- The consultations were held to build awareness about the project amongst the people, district level administration, and NGOs and to enlist their support in preparation and implementation of the project. Also, it served the purpose of understanding the reaction of the likely affected persons.
- Issues raised by individuals during the consultations were mainly related to land acquisition, loss of livelihood and income restoration, loss of religious structures, community structures, trees, etc.
- A preliminary baseline socio-economic survey identified that structures are likely to be affected due to the project. The remaining includes private and government structures that will be affected due to the proposed project. Most of the structures affected are of kuccha type i.e. temporary in nature.
- List of Revenue Villages are coming under the project road and list are as given below:

Sl. NO.	Taluk/Tehsil	Name of Village
Design Km 31.449 to Km 65.150 Comes under Doda District		
1	Doda	Haleja
2		Paryote
3		Sohanda
4		Kehlote
5		Shaerna-Khurd
6		Bhadra
7		Shaja
8		Shaerna-Kalan
9		Balasu
10		Khellani

Sl. NO.	Taluk/Tehsil	Name of Village
11	Thathri	Parnot
12		Shibnot
13		Daron Kerani
14		Herani
15		Kandote
16		Shahrote
17		Hanejo
18		Renkha
19		Jangalwar
20		Thatri
21		Bhela
22		Thalela

0.16 Land acquisition Requirement

The existing Right of way (ROW) of the road is varying from 6m to 18m. However, the proposed right of way shall be based on the requirement of alignment and the same shall be submitted separately.

Table 16: Details of Land Acquisition

Sr. No.	Chainage in Km		Packages	Land Available in Ha.	To be acquired in Ha.	Total Area (Ha.)
	From	To				
1	31+449	51+700	Pack-1	11.065	34.962	46.027
Total Area in Ha.				**11.065**	**34.962 including forest land 13.95 ha.**	**46.027**

Note: 3(a) Notified on Doda on 01.09.2020 and Kishtwar on 10.09.2020.

0.13 Material investigation

Material investigations were carried out to explore the availability and identify sources of suitable material for the construction of the project.

0.13.1 Borrow pits for soil

No borrow area will be proposed. The excavated earth from roadway shall be used in earth fill.

0.13.2 Sand

Sand is to be made available from Thatri .

0.13.3 Gravel

Several quarries were identified for sourcing aggregates in the project zone. The

quarries proposed for the project is at Ghat near Doda .

0.13.4 Bitumen

Bulk bitumen of the VG-10 Grade is available at Panipat, refinery. For the project road VG -10 of bitumen has been proposed for DBM & BC.

0.13.5 Cement

Cement source is taken as from Gurdaspur. The proposed cement grade shall be OPC 43/53 Grade.

0.14 Cost Estimate

Preliminary cost estimate for the project Road is finalised based on the improvement proposed. The preliminary cost estimate is worked out based on the quantities calculated for major items of work to be executed in the project and rates derived based on the prevailing **J&K Schedule of Rates-2020, for Civil works of all Engineering Departments, sanctioned vide Govt. Order no. 192-PW(R&B) of 2020 dated 07.07.2020 & Standard Data book** after detailed analysis.

Table 17: Package wise Summary of Cost estimate

SUMMARY OF ESTIMATE (As Per MoRT&H Norms)				
Sr. No	**Item No.**	**Description**	**Length (20.251 Km)**	**Total Amount (Rs. in Crores)**
1	BILL NO. 1	SITE CLEARANCE		1.01
2	BILL NO. 2	EARTH WORKS		28.03
3	BILL NO. 3	SUB-BASES AND BASES COURSES		12.64
4	BILL NO. 4	BITUMINOUS COURSES		19.83
5	BILL NO. 5	CROSS DRAINAGE WORKS(CULVERTS)		10.65
6	BILL NO. 6	BRIDGES		53.99
7	BILL NO. 7(A)	TRAFFIC SIGNS, MARKINGS		6.37
8	BILL NO. 7(B)	DRAIN & PROTECTION WORK		
9	i)	PCC DRAIN	19537 m	2.66
10	ii)	RRM CATCH WATER DRAIN	19537 m	3.54
11	iii)	RRM RETAINING WALL	2610 m	10.25
12	iv)	GABION WALL	800 m	6.36
13	v)	BREAST WALL	12700 m	28.73
14	vi)	Wire Mesh	12640 m	44.31
15	BILL NO. 8	JUNCTIONS		0.82

SUMMARY OF ESTIMATE (As Per MoRT&H Norms)				
Sr. No	**Item No.**	**Description**	**Length (20.251 Km)**	**Total Amount (Rs. in Crores)**
16	BILL NO. 9	PROJECT FACILITIES		
17	A)	BUS STOP		0.13
18	B)	RAIN WATER HARVESTING		0.37
19	BILL NO. 10	SAFETY AND TRAFFIC MANAGEMENT DURING CONSTRUCTION		7.32
20	BILL NO. 11	TEMPORARY DIVERSION AT STRUCTURE LOCATION		0.48
21	BILL NO. 12	ENVIORNMENT MANAGEMENT & MUCK DISPOSAL MANAGEMENT		3.87
22	BILL NO. 13	ENVIORMENT MANAGEMENT PLAN COST		2.60
23	BILL NO. 14	MISCELLANEOUS ITEMS		1.42
A	**Civil Cost**			**245.39**
B	**GST @ 12% @ Payable ON Civil Cost only (on A)**			**29.45**
C	**SUB TOTAL (A+B)**			**274.84**
D	Contingencies at 2.8% of (A)			6.87
E	Construction Supervision Charges @ 3% of (A)			7.36
F	Agency Charges @ 3% of (A)			7.36
G	Escalation @ 5%per annum for 2nd year during Construction payable to Contractor of (C)			6.13
H	**TOTAL COST INCLUDING CENTAGES (C+D+E+F+G)**			**302.56**
I	Maintenance Charges @ 0.5% for 2nd, 3rd, 4th years & 1% for 5th year of (C)			6.13
J	**TOTAL PROJECT COST (H+I)**			**308.70**
K	Cost of Land Acquisition and R & R Cost (Approx.)			79.76
L	Cost towards Utility Shifting (Approx.)			6.10
TOTAL CAPITAL COST (J+K+L)				**394.57**

0.15 Economic and Financial Analysis

0.15.1 Economic Analysis of the project

HDM software is used for the economic analysis. Economic Analysis have also been carried out for 30 years of analysis period. The summary of Economic internal rate of return (EIRR) worked out, for construction option based on life cycle cost analysis is presented below.

Table 18: Results of Economic Analysis

Homogeneous Sections	Option	Net Economic Benefit (NPV @ 12%)	Economic Internal Rate of Return (12 %)
Khellani - Chhatroo	With time saving	-47.97	8.8

The sensitivity analysis has been performed with following situations.

S1: Base cost plus 15% and Base Benefits

S2: Base cost and Base Benefits minus 15%

S3: Base cost plus 15% and Base Benefits minus 15%

Table 19: The results of Economic IRR

Option	Economic Internal Rate of Return (%)		
	S1	**S2**	**S3**
With time saving	7.91	7.45	6.48

0.15.2 Financial Analysis of the project

With the assumptions already stated above the financial analysis for the project corridor has been undertaken. The results of financial analysis have been presented in **Annexure 10** for BOT and EPC option.

The project is found viable for EPC mode.

0.16 Execution Plan & Construction Time

In Consultation with NHIDCL, it is proposed to complete the proposed project road in a period of 24 months for Package I.

0.16.1 Packaging

The total proposed project length is 78.347 Km and a link road of 1.871 Km, the entire project is planned to be bid out in five (5) packages as listed below.

Table 20: Details of Package Distribution

Package Wise distribution	Design Chainage		Length (Km)
	From	**To**	
Package-I	31+449	51+700	20.251
Package-II	51+700	66+535	14.835
Package-III	67+805	80+675	12.870
Package-IV & A Link Road to Kishtwar City (start at Design Ch 92+070)	80+675	95+550	14.875
	0+000	1+871	1.871
Package-V	95+550	111+066	15.516
Note: This report deals with Package 1 only.			

0.17 Conclusion and Recommendations

- Based on the lane capacity analysis results, the project road requires 2 lanes with

paved shoulder for capacity augmentation and efficient movement of traffic up to project common concession period of 20 years i.e. horizon year 2049 .

- The project road can be improved without causing significant adverse environmental impacts to the natural, social, economic, or cultural environments.
- The process of land acquisition is under progress i.e. ground verification works are under progress based on widening schedule.
- The construction time for Package I is 24 months period. The construction work may begin from March 2021. The estimated basic cost is given below table

Table 21: Base Cost

Section	Proposed Length (km)	Base Cost in Crore (Including GST)	Base Cost in Crore (Including Centages)	Total Capital Cost
Package-I Design CH. km 31+449 to Km 51+700	20.251	274.83	302.56	394.57

Chapter 1

Introduction

1.0 Introduction

1.1 General

National Highways & Infrastructure Development Corporation Limited (NHIDCL), Ministry of Road, Transport & Highways, Govt. of India has been assigned the work of preparation of feasibility study / DPR and providing pre-construction services of road stretches/ corridors for up-gradation to two/four laning with paved shoulder according to NH Configuration.

In pursuance of the above, **M/S Rodic Consultants Pvt. Ltd., New Delhi** in joint venture with **M/S Monarch Surveyors and Engineering consultant Pvt. Ltd**. have been appointed as Consultants to carry out the "**Consultancy Services for Feasibility Study, Preparation of Detailed Project Report and providing Pre-Construction Services for upgradation to 2 lane with paved shoulder from (i) Km 44.500 to Km 142.000 of Chattroo Village & (ii) Km 235.000 (Vailoo Village) to Km 269.000 (Khanabal) of Khellani – Kishtwar – Chattroo - Khanabal Section of NH 244 in the state of Jammu and Kashmir**. The agreement was signed on 4th June 2019.

This project deals with Khellani- Chattroo section from existing. Km. 44+500 to Km. 140+870 [Proposed Chainage km 31+449 (End of Khellani Tunnel) to km 111+066 (Chattroo)]. The total project length is 78.347 Km {Excluding Chainage 83 Tunnel project of Length 1.270 Km (From Design Ch. Km 66+535 to Km 67+805)}.

The project has been divided into five packages which are as follows:

Package-I from Design km 31+449 to Km 51+700 =20.251 km

Package-II from Design km 51+700 to Km 66+535 =14.835 km

Package-III from Design km 67+805 to Km 80+675=12.870 km

Package-IV from Design km 80+675 to Km 95+550 (Kishtwar Bypass) =14.875 km

Package-V from Design km 95+550 to Km 111+066 =15.516 km

A Link Road connecting Kishtwar town of length 1.871 Km.

This report deals with the details of Package-I from Design CH. Km 31+449 to Km 51+700 =20.251 km

1.2 Overview of MORT&H, NHDP and Project Financing

1.2.1 Introduction

The road network of India is comprised of (I) National Highways and Expressways – 1,01,011 Km, (II) State Highways -1,76,166 Km, (III) Major District Roads- 561,940, Rural Roads and Urban Roads- 44,45,067 Km (approx.). As National Highways comprise about 1.80% of the total road length in the country and yet carry over 40% of total traffic, there is an immediate need to augment the existing road network.

About 60% of freight and 85% passenger traffic is carried by the roads.

- National Highways constitute only about 1.80% of the road network but carry about 40% of the total road traffic.
- Number of vehicles has been growing at an average pace of 10.16% per annum over the last five years.

Advantages of having a well-developed network of world class highways are many for a nation like India, poised to surge ahead. These are enlisted below.

- Savings in vehicle operating costs.
- Faster, comfortable journeys.
- Reduced fuel consumption.
- Safer travel.
- Benefits to trade especially in movement of perishable commodity.
- Reduced maintenance costs.
- Induced development in project influence area; and
- Overall boost in country's economy.

1.2.2 Ministry of Road Transport & Highways

This Department is responsible for development and maintenance of National Highways, administration of the Central Road Fund and formulation and implementation of policies relating to road transport. The subjects allocated to the

Department of Road Transport & Highways.

1.2.2.1 Organizational Set-up

The organizational chart of the Department is in **Figure 1.1.** There are five Wings viz. Administration Wing, Transport Wing, Transport Research Wing, Roads Wing and Finance Wing with the following organizational set-up.

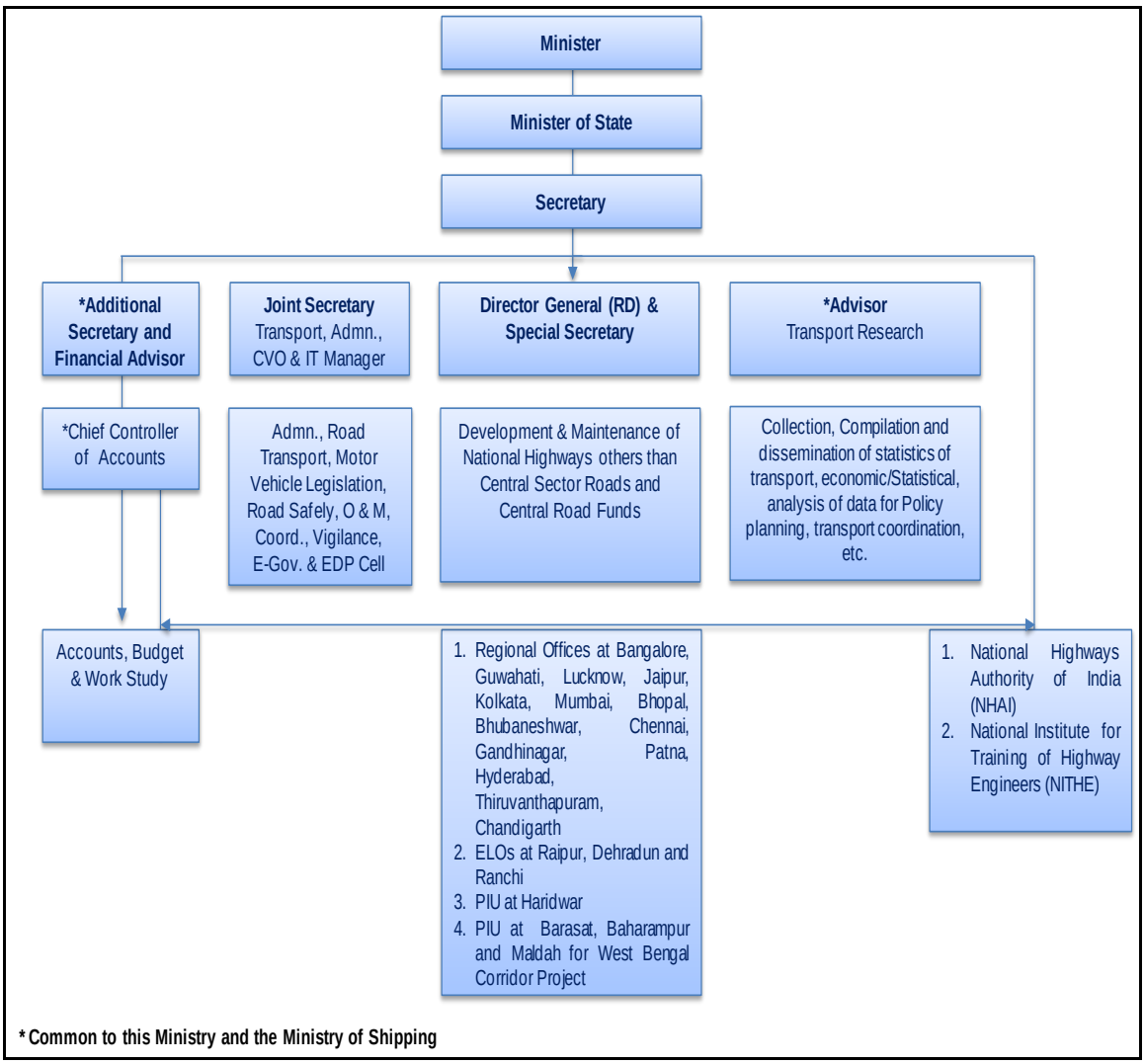


Figure 1. 1: Organisational Chart

1) Administration Wing

The Administration Wing, which is headed by a Joint Secretary, provides administrative and infrastructure support to the officers/employees of the Department. The cadre management of the Central Engineering Services (Roads) Group 'A' and service matters in respect of other categories of posts is dealt with by

this Wing. The various cadres are managed as per the instructions and guidelines issued by the Department of Personnel and Training, Ministry of Personnel, Public Grievances and Pensions.

2) Transport Wing

The Transport Wing is headed by a Joint Secretary and is concerned with the formulation of policies relating to regulation of road transport, legislation relating to road transport including aspects of road safety, environmental issues, and automotive norms besides making arrangements for movement of vehicular traffic with neighbouring countries. The Motor Vehicles Act, 1988 is the main enactment for regulating motor vehicles in the country.

3) Transport Research Wing

The Transport Research Wing (TRW) headed by Adviser (Transport Research) is also common to both the Departments (the Department of Road Transport & Highways and the Department of Shipping). The TRW is responsible for collection, compilation and dissemination of statistics on road and water transport.

4) Roads Wing

The Roads Wing is headed by a Director General (Road Development), who is assisted by other technical and secretarial staff. The work of Roads Wing has been divided into sixteen zones, each headed by a Chief Engineer. There are ten project zones which look after the work of development and maintenance of National Highways and other centrally sponsored road works. In addition, Chief Engineers also look after Planning, Monitoring, Standards & Research, Project Implementation Cell and Mechanical zones. Roads Wing is concerned mainly with matters relating to (i) advising Government on all policy matters relating to Highways (ii) development and maintenance of roads declared as National Highways (iii) roads other than National Highways in Union Territories (iv) administration of Central Road Fund (CRF) pertaining to State Roads (other than rural roads) (v) evaluation of standards for roads and bridges and formulation of specifications (vi) road research.

5) Finance Wing

The Finance Wing is headed by the Additional Secretary & Financial Adviser (AS&FA) and is common to both the Department of Road Transport & Highways and

the Ministry of Shipping; and renders financial advice on various matters. It also assists in planning, budgeting, monitoring and evaluation of schemes/programmes.

6) Autonomous Bodies

The following autonomous bodies are under the administrative preview of this Department:

a) National Highways Authority of India (NHAI)

The National Highways Authority of India (NHAI) was constituted by an Act of Parliament in 1988 under the administrative control of the Ministry of Road Transport and Highways. NHAI has been set up as a Central Authority to develop, maintain and manage the National Highways entrusted to it by the Government of India. The Authority, however, became operational in February 1995.The Authority consists of a full time Chairman, and not more than five full time Members and four part time Members who are appointed by the Central Government. The part time Members are the Secretary (RT&H), Secretary (Expenditure), Secretary (Planning) and DG (RD) & SS. NHAI has Technical, Finance, Administrative and Vigilance Wings at its Headquarters. Project Implementation Units (PIUs) headed by a Project Director and supported by various technical and accounts officers have been set up at various sites to oversee timely completion of the projects.

b) Ministry of Road Transport and Highways (MoRT&H)

The Ministry of Road Transport and Highways is a ministry of the Government of India, that is the apex body for formulation and administration of the rules, regulations and laws relating to road transport, transport research and in also to increase the mobility and efficiency of the road transport system in India. Through its officers of Central Engineering Services (Roads) cadre it is responsible for the development of National Highways of the country. Road transport is a critical infrastructure for economic development of the country. It influences the pace, structure and pattern of development. In India, roads are used to transport over 60 percent of the total goods and 85 percent of the passenger traffic. Hence, development of this sector is of paramount importance for India and accounts for a significant part in the budget.

c) National Highways and Infrastructure Development Corporation Ltd. (NHIDCL)

National Highways and Infrastructure Development Corporation is a fully owned company of the Ministry of Road Transport & Highways, Government of India. The company promotes, surveys, establishes, designs, builds, operates, maintains and upgrades National Highways and Strategic Roads including interconnecting roads in parts of the country which share international boundaries with neighbouring countries. The regional connectivity so enhanced would promote cross border trade and commerce and help safeguard India's international borders. This would lead to the formation of a more integrated and economically consolidated South and South East Asia. In addition, there would be overall economic benefits for the local population and help integrate the peripheral areas with the mainstream in a more robust manner.

d) Indian Academy of Highway Engineer (IAHE)

Indian Academy of Highway engineer (IAHE) formerly known as the National Institute for Training of Highway Engineers (NITHE) is a registered Society under the administrative control of this Ministry. Hon'ble Minister-in-Charge is the President and the Secretary, Road Transport & Highways is the Vice- President of this Society, which is advised by a Governing Body comprising eminent and distinguished engineers and administrators. The Director General (Road Development) & Special Secretary of this Department is the Chairman of the Body. It was set up as a collaborative body of the Central and State Governments in 1983. This Institute has been shifted in 2001 to its permanent campus at A-5, Institutional Area, Sector-62, Noida, (U.P.). The campus has all facilities for providing training and has a trainees' hostel and staff quarters.

Training is imparted to freshly recruit as also to in-service highway engineers. The areas of training include different aspects of road and bridge engineering, contract management, quality control, etc.

e) Border Roads Organisation (BRO)

The BRO was conceptualised initially in 1960, to construct and maintain roads in border areas as per the operational requirements of the Ministry of Defence. The road works so entrusted were classified as General Staff (GS) roads. Besides GS roads, the BRO also executes agency works entrusted by other Ministries of the Central Government. The BRO is under the administrative control of the Ministry of Defence. The Director General Border Roads (DGBR) is the executive head of the BRO.

1.2.3 NHDP

1.2.3.1 General

As National Highways comprises about 2% of the total road length in the country and yet carryover 40% of total traffic, the first and the foremost task mandated to the NHAI is the implementation of NHDP- comprising of the Golden Quadrilateral and North-South & East-West Corridors. In addition to the projects under NHDP, the NHAI is also currently responsible for about 1 000 km of Highways connecting major Ports & also on National Highways 8A, 24, 6, 45 & 27. Highways length with NHAI currently is around 70,000 km.

NHDP's prime focus is on developing roads of international standards with facilities for uninterrupted flow of traffic with:

- Enhanced safety features;
- Better riding surface;
- Better road geometry;
- Better traffic management and noticeable signage;
- Divided carriageways and service roads;
- Grade separators;
- Over bridges and underpasses;
- Bypasses; and
- Wayside amenities

1.2.3.2 Need of NHDP

There has been a major shift in transportation mode from railways towards the road sector since 1980s. Before inception of NHDP, country's road network was having the following bottlenecks.

- Growth rate of primary road network was hovering around 2%- 3%. Out of which, only 2.5% was four laned and 15% two laned.

- There was severe capacity constraint and lack of mobility in primary / secondary network.
- Tertiary network was plagued with lack of connectivity to primary / secondary network and nearly 40% habitations were not connected by all weather roads.
- Above all, main commuting mode remained to be road as depicted in the **Table 1.1**.

Table 1. 1: Mode of Transport

Type	Road	Railways
Passenger	85%	15%
Freight	60%	40%

1.2.3.3 NHDP Phase:

NHDP Phase-I: Government has approved four/ six/eight laning of 7,498 km of National Highways at an estimated cost of Rs. 30,300 crores. It mainly includes four/ six/eight laning of Golden Quadrilateral connecting four metropolitan cities i.e. Delhi, Mumbai, Chennai and Kolkata. Implementation of NHDP-I mainly on Item Rate Construction Contract (IRCC). All the contracts awarded and about 94% of NHDP –I project has been completed. Around 12% through PPP route on BOT (Toll) [6.0%] and BOT (Annuity) [6.0%] mode.

NHDP Phase-II: Under this Government has approved 6644 km of National Highways to be widened to four /six lane facility at a cost of Rs. 34,339 crores. Under this North South Corridor from Srinagar to Kanyakumari with Cochin Selam Spur and East West Corridor from Silchar to Porbandar are to be developed. Implementation of NHDP-II mainly on IRCC. Though around 24% through PPP on BOT (Toll) [11%] and BOT (Annuity) [13%]. 87.34% of length is awarded out of which around 19.51% completed.

NHDP Phase-III: Under this, Government has approved up gradation of 12109 km of existing National Highways to two lane with paved shoulders/ four /six lane having high traffic density, connecting important tourist locations, economically important

areas, State capitals etc on build, operate and transfer (BOT) basis with a maximum viability gap funding (VGF) of 40%. The estimated cost for development of these stretches is Rs. 80,626 crores. 17.13% of length awarded, out of which 3.39% length completed. NHDP-III is scheduled for completion by Dec. 2013.

NHDP Phase-IV: There is a proposal under consideration for widening of 20,000 km of existing single /intermediate /two lane highways to two lanes with paved shoulders at an estimated cost of Rs. 27,800 crores through PPP route on BOT (Toll) /BOT (Annuity) basis.

NHDP Phase -V: Under this Government has approved six laning of 6500 km of National Highways at a cost of Rs. 41,210 crores through PPP route on BOT (Toll) mode using Design Build Finance and Operate (DBFO) pattern with a maximum VGF of 10%. In DBFO private parties needs the upfront cost of design, construction and expenditure on annual maintenance and recovers the entire cost along with the interest from toll collection during the concession period. A length of 882 km awarded. NHDP-V is scheduled for completion by Dec. 2012.

NHDP Phase-VI: Under this Government has approved construction of 1000 km of expressways at an estimated cost of Rs. 16,680 crores through PPP route on BOT (Toll) mode following a DBFO pattern with a maximum VGF of 40%. Action is being taken for preparation of feasibility report. NHDP-VI is scheduled for completion by Dec. 2015.

NHDP Phase-VII: Under this Government has approved construction of 700 km of stand-alone ring roads/bypasses as well as grade separators, flyovers, elevated road, tunnels road over bridge, under passes etc at an estimated cost of Rs. 16,680 crores through PPP route on BOT (Toll) mode with a maximum VGF of 40% Action is being taken for preparation of feasibility study. NHDP-VII is scheduled for completion by Dec. 2014.

1.2.3.4 Finance Mechanisms

Government of Jammu and Kashmir proposes to finance its projects by a host of financing mechanisms. Some of them are as follows.

a) Through Budgetary Allocations from the Government of India

b) Cess

In a historic decision, the Government of India introduced a Cess on both Petrol and Diesel. This amount at that time (at 1999 prices) came to a total of approximately Rs. 2,000 crores per annum. Further, Parliament decreed that the fund so collected were to be put aside in a Central Road Fund (CRF) for exclusive utilization for the development of a modern road network. The developmental work that it could be tapped to fund, and the agencies to which it was available were clearly defined as:

I) Construction and maintenance of state highways by state governments.

II) Development of rural roads by state governments

III) Construction of rail over- bridges by Indian Railways

IV) Construction and maintenance of national highways by NHDP and

V) Ministry of Road Transport & Highways (MoRTH).

Today, the Cess contributes between Rs. 5 to 6 thousand crores per annum towards NHDP.

c) Loan Assistance from International Funding Agencies

Loan assistance is available from multilateral development agencies like Asian Development Bank and World Bank or Other overseas lending agencies like Japanese Bank of International Co - Operation.

d) Market Borrowing

Government of Jammu and Kashmir proposes to tap the market by securities cess receipts.

e) Private Sector Participation

Major policy initiatives have been taken by the Government to attract foreign as well as domestic private investments. To promote involvement of the private sector in construction and maintenance of National Highways, some projects are offered on Build Operate and Transfer (BOT) basis to private agencies. After the concession period, which can range up to 30 years, the

road is to be transferred back by the Concessionaires.

f) Special Purpose Vehicle

Funds are also leveraged by the setting up of Special Purpose Vehicles (SPVs). The SPVs will be borrowing funds and repaying these through toll revenues in the future. This model will also be tried in some other projects. Some more models may emerge in the near future for better leveraging of funds available such as Annuity.

The financial arrangement for the development of NHDP has been made as shown vide **Table 1.2**. Total cost of NHDP has been estimated to be Rs. 54,000 Crores or US$ 13.2 billions whose components are as below.

Table 1. 2: Financing of NHDP

Total Cost	**Rs.54,000 Crores**	**US$ 13.2 Billion**
Likely sources	***Rs.Cr.* (On 1999 prices)**	***US$ Billions*** **(On 1999 prices)**
Cess on Petrol and Diesel	20,000	4.90
External assistance	20,000	4.90
Market borrowings	10,000	2.40
Private Sector Participation	4,000	1.00

1.2.3.5 Policy Initiatives for Attracting Private Investment

- Government will carry out all preparatory work including land acquisition and utility removal. Right of way (ROW) to be made available to concessionaires free from all encumbrances.
- Government of India to provide capital grant up to 40% of project cost to enhance viability on a case to case basis.
- 100% tax exemption for 5 years and 30% relief for next 5 years, which may be availed of in 20 years.

- Concession period allowed up to 20 years.
- Arbitration and Conciliation Act 1996 based on UNICITRAL provisions.

In BOT projects entrepreneurs can collect and retain toll.

1.3 The Consultant

The Consultancy Services for Feasibility Study, Preparation of Detailed Project Report and providing Pre-Construction Services for upgradation to 2 lane with paved shoulder from (i) Km 44.500 to Km 142.000 of Chattroo Village & (ii) Km 235.000 (Vailoo Village) to Km 269.000 (Khanabal) of Khellani – Kishtwar – Chattroo - Khanabal Section of NH 244 in the state of Jammu and Kashmir (Total length 97.500 km) have been entrusted to **M/S Rodic Consultants Pvt. Ltd., New Delhi in joint venture with M/S Monarch Surveyors and Engineering consultant Pvt. Ltd.** The Corporate office of the Consultants is located at the following address.

Head Office

Rodic Consultants Pvt. Ltd.

1, Jai Singh Marg (First Floor),

YMCA Cultural Centre Building

New Delhi – 110001 (INDIA)

1.4 Objectives of Consultancy

- The main objective of the consultancy service is to establish the technical, economical, and financial viability of the project and prepare detailed project reports for rehabilitation and upgrading of the existing road to 2 lanes with paved shoulder configuration.
- The viability of the project shall be established taking into account the requirements with regard to rehabilitation, upgrading and improvement based on highway design, pavement design, provision of service roads wherever necessary, type of intersections, rehabilitation and widening of existing and/or construction of new bridges and structures, road safety features, quantities of various items of works and cost estimates and economic analysis within the given time frame.

- The Detailed Project Report (DPR) would inter-alia include detailed highway design, design of pavement and overlay with options for flexible or rigid pavements, design of bridges and cross drainage structures and grade separated structures, design of service roads, quantities of various items, detailed working drawings, detailed cost estimates, economic and financial Viability analyses, environmental and social feasibility, social and environmental action plans as appropriate and documents required for tendering the project on commercial basis for international / local competitive bidding.

- The DPR consultant should ensure detailed project preparation incorporating aspects of value engineering, quality audit and safety audit requirement in design and implementation. The Consultant shall ensure to carry out Road Safety Audit at various stages as per supplement-III (Additional Requirement for Safety Audit) of TOR.

- The consultant should, along with Feasibility Report, clearly bring out through financial analysis the preferred mode of implementation on which the Civil Works for the stretches are to be taken up. The consultant should also give cost estimates along with feasibility report/ detailed Project Report.

- If at inception stage or feasibility stage, employer desires to terminate the contract, the contract will be terminated after payment up to that stage.

1.5 Scope of Services

The general scope of services is given in the sections that follow. However, the entire scope of services would, inter-alia, include the items mentioned in the Letter of Invitation, terms of reference, general contract and any supplements and appendices to these documents.

1.5.1 ROW and Land related aspects

- The land for any Expressway will be acquired with a RoW of 100 m.

As for the four-lane / six-lane Highway Road Projects, experience shows that all the existing two-lane Roads requiring upgradation to 4/6-lane involve acquisition of land, shifting of utilities, felling of trees and other statutory clearances etc. As such, keeping in view a futuristic approach, it has been decided that the land for any 4/6 lane Highway Road will be acquired with a RoW of 60 m irrespective of the width of

the carriageway. Further, efforts shall be made to design the road for upgradation from 2 lane to 4 lane in such a way that the existing 2 lane shall be retained for one way traffic and separate one way 2 lane Greenfield shall be provided at an appropriate distance from existing 2 lane road with interlinking in between, to avoid higher LA cost, avoiding shifting of utilities and felling of trees depending upon specific site conditions and economic considerations.

- All efforts shall be made to avoid any road alignment through National Parks and Wildlife Sanctuaries, even if it requires taking a longer route / bypass. However, where it becomes unavoidable and necessary to keep the alignment through such reserve forest / restricted areas, land would be acquired with RoW of not more than 30 m. The cross-section in such areas may be kept as 3.25m, (shoulder / Utility Corridor) + 10.5m (three-lane one side carriageway) + 2.5m (Median) + 10.5m (2nd three-lane carriageway) + 3.25m (shoulder / Utility Corridor).

- Similarly, though it may be difficult, while determining the alignment for any bypass, efforts be made to see if these could be along the revenue boundaries of two revenue estates thereby minimizing the compulsions of landowners / farmers for cross-overs to the other side. In case such an alignment is not found feasible, it should be ensured that access to common facilities for the local people (e.g. schools, Healthcare facilities etc.) is maintained only on one side of the alignment, thereby minimizing the need for cross-over for day-to-day life.

- Protection of the acquired ROW against any possible encroachments is extremely important. Boundary stones be provided at the end of the ROW as per Clause 9.8 of IRC: SP:84-2014 and also supplemented as per Circular dated 08.12.2015 issued by NHIDCL. The boundary pillars alone, which are subject to removal with passage of time, may not be enough to save against encroachments. As such, the typical cross-section of a Highway Road is being re-visited separately with the intention of providing permanent features in this behalf. For a typical ROW of 60 mtrs, starting from one end, these will require the following:

  a) Use barricading of the ROW with plantation of hedge-like species (Ficus / Poplars) within a 3m wide strip area, dug up to 0.6 to 0.9 mtrs, of which 2.0 mtrs to serve as a Utility Corridor.

  b) Provision of a Service Road (along the inhabited area) with its drainage slope towards the drain / area reserved for Strip Plantation, for a width of 9.0 mtrs.

c) Earmark width of 1.5 mtrs for construction of a drain so as to be able to capture the rainwater flow from the Service Road (wherever provided) and the main carriageway.

d) Three lanes with paved shoulders: Main carriageway – 10.5 mtrs, paved shoulder – 1.5 mtrs and earthen shoulder – 2.0 mtrs (Total – 14 mtrs).

e) Median – 5.0 mtrs (effective width 4.5 m), and

f) A Mirror Image on the other end.

- Provisions of short bypasses, service roads, alignment corrections, improvement of intersections shall be made wherever considered necessary, practicable and cost effective. However, bypasses proposals should also be considered, wherever in urban areas, improvement to 4/6/8-lane, as the case may be, of the existing road is not possible.

- The Consultant shall furnish land acquisition details as per revenue records/maps for further processing of land acquisition. Consultant shall also submit 3a, 3A and 3D draft notification for acquisition of land.

- Support in land Acquisition process till the receipt of land possession certificate from CALA

a) The Consultant shall identify all land parcels needing to be acquired as part of project ROW and shall furnish land acquisition details as per revenue records/maps for further processing of land acquisition.

b) Assist CALA in preparation and verification of draft 3A/3D/3G/3H notifications, collecting information/documents, claims hearing etc.

c) Liaison with state departments like land revenue department and registrar's office for collection and verification of revenue records, surveys, sale deeds, circle rates and for valuation of land related assets.

d) Conduct all required surveys/valuation including joint measurement survey and valuation of land assets.

e) Support CALA by providing technical manpower (like Amins) clerical manpower and other resources (like vehicles, printers)

f) Assist PIU in verification of 3A/3D/3G/3H drafts from CALA, drafting of documents (to be forwarded to RO/HQ), receipt of land possession certificate and in related activities till award of civil work

g) Assist PIU in all official communications with CALA and other State department.

- **Approach to the provision and specifications for Structures:**

a) The structures on roads viz. Bridges, ROB's (Road Over Bridges, and Flyovers), RUBs (Road under Bridges) etc. are designed for more than 50 years. It is difficult to increase the width of the structures later which may also have larger financial implications apart from construction related issues in running traffic. Therefore, it has been decided to keep provision for all the structures including approaches comprising of retaining structures as 6-lane (length of such approaches shall, in no case, be less than 30m on either side) on all the four-lane highways except in the following cases (i) Reserve Forest (ii) Wild life Areas (iii) Hilly Areas (iv) Urban Areas where site condition do not permit this. Wherever elevated sections are designed through any inhabited areas, these should be six-lane structures supported on single piers so that the road underneath serves as effective service roads on both sides.

b) Highway projects shall be designed for separation of local traffic especially for Vulnerable Road Users (VRUs), for longitudinal movements and crossing facilities through viaduct(s) located at convenient walking distance. Provision of PUPs and CUPs with size of 7.0m x 3.0m, as specified in para 2.10 of the IRC specifications, has proved to be insufficient keeping in view the increased use of mechanization in agriculture practices. These structures do not support the easy passage / crossing for the tractors with trolleys so often used for agricultural operations. As traffic on cross roads is increasing day-by-day, it has been decided to substitute the provision of Pedestrian Underpass (PUP) / Cattle Underpass (CUP) [for para 2.10 of IRC specifies the dimensions of 7.0m x 3.0m] with a VUP Grade-II with a minimum size of 12m (lateral clearance) x 4m (vertical clearance). Out of 12m lateral width, 2.5m width on one side shall be raised for pedestrian sidewalks with grills to make pedestrian movement convenient and safe. These structures shall be located at the most preferred place of pedestrian / cattle / day-to-day crossings. Depending on the site conditions, feasibility of clubbing the crossing facilities through service roads shall also be explored. Further, the bed level of

these crossings shall not be depressed as any such depression, in the absence of proper drainage facilities becomes water-logged rendering the same unusable. Ideally, the bed level of the crossings should be a bit higher with proper connectivity to a drain, which could serve the drainage requirements of the main carriageway, the underpass and the service road as well.

c) Wherever the alignment of 4-lane Highway road project is retained in-situ while passing through inhabited areas (e.g. villages), it should be ensured that Service Roads are provided on both sides of the carriageway, connected underneath with a cross-over structure (VUP/PUP/CUP). Thus, each habitation should preferably have crossing facility at the highways with a vertical clearance of 4 m.

d) To ensure that bypass once constructed serves the intended purpose during its life, all the bypasses shall be well designed, and access controlled. The entry / exit from / to side roads shall be controlled such that they are grade separated at major roads or at spacing not less than 5 km. Side roads at closer spacing shall be connected to the service roads on either side and taken to major roads for provision of grade separated interchange.

- The provision of embankments shall be kept minimum so as to save land as well as earth which are scarce resources. This can be decided on case to case basis with due deliberations. However, economic considerations may also be given due weightage before deciding the issue.

- The Consultant shall study the possible locations and design of toll plaza if applicable to the project. Wayside amenities Land (minimum 5 acres, length and depth preferably in the ratio of 3:2) shall also be acquired for establishment of Way-side amenities at suitable locations at distances varying between 30 to 50 km on both sides of the Highway. The local and slow traffic may need segregation from the main traffic and provision of service roads and fencing may be considered, wherever necessary to improve efficiency and safety.

- The Consultant will also make suitable proposals for widening/improvement of the existing road and strengthening of the carriageways, as required at the appropriate time to maintain the level of service over the design period. The Consultants shall prepare documents for EPC/PPP contracts for each DPR assignment.

- Already to implement "good for construction" drawings shall be prepared

incorporating all the details.

- Environmental Impact Assessment, Environmental Management Plan and Rehabilitation and Resettlement Studies shall be carried out by the Consultant meeting the requirements of the lending agencies like ADB/ World Bank/JICA, etc.

- Wherever required, consultant will liaise with concerned authorities and arrange all clarifications. Approval of all drawings including GAD and detail engineering drawings will be got done by the consultant from the Railways. However, if Railways require proof checking of the drawings prepared by the consultants, the same will be got done by NHIDCL and payment to the proof consultant shall be made by NHIDCL directly. Consultant will also obtain final approval from Ministry of Environment and Forest for all applicable clearances. Consultant will also obtain approval for estimates for shifting of utilities of all types from the concerned authorities and NHIDCL. Consultant is also required to prepare all Land Acquisition papers (i.e. all necessary schedule and draft 3a, 3A, and 3D, 3G notification as per L.A. act) for acquisition of land either under NH Act or State Act.

- The DPR consultant may be required to prepare the Bid Documents, based on the feasibility report, due to exigency of the project for execution if desired by NHIDCL.

- Consultant shall obtain all types of necessary clearances required for implementation of the project on the ground from the concerned agencies. The client shall provide the necessary supporting letters and any official fees as per the demand note issued by such concerned agencies from whom the clearances are being sought to enable implementation.

- Consultant shall obtain all types of necessary clearances required for implementation of the project on the ground from the concerned agencies. The client shall provide the necessary supporting letters and any official fees as per the demand note issued by such concerned agencies from whom the clearances are being sought to enable implementation.

- The consultant shall prepare separate documents for BOT as well as EPC contracts at Feasibility stage / DPR stage. The studies for financing options like BOT, Annuity, EPC will be undertaken in feasibility study stage.

- The consultant shall be guided in its assignment by the Model Concession/ Contract

Agreements for PPP/ EPC projects, as applicable and the Manual of Specifications and Standards for four/ six laning of highways published by IRC (IRC: SP:84 or IRC: SP:87, as applicable) along with relevant IRC codes for design of long bridges.

- The consultant shall prepare the bid documents including required schedules (as mentioned above) as per EPC/ PPP documents. For that it is suggested that consultant should also go through the EPC/PPP documents of ministry before bidding the project. The Consultant shall assist the NHIDCL and the Legal Adviser by furnishing clarifications as required for the financial appraisal and legal scrutiny of the Project Highway and Bid Documents.

- Consultant shall be responsible for sharing the findings from the preparation stages during the bid process. During the bid process for a project, the consultant shall support the authority in responding to all technical queries, and shall ensure participation of senior team members of the consultant during all interaction with potential bidders including pre-bid conference, meetings, and site visits etc. In addition, the consultant shall also support preparation of detailed responses to the written queries raised by the bidders.

1.5.2 General

Primary Tasks

- General Scope of Services shall cover but be not limited to the following major tasks (additional requirements for Preparation of Detailed Project Report for Hill Roads and Major Bridges are given in Supplement I and II respectively):

i. Review of all available reports and published information about the project road and the project influence area;

ii. Environmental and social impact assessment, including such as related to cultural properties, natural habitats, involuntary resettlement etc.

(a) Public consultation, including consultation with Communities located along the road, NGOs working in the area, other stakeholders and relevant Government departments at all the different stages of assignment (such as inception stage, feasibility stage, preliminary design stage and once final designs are concretized).

iii. Detailed Reconnaissance;

iv. identification of possible improvements in the existing alignment and bypassing congested locations with alternatives, evaluation of different alternatives comparison on techno-economic and other considerations and recommendations regarding most appropriate option;

v. traffic studies including traffic surveys and Axle load survey and demand forecasting for next thirty years;

vi. Inventory and condition surveys for road;

vii. Inventory and condition surveys for bridges, cross-drainage structures, other Structures, river Bank training/Protection works and drainage provisions;

viii. Detailed topographic surveys using LiDAR equipped with minimum engineering grade system or any other better technology having output accuracy not less than (a) specified in IRC SP 19 (b) Total Station (c) GPS/ DGPS. The use of conventional high precision instruments i.e Total Station or equivalent can be used at locations such as major bypasses, water bodies etc. where it may not be possible to survey using LiDAR. Use of mobile / Aerial LiDAR survey is preferable.

ix. Pavement investigations;

x. Sub-grade characteristics and strength: investigation of required sub-grade and sub-soil characteristics and strength for road and embankment design and sub soil investigation;

xi. Identification of sources of construction materials;

xii. Detailed design of road, its x-sections, horizontal and vertical alignment and design of embankment of height more than 6m and also in poor soil conditions and where density consideration require, even lesser height embankment. Detailed design of structures preparation of GAD and construction drawings and cross drainage structures and underpasses etc.

xiii. Identification of the type and the design of intersections;

xiv. Design of complete drainage system and disposal point for storm water

xv. Value analysis / value engineering and project costing;

xvi. Economic and financial analyses;

xvii. Contract packaging and implementation schedule.

xviii. Strip plan indicating the scheme for carriageway widening, location of all existing utility services (both over- and underground) and the scheme for their relocation, trees to be felled, transplanted and planted and land acquisition requirements including schedule for LA: reports documents and drawings arrangement of estimates for cutting/ transplanting of trees and shifting of utilities from the concerned department;

xix. Develop 3D engineered models of terrain and elevation, as-is project highway, proposed and project highway along with all features, current and proposed structures, current and proposed utilities and land acquisition plans.

xx. To find out financial viability of project for implementation and suggest the preferred mode on which the project is to be taken up.

xxi. Preparation of detailed project report, cost estimate, approved for construction Drawings, rate analysis, detailed bill of quantities, bid documents for execution of civil works through budgeting resources.

xxii. Design of toll plaza and identification of their numbers and location and office cum residential complex including working drawings

xxiii. Design of weighing stations, parking areas and rest areas.

xxiv. Any other user-oriented facility en-route toll facility.

xxv. Tie-in of on-going/sanctioned works of MORT&H/ NHIDCL/ other agencies.

xxvi. Preparation of social plans for the project affected people as per policy of the lending agencies/ Govt. of India R&R Policy.

- While carrying out the field studies, investigations and design, the development plans being implemented or proposed for future implementation by the local bodies, should be considered. Such aspect should be clearly brought out in the reports and drawings.

- The consultant shall study the possible locations and design of toll plaza, wayside

amenities required and arboriculture along the highway shall also be planned.

- The local and slow traffic may need segregation from the main traffic and provision of service roads and physical barrier including fencing may be considered, wherever necessary to improve efficiency and safety.

Standards and Codes of Practices

1) All activities related to field studies, design and documentation shall be done as per the latest guidelines/ circulars of MoRT&H and relevant publications of the Indian Roads Congress (IRC) and Bureau of Indian Standards (BIS). For aspects not covered by IRC and BIS, international standards practices, may be adopted. The Consultants, upon award of the Contract, may finalize this in consultation with NHIDCL and reflect the same in the inception report.

2) All notations, abbreviations and symbols used in the reports, documents and drawings shall be as per IRC:71.

1.6 Project Stages

The Project must be completed in eight stages as described herein below:

No	Stage	Key activities	Report/deliverable submitted
1	Inception	Project planning and mobilization	Inception Report and QAP
2	Feasibility	Alignment finalization, preliminary surveys	Alignment Options Report and Feasibility Report
3	LA and Clearances	LA, utilities identification; creation of draft notifications and proposals	Strip Plan, LA Report (3a, 3A), Clearances and Utility Shifting proposals
4	DPR	Detailed design of highway, preparation of detailed project report with drawings,	Draft DPR Report, Final DPR Report, documents and drawings
5	Technical Schedules	Preparation schedules of bid documents and technical	Civil Works Contract Agreement and Schedules

6	(i) LA II (ii) Project Clearances	Land acquisition process, obtaining final utilities estimates and required clearances	JMS and 3D Report, Final Project Clearances and Utilities Report
7	LA III- Award Determination	Land acquisition award determination	3G Report
8	LA IV- Possession	Obtaining possession of land	Land Possession Report

1.7 The Detailed Project Report

The Detailed Project Report consists of following volumes as per TOR 10.9 given and named in detail below.

Volume-I	Main Report
Volume-I (A)	Annexure to Main Report
Volume-II (A)	Design Report Highways
Volume-II (B)	Design Report Structures
Volume-III	Material Report
Volume-IV	EIA & EMP
Volume-V	Technical Specification
Volume-VI	Rate Analysis
Volume-VII	Cost Estimate
Volume-VIII	Bill of Quantities
Volume-IX	Drawings

Table 1.3: Volume-I Main Report of Detailed Project Report consists of following chapters.

Chapter No.	**Name**
0	Executive Summary
1	Introduction
2	Socio- Economic Profile
3	Traffic Surveys and Analysis
4	Engineering Surveys, Investigations and Analysis
5	Traffic Forecast
6	Social Screening Report
7	Environmental screening Report

Chapter No.	Name
8	Improvement Proposal and Design
9	Cost Estimate (Road & Structures)
10	Economic Analysis
11	Financial Analysis
12	Conclusion and Recommendations

1.8 Compliance of TOR

Para 10.9 of TOR stipulates the requirement of Main Report. These contents of Volume I, Main Report have been fully compiled within the different chapters. The responses of various compliance are tabulated herein below.

Table 1.4: TOR Requirements

Sr. No.	Requirement	Location
1	Executive Summary	Executive Summary
2	Background	Chapter 1 and 2 of Main Report
3	Social analysis of the project road	Chapter 2 and 6 of Main Report
4	Details of surveys and investigations carried out	Chapter 4 of Main Report
5	Analysis and interpretation of survey and investigation data	Chapter 3 and 4 of Main Report
6	Traffic studies and demand forecasts designs	Chapter 3 and 5 of Main Report
7	Cost estimation	Chapter 9 of Main Report
8	Environmental aspects	Chapter 7 of Main Report
9	Economic and commercial analysis	Chapter 10 and 11 of Main Report
10	Conclusions and recommendations	Chapter 12 of Main Report

Sr. No.	Requirement	Location
11	Overview of NHIDCL organization and activities, and project financing and cost recovery mechanisms	Chapter 1 of Main Report
12	Project description including possible alternative alignments/bypasses and technical/engineering alternatives	Chapter 4 and 8 of Main Report
13	Improvement Proposals, Indicative design standards, methodologies and specifications	Chapter 8 of Main Report

Chapter 2

Socio-Economic Profile of the Project Influence Area

2.0 Socio-Economic Profile of the Project Influence Area

2.1 Background

The entire project road lies in the districts of Doda and Kishtwar in newly formed Union Territory of Jammu and Kashmir. The project road start from 33°7.893'N and 75°31.028'E and ends at 33°26.401'N and 75°36.238'E. The state occupies a total area of 42241 square kilometres. Jammu and Kashmir borders with the states of Himachal Pradesh and Punjab to the south and union territory of Ladakh to the east. Jammu and Kashmir has an international border on the west, the Line of Control separates it from the Pakistan. Jammu and Kashmir consist of two divisions: Jammu and Kashmir. It is further divided into 20 districts.

The Khellani - Chhatroo road section "Project Road" situated at south-west part of Jammu and Kashmir which has total design length of about 78.347 Kilometres. The project road has significant influence on Jammu and Kashmir region specifically on the Doda and Kishtwar districts. Jammu & Kashmir is located around 33°48'40.3"N and 76°34'42.2"E.

The project has been divided into five packages which are as follows:

Package-I from km 31+449 to Km 51+700 =20.251 km
Package-II from km 51+700 to Km 66+535 =14.835 km
Package-III from km 67+805 to Km 80+675=12.870 km
Package-IV from km 80+675 to Km 95+550 (Kishtwar Bypass) =14.875 km
Package-V from km 95+550 to Km 111+066 =15.516 km
A Link Road connecting Kishtwar town of length 1.871 Km

This report deals with the details of Package-I from Design CH. Km 31+449 to Km 51+700 =20.251 km

2.2 Delineation of the Project Influence Area (PIA)

The entire project road is passing within the two districts: Doda and Kishtwar.
Hence, for analysing the immediate influence area of the project road Doda and Kishtwar districts in Jammu and Kashmir UT have been considered.

2.3 Demographic Profile of PIA State and Districts

2.3.1 Jammu and Kashmir State

2.3.1.1 Location and Geography

The Union Territory of Jammu and Kashmir covers an area of 42241 sq.km. The UT is very rich in natural heritage since it is located mostly in Himalayan Mountains. Jammu and Kashmir is home to several valleys such as the Kashmir Valley, Tawi Valley, Chenab Valley, Poonch Valley, Sind Valley and Lidder Valley. The main Kashmir Valley is 100 km. The Indus, Tawi, Ravi and Chenab are the major rivers flowing through the state. Jammu and Kashmir is home to several Himalayan glaciers with an average altitude of 5,753 metres (18,875 ft) above sea-level. In the south around Jammu, the climate is typically monsoonal. In the summer season, Jammu city becomes very hot and can reach up to 40 °C whilst in July and August, very heavy though erratic rainfall occurs with monthly extremes of up to 650 millimetres.

2.3.1.2 Administrative Setup

Jammu and Kashmir consist of two divisions: Jammu and Kashmir Valley and is further divided into 20 districts. The major cities in Jammu and Kashmir are:

Table 2.0 Population Census of Jammu and Kashmir

Division	Districts	Area (Square-Km)	Population	Headquarters
Jammu	Kathua District	2651	616,435	Kathua
	Jammu District	2336	1,529,958	Jammu
	Samba District	1002	3,18,898	Samba
	Udhampur District	5550	554,985	Udhampur
	Reasi District	1719	314,667	Reasi
	Rajouri District	2630	642,415	Rajouri
	Poonch District	1674	476,835	Poonch

Division	Districts	Area (Square-Km)	Population	Headquarters
	Doda District	2625	409,936	Doda
	Ramban District	1329	283,713	Ramban
	Kishtwar District	7737	230,696	Kishtwar
	Total for division	**29253**	**5059640**	**Jammu**
Kashmir	Anantnag District	3574	1,078,692	Anantnag
	Kulgam District	1067	424,483	Kulgam
	Pulwama District	1398	560,440	Pulwama
	Shopian District	612.9	266,215	Shopian
	Budgam District	1370	753,745	Budgam
	Srinagar District	1979	1,236,829	Srinagar
	Ganderbal District	1979	297,446	Ganderbal
	Bandipora District	345	392,232	Bandipora
	Baramulla District	3353	1,008,039	Baramulla
	Kupwara District	2379	870,354	Kupwara
	Total for division	**18056.9**	**6,888,475**	**Kashmir**

2.3.1.3 Demographic Features

The major ethnic groups living in Jammu and Kashmir include Kashmiris, Gujjars/Bakarwals, Paharis, and Dogras. The Kashmiris live mostly in the main valley of Kashmir and Chenab valley of Jammu division with a minority living in the Pir Panjal region. The Pahari-speaking people mostly live in and around the Pir Panjal region with some in the northern Kashmir valley. The nomadic Gujjars and Bakarwals practice transhumance and mostly live in the Pirpanjal region. The Dogras are ethnically,

linguistically and culturally related to the neighboring Punjabi people and mostly live in the Udhampur and Jammu districts of the UT.

J&K along with Ladakh is **one of India's two administrative divisions with a Muslim majority population. According to the 2011 census, Islam is** practiced **by about 68.3% of the UT population, while 28.4%** follow Hinduism and **small minorities follow Sikhism (1.9%), Buddhism (0.9%) and Christianity (0.3%). About 96.4% of the population of the Kashmir valley are Muslim followed by Hindus (2.45%) and Sikhs (0.98%) and others (0.17%).**

Religion in Jammu and Kashmir

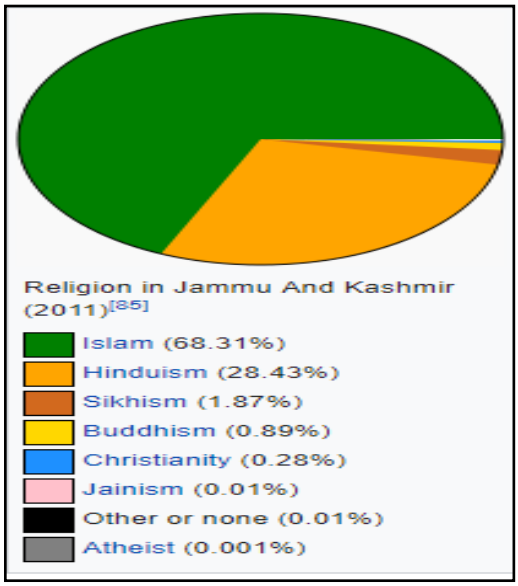


Fig 2.0: Religion Chart of Jammu and Kashmir

According to the 2011 census of India, the total population of Jammu and Kashmir is 12,258,433 having density of 270 individuals per Km^2. The official language of the union territory is Urdu, among other languages Kashmiri, Dogri, Hindi, Punjabi, Pahari, Balti, Gojri, Shina and Pashto are also spoken in other parts of Jammu and Kashmir. Jammu and Kashmir have a rich literary heritage with roots that lie deep in the sociological and historical movements of the region. Its literature reflects the regional consciousness and the evolution of an identity distinct from others in Northern India. The literacy is about 68.74%.

Table 2.1: Demographic Profile of Jammu and Kashmir

Division	% Muslim	% Hindu	% Sikh	% Buddhist & others
Kashmir	96.40%	2.45%	0.98%	0.17%
Jammu	33.45%	62.55%	3.30%	0.70%

2.3.2 Doda District

Some part of our project road lies in Doda District of Newly Formed Union territory of Jammu and Kashmir.

The District is endowed with vast wealth of natural beauty and resources. Full of natural endowments, scenic splendour, places of tourist interest, Worship, round the year snow cladded mountain peaks and challenging tracks allure the adventurers and trekkers not only from India but also from abroad.

The District has good potential for tourism including pilgrim and adventure tourism owing to its captivating scenic splendour, pilgrim centres and lofty mountain peaks. Monuments of archaeological importance near district include a fort at Bhadarwah, Bhandharkot fort in Kishtwar and Ghajpat Qila at Ramban.

The District is known for its rich mineral deposits. Lead, mica, gypsum, manganese, marble, graphite copper etc. The costliest blue sapphire is found in Paddar, at a height of about 15,000 feet. The work on this mine is abandoned at present. Blankets of some tehsils are famous in J&K union territory. Saffron and Zeera are a special variety in the District. Wild Mushroom is also a special variety in Distt. Doda.

2.3.2.1 Location and Geography

Doda Lies in the outer Himalayan range in newly formed Union Territory of J&K and falls between 32°53´N and 34°21´N latitude and 75°1´E and 76°47´E longitude. It has an average elevation of 1107 meters (3361 feet).Doda is a District in eastern part of Jammu Division of the newly formed Union Territory of Jammu and Kashmir.

District Headquarter Doda is located about 175 Km. from Jammu and about 200 Km. from Srinagar. There are two National Highways connecting the District viz. NH-1A and NH1B. The general approach to the whole of the District is through road transport i.e.

Taxi, Deluxe Buses etc. visitors coming from other parts of the country can also utilize the Flight or Train services up to Jammu/Srinagar. From Jammu / Srinagar, road transport services are easily available to reach District Headquarter Doda and to other Tourist Spots of the District. One can have the view of River Chenab while approaching to Doda.

2.3.2.2 Administrative Setup

Doda District have a sub district as Bhaderwah and three towns namely Bhaderwah, Doda and Thatri. It also have three sub divisions Gandoh, Assar and Thatri .

The district consists of 17 Tehsils: Thathri, Bhaderwah, Doda, Marmat, Bhagwah, Mohalla, Bhalla, Kahara, Assar,Bhella, Bharat Bagla, Chiralla, Chilli Pingal, Gandoh, Gundna, Phagsoo and Kastigrah.

The district is having 406 villages, three being un-inhabited divided into 232 number of Panchayats.

2.3.2.3 Demographic Profile of Doda District:

The brief Demographic features are shown below in Table

Total Population	409936
Total Male	213641
Total female	196295
Sex Ratio	919/1000
Total Child Population (0-6 Age)	71,240
Male Population (0-6 Age)	36,862
Female Population (0-6 Age)	34,378
Child Sex Ratio (0-6 Age)	933/1000
Average Literacy	64.68
Male Literacy	78.41%
Female Literacy	49.69%

2.3.2.4 Climate

Due to its varying physical features, the District does not have a uniform climate. Average rainfall in District Doda has been recorded as 35.08 inches per year which is lowest as compared to other Districts of Jammu Division. Due to low average annual precipitation, the whole of District Doda has been declared as Drought prone.

DODA WEATHER BY MONTH // WEATHER AVERAGES

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	7.8	10.5	15.1	20.3	25.1	27.5	26.1	25.1	23.6	19.7	14.3	10.3
Min. Temperature (°C)	3.4	5.6	9.9	14.4	19	21.4	21.5	20.8	18.4	13.5	7.9	5
Max. Temperature (°C)	12.2	15.4	20.4	26.3	31.3	33.7	30.8	29.5	28.9	26	20.8	15.7
Avg. Temperature (°F)	46.0	50.9	59.2	68.5	77.2	81.5	79.0	77.2	74.5	67.5	57.7	50.5
Min. Temperature (°F)	38.1	42.1	49.8	57.9	66.2	70.5	70.7	69.4	65.1	56.3	46.2	41.0
Max. Temperature (°F)	54.0	59.7	68.7	79.3	88.3	92.7	87.4	85.1	84.0	78.8	69.4	60.3
Precipitation / Rainfall (mm)	126	126	148	87	61	61	179	156	105	43	23	67

The variation in the precipitation between the driest and wettest months is 156 mm. Throughout the year, temperatures vary by 19.7 °C.

2.3.3 Kishtwar District

2.3.3.1 Location and Geography

Kishtwar is bounded on the North by Kashmir and Zanskar valleys, on the South by Bhaderwah and Doda Tehsils, on the east by Himachal Pradesh and on the west by Anantnag and Ramban district. It is very mountainous district which lies between 33°10′N and 33°25′N latitude and 75°25′E and 76°10'E longitude. It has an average elevation of 1631 meters (5300 feet).

District Headquarter Kishtwar is located about 235 Km. from Jammu and about 280 Km. from Srinagar. There are two National Highways connecting the District viz. NH-1A and NH-1B. The general approach to the whole of the District is through road transport. From Jammu / Srinagar, road transport services are easily available to reach District Headquarter Kishtwar and to other Tourist Spots of the District.

Chenab river passes through this district. The district can be classified by its climate as humid subtropical. The Kishtwar Anantnag National Highway passes through the Sinthan Pass and Daksum Nowpachi Road passes through the Margan top a 13 km long and 5100-metre-high pass. The Steep Brahma mountain peak is situated at

Dachhan. Kishtwar National Park, in the northeast region of the district, has a large number of peaks and glaciers. Kishtwar District is endowed with dense forests of deodar, pine and fir. There are high altitude mountains ranging between 20,000 feet to 21,000 feet like Nun Kun, Burmah and Barnag.

According to the 2011 census Kishtwar district has a population of 230,696 having a population density of 29 inhabitants per square kilometre. Its population growth rate over the decade 2001-2011 was 21.06%. Kishtwar has a sex ratio of 938 females for every 1000 males, and a literacy rate of 58.54%.

The district is Muslim majority 57.75%, with Hindus constituting 40.72% of the population.

The Padder area produces world class Pine nuts called chilgoza which is a delicacy and costly dry fruit. In Marwah, Chatroo, Mughalmaidan and Bounjwah Tehsils wall nut production of best quality walnuts in thousands of tons is recorded. The local towns and villages are known for their respective goods:

- Villages of Pochhal, Matta and Hidyal produce saffron of good quality.
- Kishtwar has the distinction of producing world class blue Diamond Sapphire and its Kashmir sapphire was mined at Padder valley. The area is although rich in natural mineral resources, but poor infrastructure has posed difficulty in its extraction.
- Mineral gypsum is mined at Village Trigam. The river sand of Chenab is of best quality and used extensively for construction purpose.
- The rural households are also abundantly gifted nature through cash crops of eatable mushrooms and morchella called guchhi in local language.
- The rivers are rich source of electricity and the by site of the hydroelectric power projects of Dul Hasti 390 MW, Ratle Hydroelectric Project 850 MW, Kirthai 1400 MW, Pakal Dool 1,000 MW, Lower Kalnai 48 MW and Chaudhary 15MW, Keeru HEPP and Kwar HEPP with the highest per capita wattage production in world for such a small area.

2.3.3.2 Administrative Setup

Kishtwar district consists of 13 blocks: Marwah Warwan, Dachan, Kishtwar, Nagsani, Drabshalla, (Inderwal), Mughal Maidan, Bhunzwah, Palmar, Thakrie Trigham & Paddar. Each block consists of a number of panchayats.
Block Kishtwar is the 1st block of Kishtwar District and Beron Town 1st Kishtwar is the 1st panchayat of Block Kishtwar, beron town panchayat consists of Panditgam, Zewar, Nagdera, Bucherwal Mohalla, Semmna and Wazgwari.

ADC Kishtwar:

- Kishtwar tehsil
- Drabshalla tehsil

- Bhunzwah tehsil
- Nagsini Tehsil

Marwah Sub-District:

- Warwan tehsil
- Dachan tehsil
- Marwah Tehsil

Paddar Sub-District:

- Paddar tehsil is the most remote town of the district bordered by Zanskar to the north and towered by the Sickle Moon Peak.

Subdivision Chatroo

- Chatroo Tehsil & Mughal Maidan Tehsil

Table 2.2: Demographic Profile of Kishtwar District

DESCRIPTION	
Male	120165
Female	110531
Total	230696
Total Other Population	00
Total Rural	215831
Male Rural	111986
Female Rural	103845
Total Other Rural	00
Total Urban	14865
Male Urban	8179
Female Urban	6686
Total other Urban	00
Sex Ratio	920
Literacy Rate	56.20%
Density	30/sq.km
Hindu	40.72 %
Muslim	57.75 %
Sikh	0.20 %
Density	30/sq.km
Population growth rate	20.88%

2.3.3.3 Climate

Kishtwar's climate is classified as warm and temperate it receives a significant amount of rainfall during the year. This is true even for the driest month. The climate here is classified as Cf-A by the Köppen-Geiger system which implies that Kishtwar district lies in Tropical region. The average temperature in Kishtwar district is 15.4 °C. About 994 mm of precipitation falls annually.

The rainfall is scanty, Climate is generally dry and because of this reason the District has been declared as Drought Prone Area. The temperature of the District varies from place to place. Most of the areas of Tehsil Padder & Marwah remain snow bound for five-six months of the year. In fact, Block Warwan and Marwah besides some of areas of Dachhan and Padder remain cut off from the rest of the world during winter. Summer hardly witnesses any rain and precipitation often occurs during the winter season.

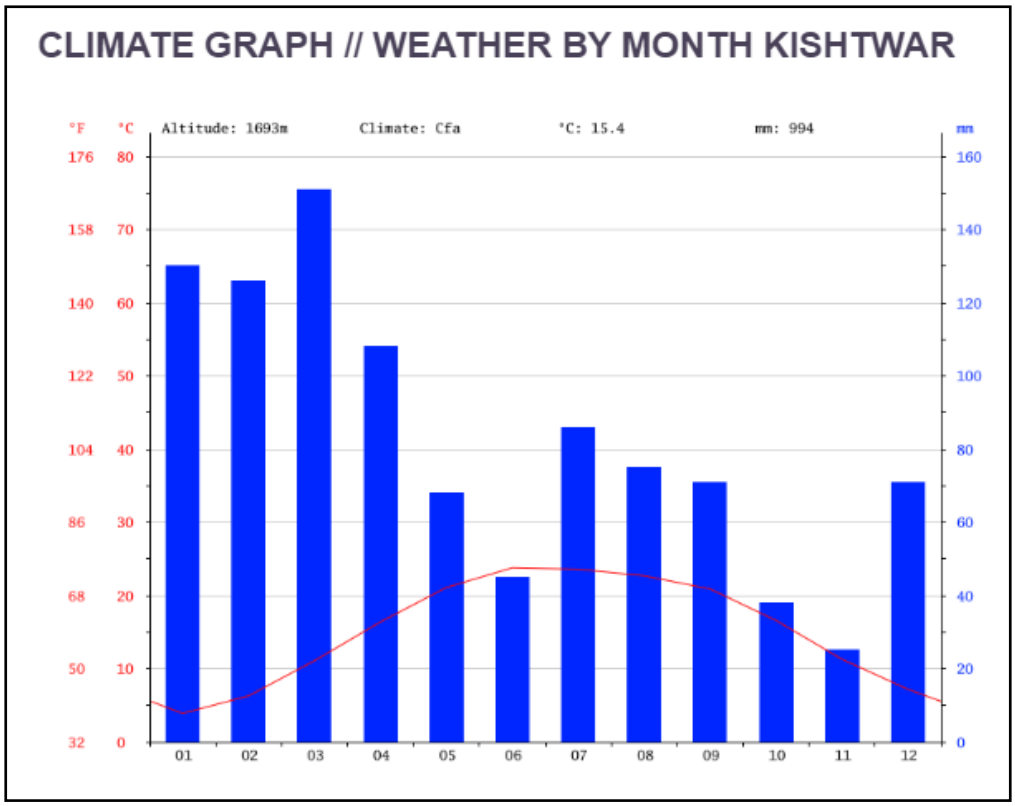


Figure 2.4 – Climate Graph for Kishtwar District (Temperature)

2.4 Employment Pattern and Economy in J&K

This micro level study, conducted in the Union Territory of Jammu and Kashmir to examine the income and employment pattern, has revealed that Due to limited job opportunities available for job seeker youth in the State, the number of job seeker youth has been increasing with every passing year. The number of job seeker youth registered in various District Employment & Counselling Centres of the J&K State is 6.01 lakhs ending September 2011.

Qualification	Kashmir Division	Jammu Division	Total
Illiterate	2771	432	3203
Middle	21211	55876	77087
Matric	78991	86217	165208
PUC	18774	656	19430
TDC	102621	83846	186467
Graduate			
Arts	26585	11977	38562
Science	15181	6620	21801
Commerce	3798	1565	5363
Others	13191	6105	19296
Total	58755	26267	85022
Post Graduate			
Arts	5432	4575	10007
Science	3227	2143	5370
Commerce	913	573	1486
Others	2690	1217	3907
Total	12262	8508	20700
Diploma Holders			
Civil	554	464	1018
Elect.	447	695	1142
T/Com	291	466	757
Mechanical	428	506	934

Fig 2.5: Qualification-wise job seekers in 2011 of Jammu and Kashmir

In India estimates of the rates of unemployment are provided by the NSSO and uses three different criterions of unemployment: (i) number of persons unemployed based on Usual Principle Status (ii) number of persons unemployed based on the Current Weekly Status and (iii) number of person-days unemployed based on the Current Daily Status.

Area	J&K (%)			All India (%)		
	Male	Female	Persons	Male	Female	Persons
Rural						
UPS	2.7	16.6	3.9	2.1	2.9	2.3
CWS	3	6.3	3.8	3.3	3.5	3.4
CDS	5	11.8	6.1	5.5	6.2	5.7
Urban						
UPS	4.7	25.6	7.8	3.2	6.6	3.8
CWS	4.5	21.8	7.6	3.8	6.7	4.4
CDS	5.3	24.2	8.4	4.9	8	5.5
Combined (Rural + Urban)						
UPS	3.2	20.2	4.9	2.4	3.7	2.7
CWS	3.4	8.8	4.7	3.5	4.2	3.7
CDS	5	14.7	6.7	5.3	6.6	5.6

Fig 2.6: Unemployment of Jammu and Kashmir

The economy of Jammu and Kashmir has suffered from disturbed conditions. It would be therefore necessary to put the economy back to the rails to enable an average person get

employment opportunities. In this direction, the following 8 sectors of economy have been identified for generation of gainful employment opportunities in the state on sustainable basis:

1. Agriculture (including Horticulture, Floriculture, Food Processing and Animal Husbandry)
2. Handlooms and Handicrafts
3. Industries (including Small Scale industries and Rural industries)
4. Tourism & travels,
5. Education & health
6. Large infrastructure projects (Roads & Railways),
7. Information Technology & Telecommunication
8. Construction Sector

Jammu and Kashmir's economy is predominantly dependent on agriculture and allied activities. The Kashmir Valley is known for its sericulture and cold-water fisheries. Wood from Kashmir is used to make high-quality cricket bats, popularly known as Kashmir Willow. Kashmiri saffron is very famous and brings the state a handsome amount of foreign exchange. Agricultural exports from Jammu and Kashmir include apples, barley, cherries, corn, millet, oranges, rice, peaches, pears, saffron, sorghum, vegetables, and wheat, while manufactured exports include handicrafts, rugs, and shawls.

Horticulture plays a vital role in the economic development of the state. With an annual turnover of over ₹3 billion (US$47 million), apart from foreign exchange of over ₹800 million (US$12 million), this sector is the next biggest source of income in the state's economy. The region of Kashmir is known for its horticulture industry and is the wealthiest region in the state:

Economy of Jammu and Kashmir	
Statistics	
GDP	₹1.32 lakh crore (US$21 billion) (2016–17 est.)
GDP rank	21st
GDP growth	14% (2016–17 est.)[142]
GDP by sector	Agriculture 22% Industry 25% Services 53% (2015)[142]
Labour force by occupation	Agriculture 64% Industry 11% Services 25% (2015) [142]
Public finances	
Public debt	49.25% of GDP (2016–17 est.)[142]
Revenues	₹53,202 crore (US$8.3 billion) (2016–17 est.)[142]
Expenses	₹64,669 crore (US$10 billion) (2016–17 est.)[142]

Fig 2.7 (a): Economy of Jammu and Kashmir

Year	State's Gross Domestic Product (in million INR)
1980	11,860
1985	22,560
1990	36,140
1995	80,970
2000	147,500
2006	₹539,850 million (US$8.4 billion)
2016	₹132,307 crore (US$21 billion)[157]

Fig 2.7 (b): Economy of Jammu and Kashmir

2.4.1 Agriculture and Irrigation

Jammu and Kashmir is essentially a mountainous area in which only about 30 per cent of the reporting area is under cultivation. Agriculture is the mainstay of the people as it provides employment, directly or indirectly to about 70 per cent of the workforce. It contributes about 65 per cent of the state revenue which explains the overdependence of the state on agriculture. Land is, however, limited and therefore, its judicious utilization is necessary to meet the growing need of the tremendously increasing population and for the sustainability of soils, ecosystems and environment. The total geographical area including region Ladakh and J&K is 2.23 lakh sq. km including those parts which are under the occupation of Pakistan and China. About 92 per cent of the geographical area of the region consists of high mountains rugged topography and only 5 per cent is available for cultivation. The general picture of land-use and the proportion of area under different categories have been given below.

Jammu and Kashmir-General Landuse, 1995-96

	Use of Land	Total Reporting Area in (000 Hect.)	Percentage
1.	Forest	658	27.24
2.	Net area sown	730	30.22
3.	Land put to non-agricultural uses	291	12.04
4.	Barren land	293	12.13
5.	Permanent pastures and other grazing grounds	125	5.17
6.	Land under miscellaneous trees and other groves	72	2.98
7.	Cultivable waste	141	5.84
8.	Fallow other than current fallow	7	0.29
9.	Current fallow	99	4.00
	Total	2416.00	100.00

Fig 2.8: Land Pattern of Jammu and Kashmir

Being, hilly, mountainous and snow covered, it is only the gentle slopes (below 15°) which may be developed as orchards and pastures after heavy investment. The proportion of old fallow and current fallow is 0.29 and 4.0 per cent respectively. About 12 per cent of the total reporting area is put to non-agricultural uses, e.g., settlement, roads, cemetery, guls (canals) and water bodies. In general, the Jammu plain has a high concentration of wheat, rice, maize, pulses, fodder and oilseeds, while the Valley of Kashmir is well known for its paddy, maize, orchards (apples, almond, walnut, peach, cherry, etc.) and saffron cultivation. In Ladakh region , barley, wheat, maize, vegetables, barseem and fodder are the main crops. The Kashmir Valley has a large capacity of fruit production. Apples, walnuts, almonds, cherries and pears are imported by many foreign countries.

Over 70 percent of the Net Sown Area is under food crops and the area under fruits is a little over 13 percent. Viability of agriculture as a profession is presently affected capital inadequacy, lack of infrastructural support and controls on movement, storage and sale etc of agricultural produce. Dwindling water resources too is a major challenge as only 42 percent of the cultivated area is under irrigation.

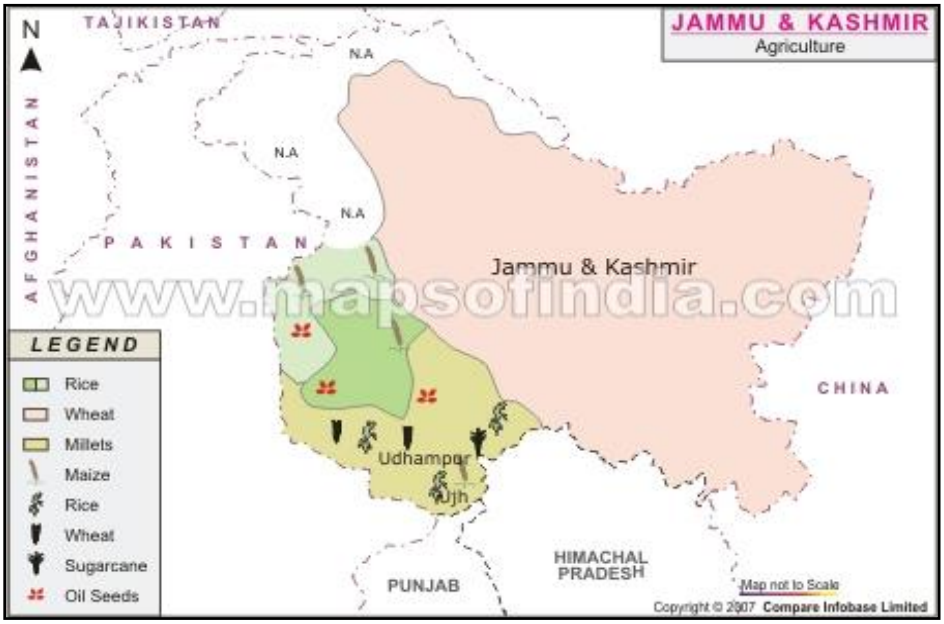


Fig 2.9: Agriculture in Jammu and Kashmir

Irrigation

Dwindling water resources too is a major challenge as only 42 percent of the cultivated area is under irrigation

Table 1: Net Area Irrigated from diffrent Sources

(000 hac.)

S.No	Year	Net Area Irrigated by				
		Canals	Tanks	Wells	Other Sources	Total
1)	1950-51	244.00	3.00	3.00	11.00	261.00
2)	1955-56	277.00	1.00	3.00	9.00	290.00
3)	1960-61	256.00	-	5.00	13.00	274.00
4)	1965-66	270.00	Neg	1.00	7.00	278.00
5)	1968-69	252.00	Neg	1.00	11.00	264.00
6)	1974-75	279.00	Neg	3.00	13.00	295.00
7)	1980-81	285.00	2.00	4.00	13.00	304.00
8)	1985-86	288.69	2.67	4.12	14.13	309.61
9)	1990-91	276.58	1.96	1.33	16.20	296.09
10)	1995-96	284.86	2.57	1.42	17.73	306.58
11)	1998-99	283.81	2.60	1.32	21.42	309.15
12)	1999-00	278.35	2.57	1.37	20.80	303.09
13)	2000-01	284.15	2.71	1.53	22.48	310.37
14)	2001-02	284.42	2.79	1.61	21.35	310.17
15)	2002-03	274.50	2.66	1.57	20.49	299.67
16)	2003-04	282.41	3.87	1.06	19.19	306.53
17)	2004-05	286.28	3.93	1.08	19.60	310.89
18)	2005-06	289.28	4.21	1.05	17.57	312.11
19)	2006-07	286.64	4.24	1.04	17.52	309.44
20)	2007-08	285.78	4.22	0.99	17.05	308.04
21)	2008-09	287.77	4.84	3.60	17.32	313.73
22)	2009-10	287.80	5.11	4.33	20.03	317.27
23)	2010-11	288.48	6.22	11.65	14.28	320.63
24)	2011-12	285.40	7.11	7.42	19.33	319.26
25)	2012-13	285.35	8.03	10.42	21.29	325.09

Fig 2.10: Net area Irrigated Data of Jammu and Kashmir

Hilly terrain puts limits to mechanical farming and transportation of Products, especially horticulture produce. Fragile soil in hilly areas is susceptible to soil erosion and a single cropping season is available in temperate and high-altitude areas. Net irrigated area in the region is just 24 percent and double and multiple cropping is followed on a larger scale in the intermediate and warmer plain sub-tropical areas. Wheat, maize and rice crops grown in about 250,000 hectares 210,000 hectares and 110,000 hectares area respectively are the major cereal crops of Jammu division. Basmati rice and Rajmaah (pulses) are valuable cash crops of the region. Vegetables, oil seeds, spices and condiments, aromatic and medicinal plants and fodder are also grown in specific areas of the region.

2.4.2 Industrialisation and Minerals

Main industrial activity is concentrated in the Jammu and Kathua districts of Jammu division. This is mainly because Jammu is the only railhead, where loading and unloading of raw material becomes easy and less cumbersome as compared to Kashmir region where transportation cost is higher. The Industry sector has been declared as the main vehicle for accelerating economic activity besides providing employment opportunities to the unemployed educated youth in the State. To attract investment, the State government has come up with a new eco-friendly industrial policy in 2004, which is valid until 2015. The industrial policy is designated to promote rapid industrialization and has evoked a great deal of interest in the private investment. The policy has slew of incentives in the form of subsidies for all sorts of industries, especially for small-scale industries to make them capable of competing in the present market. The policy also lays emphasis on promoting industries based on local raw materials and skills. The State has set up two industrial growth centers - one in Samba, Jammu and other in Lassipora, Pulwama with the assistance of Central Govt. under the centrally sponsored schemes.

The key industrial activity in J&K includes:

- Horticulture
- Floriculture
- Handloom & Handicraft

- Tourism.
- Mineral based Industries.
- Gem & Jewellery
- Sericulture
- Information Technology
- Pharmaceuticals
- Insecticides
- Pesticides
- Electronics
- Hardware

Infrastructure
Housing

As per the census 2001 there were 155768 households in the J&K and Ladakh region. The average household size is 6.5%. In urban areas, the average household size is little less i.e., 6.4%, the corresponding household size in rural areas is 6.6%.

Census 2001 has revealed that 55% of the households occupy permanent house whereas 32.16% resided in semi-permanent houses and 12.68% of household in temporary and unclassifiable houses.

Geology and Mining Activities

The J&K and Ladakh is endowed with tremendous mineral resources covering an area of 13334 Sq. Kms., out of which 60% are reported to be commercially viable for mining of various minerals. The Department of Geology and Mining, Jammu & Kashmir was established in 1960 to identify/ locate minerals like Limestone, Gypsum, Marble, Lignite, Granite, Bauxite, Coal, Magnesite, Slates, Sapphire, Dolomite, Borax, Graphite, Quartzite etc. in a big way, the quality and quantity of which are estimated for establishment of mineral based industries. A number of cement based industries as well as units for manufacture of plaster of Paris, Marble and Granite cutting units have been established

in the region.

S.No	Period	Drilling (000 Mts)	Exploratory Mining (000 Mts)	Geological Mapping (detailed) (Million Sq.Mts)	Geological Mapping (Reconnaisance) (Million Sq.Kms)	Samples Collected (000 Nos)	Analysed (000 Nos)	Royalty Realised (rs. in Lakhs)
1)	1969-70	4.60	1.30	4.80	NA	260	1.00	NA
2)	1973-74	2.00	1.10	5.90	982.00	4.00	0.40	2.60
3)	1975-76	1.70	NA	2.11	225.00	3.20	0.60	NA
4)	1977-78	3.60	0.20	4.78	1734.00	2.70	1.70	8.20
5)	1978-79	5.30	0.04	4.25	1384.00	3.30	1.40	11.90
6)	1979-80	7.40	0.01	0.03	1353.00	3.30	1.00	13.30
7)	1980-81	5.92	0.36	3.78	1995.00	4.32	0.50	14.60
8)	1981-82	5.30	0.10	3.38	1022.00	2.59	0.44	19.62
9)	1985-86	5.50	0.36	3.38	2771.00	3.14	0.46	20.10
10)	1986-87	4.23	0.20	2.17	683.37	3.15	0.40	20.36
11)	1987-88	10.20	0.12	2.47	1995.00	2.76	0.53	27.61
12)	1988-89	9.89	0.12	3.13	3091.50	3.09	0.54	49.64
13)	1989-90	10.17	0.14	3.49	3152.30	3.32	0.60	63.73
14)	1990-91	5.23	0.12	1.68	1049.00	0.78	NA	16.83
15)	1995-96	1.45	0.08	1.81	2093.50	0.50	NA	1.80
16)	1996-97	0.79	0.17	2.44	803.00	0.63	NA	64.56
17)	1998-99	0.59	-	2.81	1762.50	0.69	NA	85.25
18)	2000-01	0.61	-	0.96	776.00	0.32	0.30	296.01
19)	2001-02	0.68	-	0.79	985.00	0.40	-	328.18
20)	2002-03	1.46	-	0.82	197.50	1.04	0.36	304.51

Fig 2.11: Geology Activities of Jammu and Kashmir

Minerals in Jammu and Kashmir

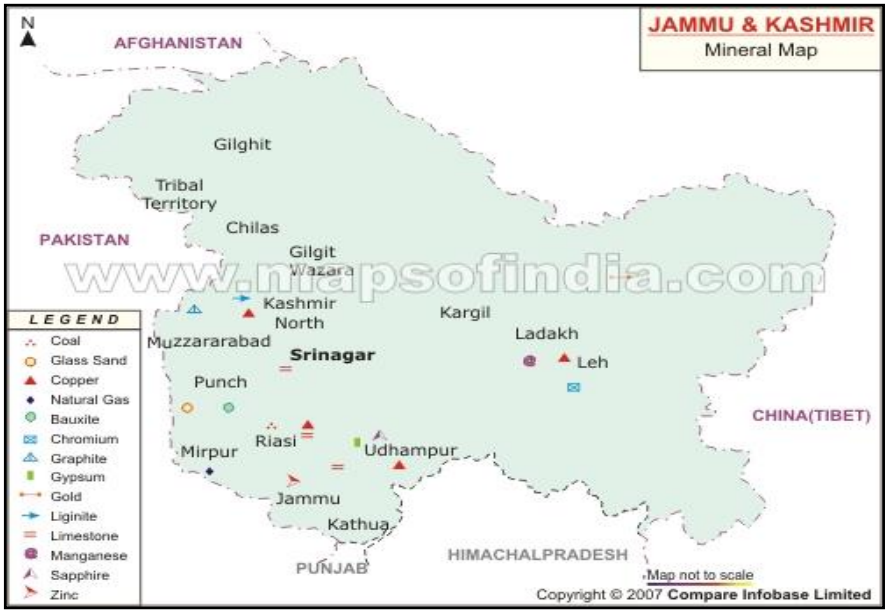


Fig 2.12: Minerals in Jammu and Kashmir

There is a wide source of mineral resources in the state that includes Limestone, Gypsum, Dolomite, Quartz etc.

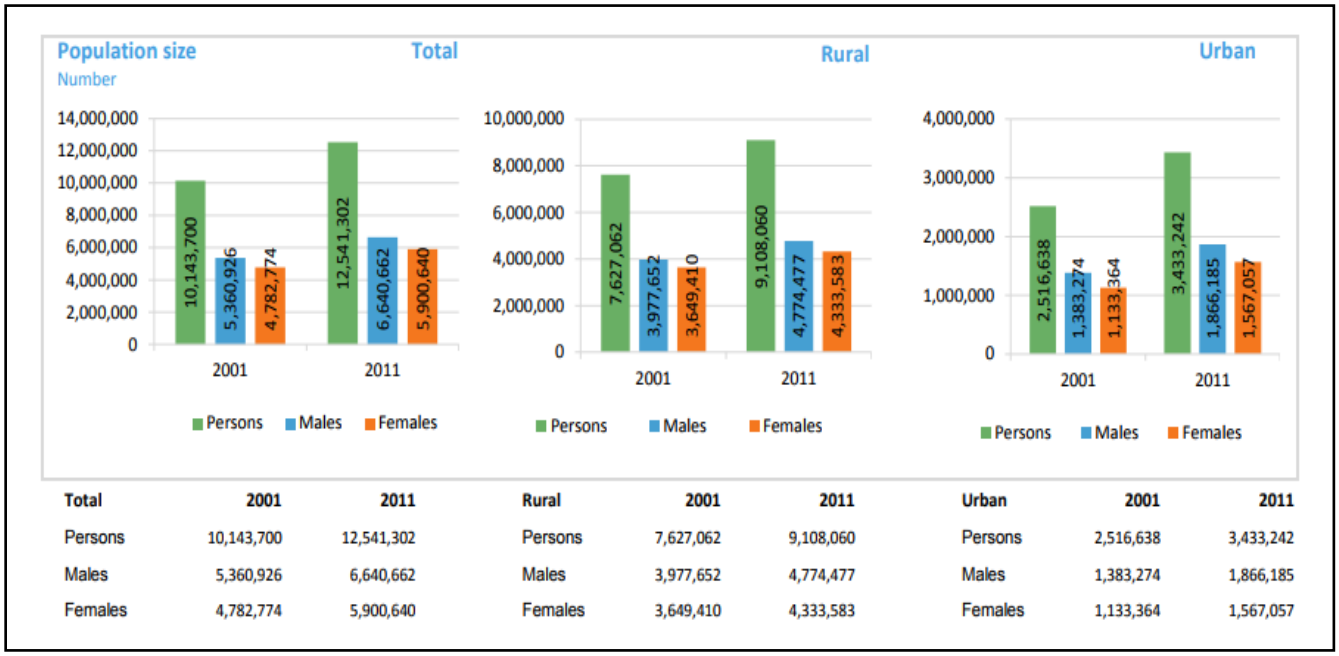
Table 2.3: Minerals in Jammu and Kashmir

Mineral	Occurrence	Reserves	Uses
Limestone	All districts of Valley, Kathua, Udhampur,Rajouri,Poonch, Kargil and Leh.	6081 Million tonnes	Manufacture of Cement, Calcium Carbide, Quicklime, Bleaching-Powder, Glass, Paper, paints
Gypsum	Baramullah,Kathua,ramban and Doda Distt.	150 Million tonnes	Cement, fertilizer, Filler in Paper, Paints, Rubber, Textile industry, Plaster of Paris & sanitary ware,
Marble	Kupwara, Kargil, Leh	400 Million Cubic mtrs	Decorative building stone.
Granite	Kargil, Leh, Ganderbal, Baramullah,Poonch and Doda	5.2 Million Cubic mtrs. However, stretched over an area of 800 sqkms	Decorative building stone.
Bauxite	Udhampur and Ramban	8.6 Million tonnes	Manufacture of aluminum, aluminum products, and aircraft industry
Coal	Udhampur,Rajouri (Kalakot)	9.5 Million tonnes	As fuel
Lignite	Nichome, Handwara, Distt Kupwara	8 Million tonnes	Thermal power and low grade fuel
Magnesite	Udhampur	7 Million tonnes	Refractory Bricks for furnaces. Pharmaceuticals
Slates	Poonch,Kathua,Doda and Baramullah	9.6 Million cubic mtrs	Building Material
Sapphire	Doda (Paddar)	2 kms mineralized zone	Precious Stone
Quartzite	Anantnag, Baramullah and Kupwara	2 Million tonnes	Glass & IT industry
Borax	Puga valley, Leh	400 tonnes annual crop	Medicine, glass, ceramics, nuclear industry, rocket fuel
Dolomite	Rajouri,Udhampur, Reasi	12.37 Million tonnes	Refractory bricks

Mineral	Occurrence	Reserves	Uses
China clay	Doda,Udhampur	28 Million tonnes	Ceramics, pottery

Population & Literacy

As per details from Census 2011, the following data is given by the Department of Ecology Environment and Remote Sensing.



Total	2001	2011	Rural	2001	2011	Urban	2001	2011
Persons	10,143,700	12,541,302	Persons	7,627,062	9,108,060	Persons	2,516,638	3,433,242
Males	5,360,926	6,640,662	Males	3,977,652	4,774,477	Males	1,383,274	1,866,185
Females	4,782,774	5,900,640	Females	3,649,410	4,333,583	Females	1,133,364	1,567,057

Figure 2.13 (a)- Population size of Jammu and Kashmir

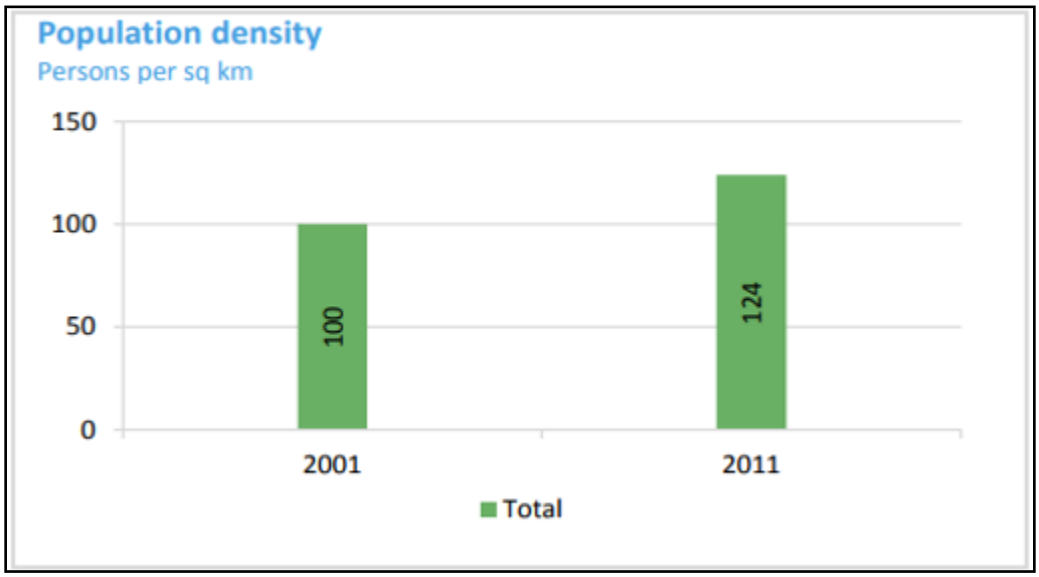
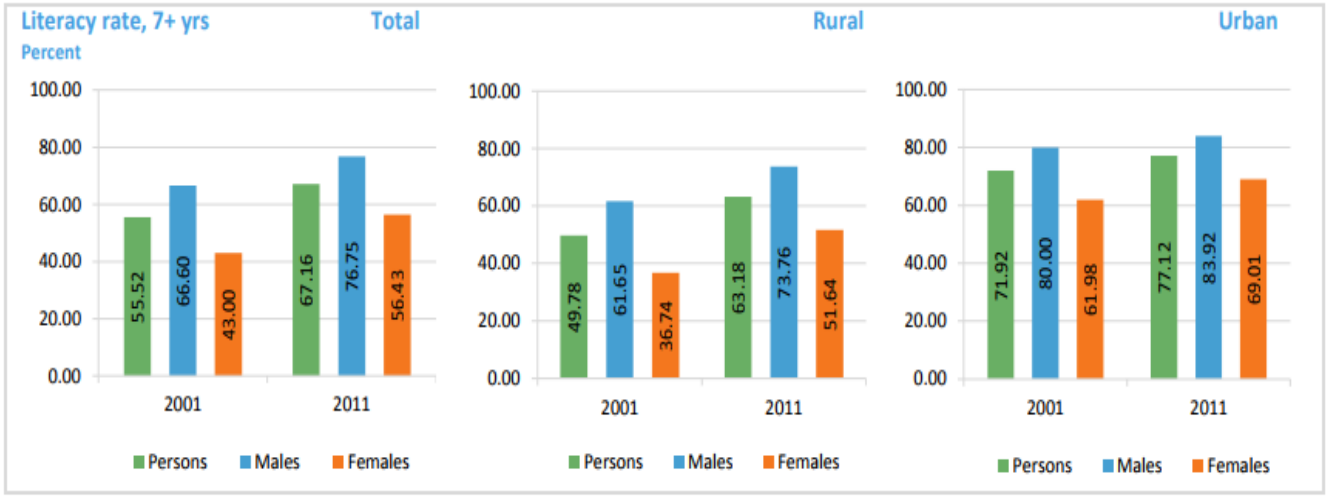


Figure 2.13 (b)-Population Density of Jammu and Kashmir



Total	2001	2011	Rural	2001	2011	Urban	2001	2011
Persons	55.52	67.16	Persons	49.78	63.18	Persons	71.92	77.12
Males	66.60	76.75	Males	61.65	73.76	Males	80.00	83.92
Females	43.00	56.43	Females	36.74	51.64	Females	61.98	69.01

Figure 2.13 (c) -Literacy Rate of Jammu and Kashmir

Tourism

Jammu & Kashmir with its vast potential and growing economy has immense potential for the sustenance of the tourism industry. Tourism has historically remained an instrument of economic growth in the region of Jammu & Kashmir and has contributed a lot in developing the economy, particularly in Kashmir Valley and Ladakh. This sector has given jobs to many people and generated economic activities especially in the tertiary sectors. Its impact is visible in-service industry sectors of the State such as transport, hospitality, horticulture and small-scale industry. The tourism activities at a particular place are directly related to the arrival of tourists at that place. The more the arrival, the more economic activities get generated and make impact on the related sectors accordingly. Tourist expenditure generates multiple effects on the service sector such as agriculture, horticulture, poultry and handicrafts.

Jammu & Kashmir is an important tourist destination and has been a place of attraction for tourists since centuries. The lush green forests, sweet springs, perennial rivers, picturesque alpine scenery and pleasant climate of Kashmir valley has remained an internationally acclaimed tourist destination, whereas Jammu region is attracting a large number of pilgrim tourists and the important destination has been Shri Mata Vaishno Devi Shrine at Katra.

Ladakh region, the moon land has been a much sought-after destination, especially for the foreign tourists and is famous for adventure tourism. The tourism tag has always placed the State of J&K in the limelight at the national level as well as international level. Besides, two Directorates of Tourism, one for the Jammu division and other for Kashmir division, 19 Tourism Development Authorities for main tourist destinations, J&K Tourism Development Corporation (JKTDC), Sher-e-Kashmir International Convention Centre (SKICC), J&K State Cable Car Corporation (JKCCC) and Royal Springs Golf Course, Srinagar are functioning for the promotion of the Tourism Sector in the State.

Fig 2.14 (a) Shikara in Dal Lake

Fig 2.14 (b) Vaishno Devi Temple

2.5 Transport system Network

2.5.1 Roads

An effective communication network is essential not only to cater to the needs of travel and transport but also for Socio-economic development of a State and the country. In case of J&K, the same is more important for promotion of tourism as well. Revival of Tourism and restoration of damaged infrastructure, which had become the target during the period of disturbance in the State has been a priority of the State Government.

The State Government, with the supplementation of Central resources, made concerted efforts in rebuilding of destroyed infrastructure in the shape of roads, bridges, school buildings and the social infrastructure, etc. With this objective in view, special schemes were launched, besides giving a boost to the ongoing schemes of the Department. Many new roads are under construction and many existing roads are under improvements.

Jammu and Kashmir has a wide range of road network that connects all the cities. The

major highways in Jammu and Kashmir are NH 1, NH 3, NH 44, NH 144, NH 244, NH 144-A, NH 301, NH 444, NH 501, NH 701, NH 701-A, Srinagar-Jammu National Highway, Udhampur -Jammu Highway and Skardu Kargil Road. A detail road network in the state is shown as below in the map.

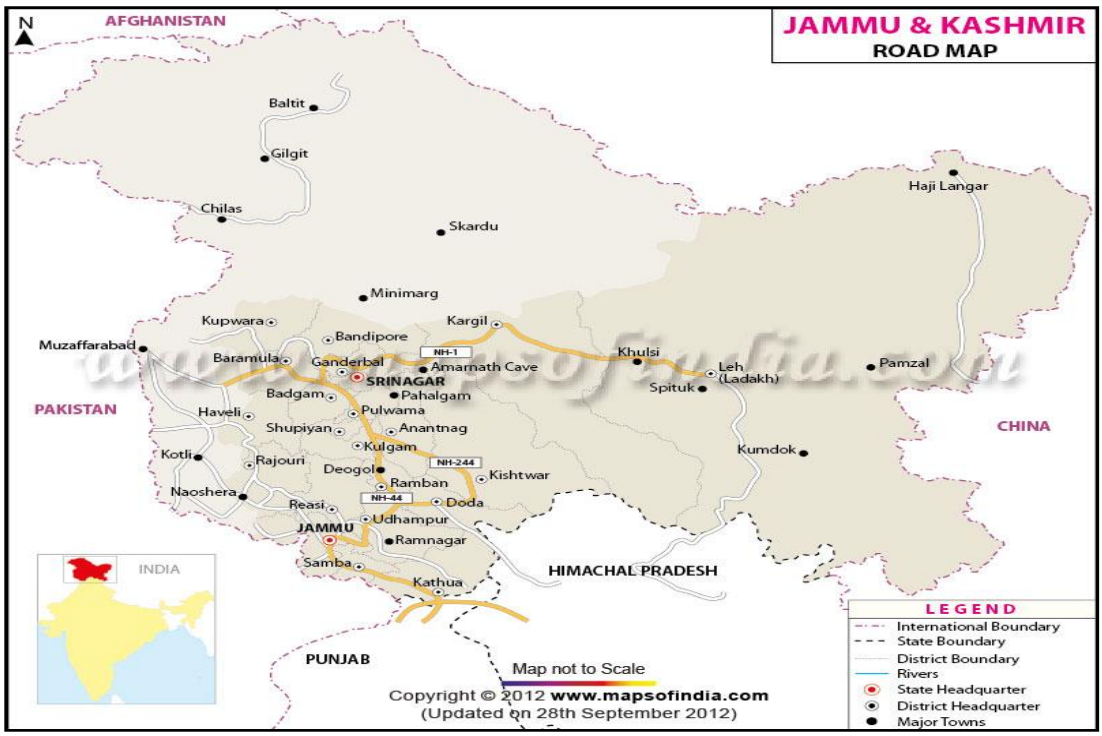


Fig 2.11: Jammu and Kashmir Road Map

2.5.2 Railways

Jammu & Kashmir have railway network of only 238.77 kms. The government has recognised the crucial role of railways in the process of economic development and in response to that the government of India has also extended full cooperation in all respects by providing technical and financial support for developing railways links in the state at a very fast speed.

The Jammu–Srinagar–Baramulla railway line is a railway track being laid to connect the Kashmir Valley in the Indian state of Jammu and Kashmir with Jammu railway station and hence to the rest of the country. This railway line will connect the state with mainstream of country and will lead to boost in trade, economy and tourism in the state.

The list of railway stations in Jammu and Kashmir can be divided into 2 parts:-

Railway stations in Jammu region, railway stations in Kashmir region.

A detail Railway network in the state is shown as below in the map.

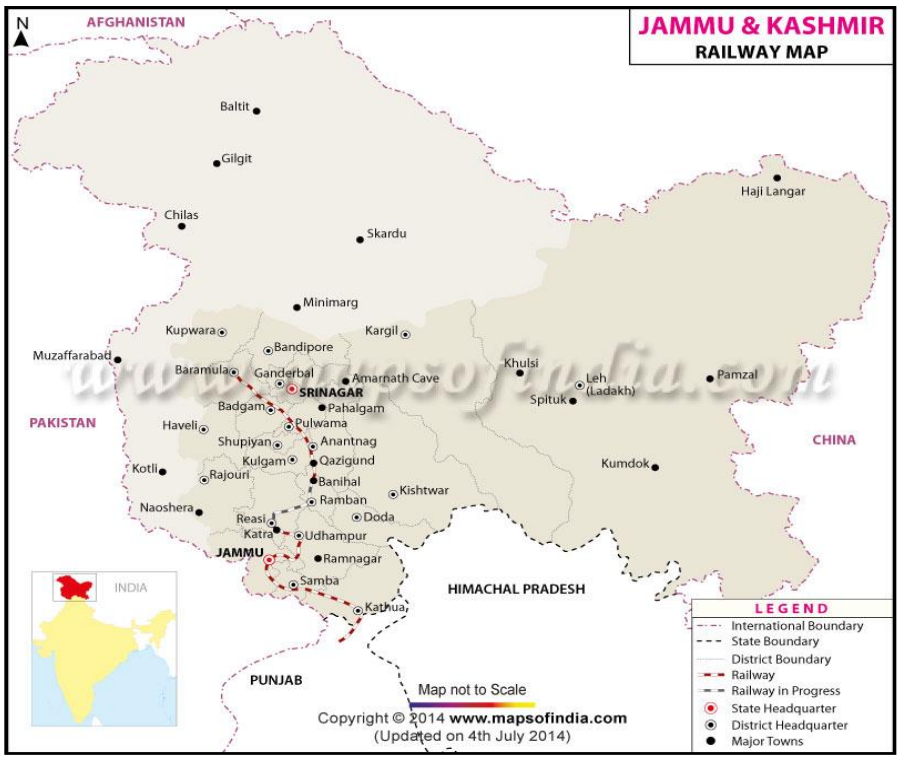


Fig 2.12: Jammu and Kashmir Rail Map

2.6 Economic Perspective

The future traffic growth will thus depend on the future economic development in the state. The economic perspective for the state is based on the past performance of the economy and the economic growth.

2.6.1 Past Performance

The details of GSDP are given in Table below.

Table 2.4: Gross State Domestic Product (GSDP) Estimates (Revised) by Economic Activity at Constant (2004-05) Prices

S. No.	Sector	2011-12 (Q)	2012-13 (Q)	2013-14 (A)
1	Agriculture including Livestock	743878	745110	756742
2	Forestry and Logging	130261	130059	131083
3	Fishing	18071	18160	18347

S. No.	Sector	2011-12 (Q)	2012-13 (Q)	2013-14 (A)
(A)	**Agriculture & Allied (1+2+3)**	**892209**	**893330**	**906171**
4	Mining and Quarrying	10446	44768	313638
(a)	**Sub-total Primary (A+4)**	**902655**	**938098**	**50300**
5	Manufacturing	290872	305100	956471
5.1	Manufacturing (Registered)	134062	138905	313638
5.2	Manufacturing (Un-registered)	163740	166195	142740
6	Construction	476989	489583	170898
7	Electricity, Gas, Water Supply	185792	188497	508922
(b)	**Sub-total Secondary (5-7)**	**690583**	**983180**	**194022**
(B)	**Industry (b+4)**	**971029**	**1027949**	**1016582**
8	Transport, Storage & Communication	326981	349799	233485
9	Trade, Hotels & Restaurants	290376	299924	379532
10	Banking & Insurance	232571	256991	286321
11	Real Estates, Ownership of Dwelling, Legal & Business Services	228437	238825	249603
12	Public Administration	684436	747025	823423
13	Other Services	519803	554075	594528
(C)	**Sub-total Tertiary (Services Sector) (8-13)**	**2200827**	**2366546**	**2566892**
	Total GSDP (a + b + c)	**4064065**	**4287825**	**4539945**
	Population in Lakhs	118.06	119.52	120.96
	Per Capita GSDP (Rs.)	**34424**	**35875**	**37533**
	Growth Rate	**6.19**	**5.51**	**5.88**

Table 2.5: Net State Domestic Product (NSDP) and Per Capita Income

S. No.	Year	NSDP (Rs. in Crore)		Per capital income (Rs.)	
		At Current Prices	At Constant (1980-81) Prices	At Current Prices	At Constant (1980-81) Prices
1	1980-81	1049.50	1049.50	1776	1776
2	1985-86	1929.23	1229.84	2874	1832
3	1986-87	2134.01	1245.82	3108	1809
4	1987-88	2086.26	1109.63	2954	1571
5	1988-89	2547.67	1257.47	3517	1736
6	1989-90	2688.38	1285.35	3618	1730
7	1990-91	2908.26	1359.89	3816	1784
8	1991-92	3249.87	1390.48	4157	1779
9	1992-93	3564.56	1452.27	4457	1816
10	1993-94	5500.20	5500.20	6543	6543
11	1994-95	6001.44	5744.99	6915	6619
12	1995-96	6973.05	6031.48	7783	6732
13	1996-97	7850.89	6320.65	8667	6978
14	1997-98	8857.86	6652.24	9491	7128

S. No.	Year	NSDP (Rs. in Crore)		Per capital income (Rs.)	
		At Current Prices	At Constant (1980-81) Prices	At Current Prices	At Constant (1980-81) Prices
15	1998-99	11128.21	7005.33	11591	7296
16	1999-00	13532.97	13532.97	13816	13816
17	2000-01	14328.40	13917.48	14268	13859
18	2001-02	15456.42	14184.90	15019	13784
19	2002-03	17399.87	14907.16	16739	14341
20	2004-05	23292.21	23292.21	21734	21734
21	2005-06	25278.10	24371.09	23240	22406
22	2006-07	27652.09	25794.32	25059	23375
23	2007-08	30720.05	27387.31	27448	24470
24	2008-09	34290.32	29102.03	30212	25641
25	2009-10	38718.20	30513.15	33650	26519
26	2010-11	4674012	3225589	40089	27666
27	2011-12 (Q)	5336075	3431596	45198	29067
28	2012-13 (Q)	6154429	3625604	51493	30335
29	2013-14 (A)	7087432	3843266	58593	31773

(Data Source: Digest of Statistics, 2012-13)

Chapter 3

Traffic Surveys and Analysis

3.0 Traffic Surveys and Analysis

3.1 General

Traffic surveys, analysis and demand forecast are an important element of any feasibility /detailed project report preparation. Traffic analysis and demand forecasting are directly related to several important aspects of project road planning and design i.e. capacity augmentation proposals, geometric design features, planning and design of toll plaza, pavement design, economic and financial analysis etc. Towards this the consultant has undertaken detailed traffic surveys, analysis, forecasting and carry out laning requirements. Various steps followed in this regard are described in the subsequent paragraphs.

3.2 Objectives

- To carry out traffic surveys and estimation of base year traffic demand
- Identification of travel pattern and influence area of project road
- Traffic demand forecasting up to project life
- Assess capacity requirement of project road, to estimate tollable traffic & to identify toll plaza locations.

3.3 Project Road

The project road deals with the section of Khellani-Chhatroo from Ex. Chainage 44+500 to 140+870 of NH-244. The total existing length of the project road is about 96+370 Km. the starting point of Vailoo Tunnel project coincides near the end point of Khellani-Chhatroo project. The project is expected fulfil the future traffic requirements , once the Vailoo Tunnel starts operating, the project road of Khellani – Chhatroo along with Vailoo Tunnel project road will work as a single system and will carry the majority of traffic load from Kishtwar side towards the Vailoo side. This proposed section will bypass the very long and absurd stretch of Sinthan Pass.

The project has been divided into five packages which are as follows:

Package-I from design km 31+449 to Km 51+700 =20.251 km

Package-II from design km 51+700 to Km 66+535 =14.835 km

Package-III from design km 67+805 to Km 80+675=12.870 km

Package-IV from design km 80+675 to Km 95+550 (Kishtwar Bypass) =14.875 km

Package-V from design km 95+550 to Km 111+066 =15.516 km.

A Link Road connecting Kishtwar town of length 1.871 Km

This report deals with the details of Package-I from Design CH. Km 31+449 to Km 51+700 =20.251 km

The Project Road falls in the Doda and Kishtwar districts in the newly formed UT of Jammu & Kashmir. The Project Road starts from Existing Km 44.500 near Khellani and passes through Gangalwar, Bhuta, Suigwari, Nai Basti, Premnagar, Thatri, Darabshalla, Kandiri, Kishtwar, Marwah, Kodia, Dhadhpeth, Mughal Maidan, and Udil Gurjan and terminates at Existing Km 140+870 near Chattroo. The location of the Project Road has been shown in the Fig. 1.1 – Key Plan.

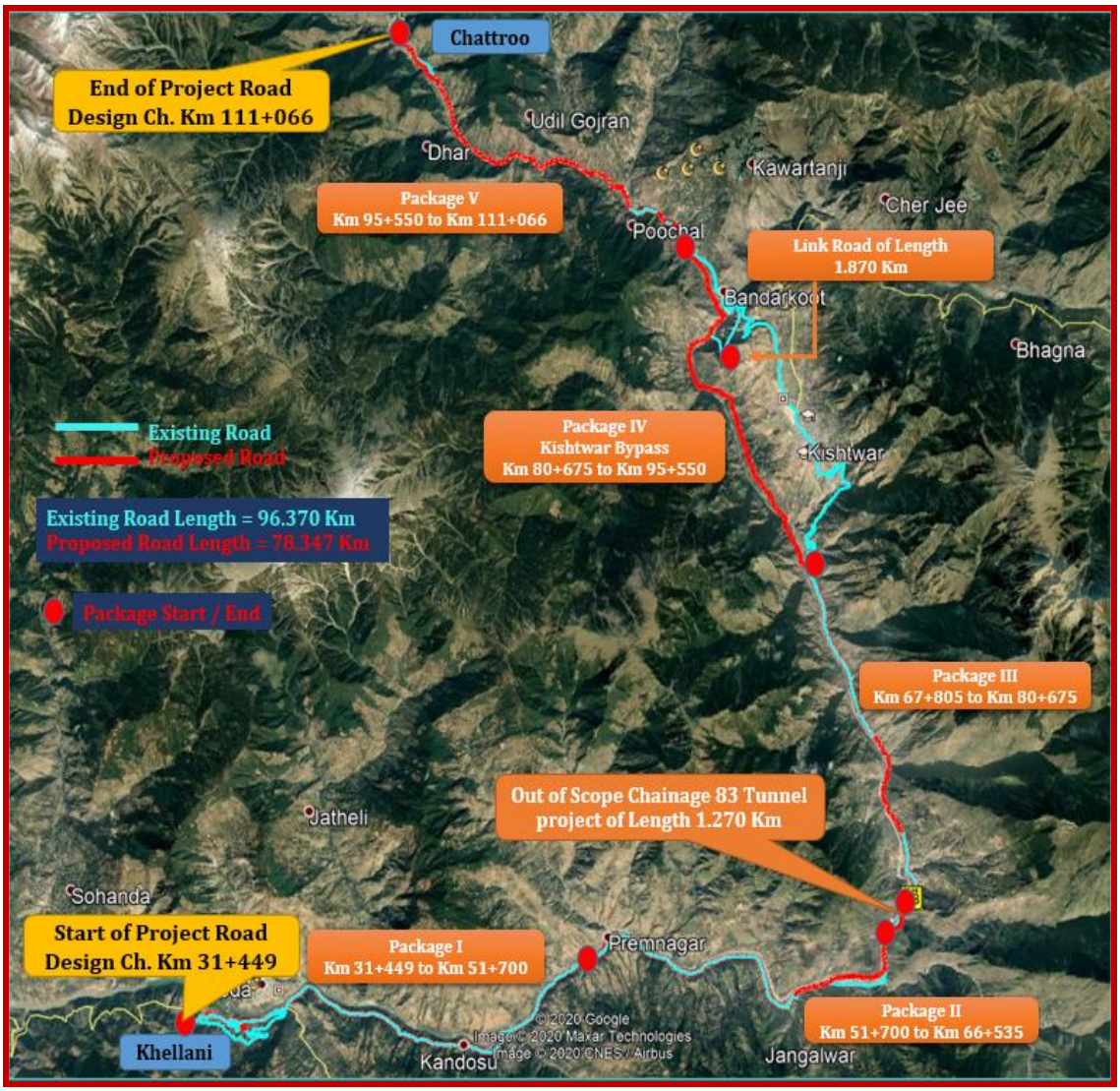


Figure 3.1 Project Road Transport Route Network

3.4 Traffic Homogeneous Section

The traffic homogeneous sections have been identified based on the major traffic generators and diversion locations along the project corridor. The passenger traffic has been observed to vary with respect to the influence of village/towns falling along the project corridor. The major traffic generators settlements and its connections (diversion) points are:

- Khellani (Existing Km 44+500) to Gandoh Junction (Km 82+710)
- Gandoh Jn (Existing km 82+710) to Kishtwar (Km 110+560)
- Kishtwar (Existing Km 110+560 to Chattroo (Km 140+870)

Traffic surveys locations were selected to capture representative traffic volume on the homogeneous sections with a view to capture section wise traffic flow characteristics, the total stretch has been segmented in to four homogeneous sections, based upon the major intersections that act as main collectors or distributors (diversion) of traffic along the project road. The traffic homogeneous section in the road section is as follows:

Table 3.1: Traffic Homogenous Section

Sr. No.	Homogeneous Section	Existing Chainage	
		From (Km)	To (km)
1	Khellani to Gandoh Junction	44+500	82+710
2	Gandoh Jn to Kishtwar	82+710	110+560
3	Kishtwar to Chattroo	110+560	140+870

3.5 Traffic Survey Planning and Selection of Survey Location

A comprehensive traffic survey plan has been prepared for the project road after considering traffic intensity on homogeneous sections and travel characteristics. Detailed site visit of project road and its influence/alternative transport network have been carried out and traffic surveys were conducted between 20th July 2019 to 27th July 2019. Traffic survey locations were finalised by consultation with client officials. Further details of survey are elaborated in this chapter. However, survey schedule and duration is enclosed in **Table 3.2.**

3.6 Traffic Surveys Schedule

It is very important, that the existing information on traffic flow, commodity movement and traffic pattern is required to assess the traffic behaviour on a project road. To collect such information to satisfy the Terms of Reference (TOR) and project requirements, following various types of traffic surveys were carried out: -

1) Classified Volume Count (CVC) Survey
2) Axle Load Spectrum Survey
3) Origin –Destination and Commodity Movement Surveys
4) Intersection Volume Count Survey
5) Speed and Delay surveys

Traffic survey locations were selected after detailed reconnaissance survey and in line with the TOR. All the traffic surveys were carried out as per the IRC guidelines given in

IRC: SP 19-2001, IRC 37:2018, IRC: 108-2015, IRC SP: 41-1994, IRC: 102-1988, IRC 103-2012 and IRC: 09-1972 etc.

All the above surveys were carried out manually by employing enough trained enumerators recording information in the pre-designed formats. The enumerators were selected from locally available educated people familiar with traffic characteristics and condition of the project road. They were properly briefed and trained about the survey work before putting them on actual survey work in field. An experienced supervisor was kept in-charge for all the locations.

The locations for the various surveys were so selected that all vehicles can be viewed and interpreted easily without endangering the safety of enumerators and drivers. The most important part of all traffic survey was to exercise adequate quality control. The quality assurance was achieved through:

- Proper briefing and demonstration to enumerators before the start of work;
- Continuous independent checking by Traffic engineers / supervisor in the field during the survey work.
- Checking of filled in survey formats by Traffic engineer; and
- Validation of computer data entry with raw surveyed data

The survey data were recorded in the pre-designated approved formats for each type of survey. All the above traffic surveys were carried out as per the schedule finalised after considering requirements of TOR and project requirements as presented below.

Table 3.2: Traffic Survey Schedule

Type of Survey	Location	Survey Date		Duration
		From	To	
Classified Traffic Volume Count Survey / Axle Load	Ex. Km 80.650	20-7-2019	27-07-2019	7 days (24 Hrs)
	Ex. Km 104.400	21-07-2019	28-07-2019	
	Ex. Km 126.000	20-7-2019	27-07-2019	
Origin and Destination Studies	Ex 104+400	22-07-2019		24 Hrs
Turning Movement Survey	Ex. Km 53+950	24-07-2019		12 Hrs
	Ex. Km 82+700	23-07-2019		
	Ex. Km 110+525	22-07-2019		
Speed & Delay Surveys	Entire project road			

3.7 Traffic Surveys Methodology

3.7.1 Classified Volume Count Survey

The objective of classified traffic volume count survey is to estimate traffic intensity on

the project road. The classified volume count surveys at four strategic locations have been carried out for 7 days, @ 24 hours/day. The traffic is counted in number of vehicles by vehicle category-wise in each direction in a 15- minute interval over 24 hrs a day for 7 days. The counts were recorded in the approved formats as per IRC specifications.

3.7.2 Origin-Destination and Commodity Movement Survey

In a transportation study, it is necessary to estimate the number of trips with respect to origin and destination. These calculations help in studying travel trends of passenger and Commercial vehicles. The trend pattern determines the basis for adopting techniques for estimating traffic growth projections. O-D surveys were carried out at one location to get travel and loading patterns.

The Origin-Destination survey was carried out to study the travel pattern of goods and passenger traffic along the project road. O-D surveys shall help calculate future diverted traffic on project roads once a better transportation facility is made available. The location of origin and destination zones has been determined in relation to each individual station and the possibility of traffic diversion to the project road from/to other routes including bypasses.

Roadside Interview Method was adopted for conducting the survey. A sample proportion of vehicles were interviewed from the total traffic. Randomly picked vehicles were stopped and interviewed. Designated trained enumerators interviewed the drivers. Variable sampling flow requires a classified hourly count of all vehicles that pass in the direction being studied while interview is in progress. A volume count survey was carried out simultaneously to get the number of vehicles passing in both the directions. The O-D survey was limited to cars/Jeeps, bus, LCV, and 2 axles / 3 axles, Multi Axle. The following information on travel was collected during the O-D and commodity movement surveys

- Origin and destination of trips.
- Trip Purpose
- Travel Route
- Trip length.
- Vehicle Occupancy.
- Type of commodity and loading in case of the goods vehicles; and
- Frequency of trips etc.

Appropriate zoning system was adopted, and coding was done for zones and type of vehicle & commodity being carried.

3.7.3 Intersection Volume Count Survey

The objective of turning movement count survey is to estimate the traffic contribution

and diversion to and from the project road. The Intersection Turning Movement count was carried out with primary objective for identifying the type of control measures required for the junction improvement. Intersection Volume Count Survey has been carried out at one major intersection along the project road. Each turning movement at the intersection was recorded by deploying sufficient trained enumerators on each arm traffic intensity.

3.7.4 Speed and Delay Survey

The purpose of the travel time and delay study is to evaluate the quality of traffic movement along a route and to determine the locations, types and extents of traffic delays. The efficiency of flow is measured by travel and running speeds. In the actual study, total travel and running times are observed and then converted into speed measures.

Before starting the test runs, major intersections or suitable control points were selected along the study route as reference/control locations. The project road was divided into two sections based on the traffic characteristics and pavement condition of the corridor. Time readings are taken at these locations to permit the development of travel speeds by sections along the travelled route.

A test vehicle is driven along the study route in accordance with moving car technique, in which, a safe level of vehicular operation is maintained by observing proper following and passing distances and by changing speed at reasonable rates of acceleration and decelerations. Delay information is recorded when the traffic flow is stopped or greatly impeded. The duration of traffic delay is measured in units of time along with notations of the corresponding location, cause and frequency of delay to travel. Following information was collected during the survey:

- Number of vehicles in the opposite direction of test car.
- Number of vehicles overtaken by the test car.
- Number of vehicles overtaking the test car.
- Amount of delay occurred; and
- Reasons for the delay etc.

3.8 Analysis of Traffic Surveys - Base Year Traffic Estimation

3.8.1 General

The base year traffic pattern is the primary input for checking existing level of service and determination of future traffic demand of project influence area. The consultant has conducted Classified Volume Count Surveys, Intersection Volume Count, O-D and commodity, Axle load and speed & delay surveys to examine the base year traffic

intensity, travel characteristics, loading patterns and travel speed on project road. For traffic estimation and projection, the year 2019 has been taken as base year.

The following section provides detailed traffic analysis and important observations about traffic pattern along the project corridor. The data collected during traffic surveys was entered into the computer for further analysis and to obtain information about traffic characteristics and travel pattern along the project road. The results of the analysis can be further used for designing the pavement crust, road cross-section, planning and designing the toll plaza & way side amenities, and for economic and financial analysis. The traffic analysis was carried out as per the guidelines given in IRC: SP 19-2001, IRC: 108-2015, IRC: 64-1990, IRC SP: 41-1994.

3.8.2 Classification of Vehicles and PCU Values

To convert recorded vehicles into a common scale, the Passenger Car Units (PCU) equivalent factor as per IRC: 64-1990 has been adopted. The PCU equivalent factors adopted are as given in **Table 3.3.**

Table 3.3: Classification of Vehicles Recommended PCU Equivalents Factor

Sr. No.	Vehicle Type	PCU Value
Fast Moving Vehicles		
1	Cars/Utility Vehicles/Jeeps/Vans & 3 Wheelers	1.0
2	2 Wheelers	0.5
3	LCV Passenger/LCV Goods/Minibus	1.5
4	Standard Bus	3.0
5	Two and 3 Axle Truck	3.0
6	Multi Axle Truck/Heavy Construction Machinery/Trailer	4.5
7	Agricultural Tractor (with Trailer)	4.5
8	Agricultural Tractor (without Trailer)	1.5
Slow Moving Vehicles		
1	Bicycle	0.5
2	Cycle Rickshaw	2.0
3	Animal Drawn Vehicle (Bullock cart)	8.0
4	Animal Drawn Vehicle (Horse drive)	4.0
5	Hand cart	3.0

3.9 Analysis of Classified Volume Count Survey

3.9.1 Average Daily Traffic (ADT)

7-Day, 24 hrs Continuous volume counts were undertaken to obtain a realistic picture of the current volume and composition of the traffic. The analysis of traffic counts provided an estimate of the Average Daily Traffic (ADT) and the analysis has been carried out in terms of total number of vehicles as well as in respect to Passenger Car Unit (PCU). Location wise results of traffic analysis are discussed below:

a) Near Doda at Ex. Km 80+650

Classified Volume count survey was carried out at Ex. Km 80+650 near Doda.

Total ADT at this station were recorded as 2528 in terms of number and 2866 in terms of PCU. Fast moving vehicles were recorded as 98% of the total traffic (in No.). Peak hour traffic flow of 263 nos. formed around 10% of the total traffic of that day. Peak hour is identified during 08:00-09:00 hours. The directional distribution for all vehicles observed is 49 percent flow towards up direction and 51 percent towards down direction.

Table 3.4: Summary of Classified Volume Count Survey at all count stations

Sr. No.	Location	Fast Moving Vehicles (PCU)	Slow Moving Vehicles (PCU)	Total ADT (No)	Total ADT (PCU)	Directional Distribution (%)		Peak Traffic (vol)	Peak Hour	Peak Traffic (%)
						Up	Down			
1	Near Doda	2844	22	2528	2866	49.0	51.0	263	08:00-09:00	10

Location wise Average daily traffic is shown in **Annexure 3.1 (a) & 3.2(a).** Survey has been carried out for seven days 24 hours continuously; the traffic flow on all the days in the week will not be same. There will be variation of traffic for each day. The daily and hourly variation of traffic is presented graphically in **Figure 3.2, 3.3 and 3.4**

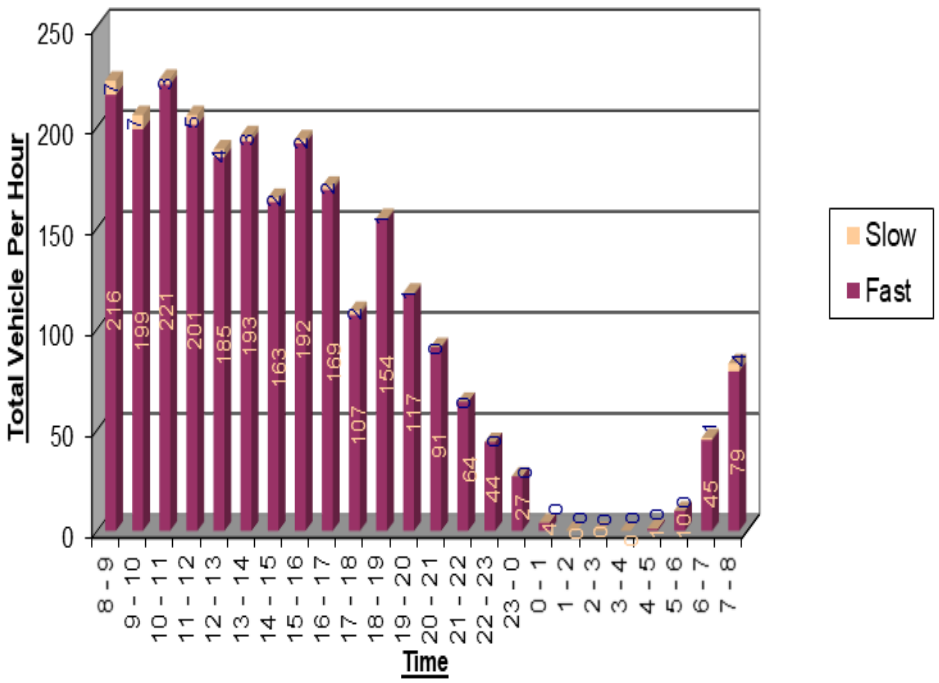


Figure 3.2: Total Vehicle per hour near Doda at Ex. Km 80+650

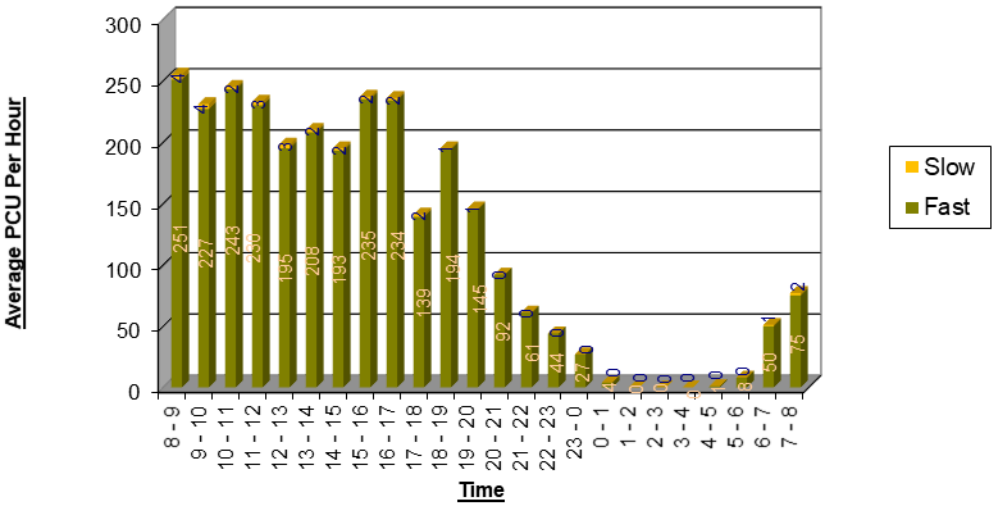


Figure 3.3: Average PCU per hour near Doda at Ex. Km 80+650

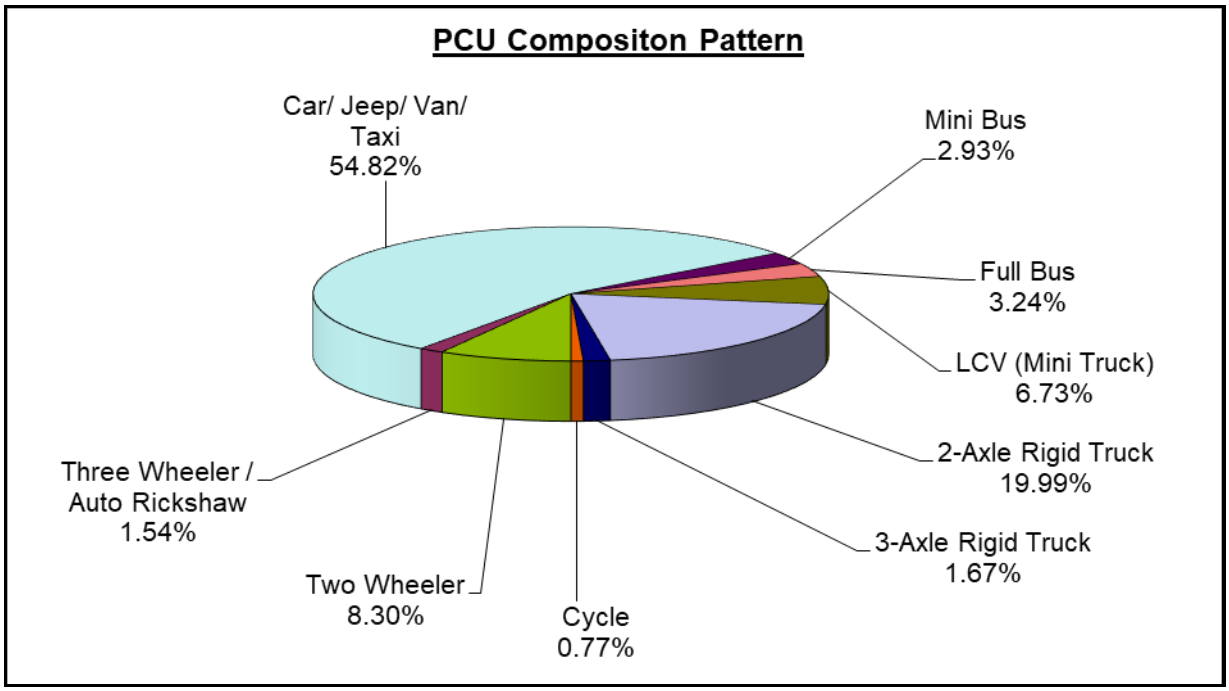


Figure 3.4: PCU composition of Total traffic near Doda at Ex. Km 80+650

Average Daily Traffic near Doda

		Motorised Vehicle																		Non-motorised Vehicles			
		Two-Wheeler		Three-Wheeler / Auto Rickshaw		Car/ Jeep/ Van/ Taxi		Bus				LCV (Mini Truck)		Truck				Total Motorised Vehicles		Cycle		Total Non-motorised Vehicles	
								Mini		Full				2-Axle Rigid Truck		3-Axle Rigid Truck							
Equivalency Factor		0.5		1.0		1.0		3.0		3.0		1.5		3.0		3.0				0.5			
Time Period		*No.*	*PCU*	*No.*	*PCU*	*No.*	*PCU*	*No.*	*PCU*	*No.*	*PCU*	*No.*	*PCU*	*No.*	*PCU*	*No.*	*PCU*	*No.*	*PCU*	*No.*	*PCU*	*No.*	*PCU*
20-Jul-19	**(Day-1)**	475	238	23	23	1535	1535	21	63	28	84	122	184	200	600	15	45	**2419**	**2772**	40	20	**40**	**20**
21-Jul-19	**(Day-2)**	413	207	34	34	1426	1426	22	66	22	66	105	158	169	507	10	30	**2201**	**2494**	33	17	**33**	**17**
22-Jul-19	**(Day-3)**	458	229	45	45	1522	1522	24	72	31	93	116	174	174	522	18	54	**2388**	**2711**	49	25	**49**	**25**
23-Jul-19	**(Day-4)**	469	235	52	52	1675	1675	31	93	38	114	129	194	192	576	13	39	**2599**	**2978**	41	21	**41**	**21**
24-Jul-19	**(Day-5)**	516	258	66	66	1640	1640	37	111	27	81	137	206	211	633	18	54	**2652**	**3049**	54	28	**54**	**28**
25-Jul-19	**(Day-6)**	484	242	41	41	1578	1578	30	90	33	99	148	222	182	546	23	69	**2519**	**2887**	38	19	**38**	**19**
26-Jul-19	**(Day-7)**	522	262	49	49	1627	1627	27	81	35	105	139	209	209	627	20	60	**2628**	**3020**	46	23	**46**	**23**
Directional Split (%)	**Up**	**53**		**55**		**48**		**46**		**52**		**46**		**43**		**44**		**49**		**51**		**51**	
	Down	**47**		**45**		**52**		**54**		**48**		**54**		**57**		**56**		**51**		**49**		**49**	
Average Daily Traffic (Up+Down)	**No. & PCU**	**476**	**238**	**44**	**44**	**1571**	**1571**	**28**	**84**	**31**	**93**	**128**	**193**	**191**	**573**	**16**	**48**	**2485**	**2844**	**43**	**22**	**43**	**22**
	Total No.	**2528**																					
	Total PCU	**2866**																					

b) Near Kishtwar at Ex. Km 104+400

Classified Volume count survey was carried out at Km 104+400 near Kishtwar

Total ADT at this station were recorded as 1816 in terms of number and 2263 in terms of PCU. Fast moving vehicles were recorded as 98% of the total traffic (in No.). Peak hour traffic flow of 174 nos. formed around 09% of the total traffic of that day. Peak hour is identified during 12:00-13:00 hours. The directional distribution for all vehicles observed is 51 percent flow towards up direction and 49 percent towards down direction.

Table 3.5 : Summary of Classified Volume Count Survey at all count stations

Sr. No.	Location	Fast Moving Vehicles (PCU)	Slow Moving Vehicles (PCU)	Total ADT (No)	Total ADT (PCU)	Directional Distribution (%)		Peak Traffic (vol)	Peak Hour	Peak Traffic (%)
						Up	Down			
1	Near Kishtwar	2242	21	1816	2263	51.0	49.0	174	12:00-13:00	09

Location wise Average daily traffic is shown in **Annexure 3.1(b) & 3.2(b).** Survey has been carried out for seven days 24 hours continuously; the traffic flow on all the days in the week will not be same. There will be variation of traffic for each day. The daily and hourly variation of traffic is presented graphically in **Figure 3.5, 3.6 and 3.7**

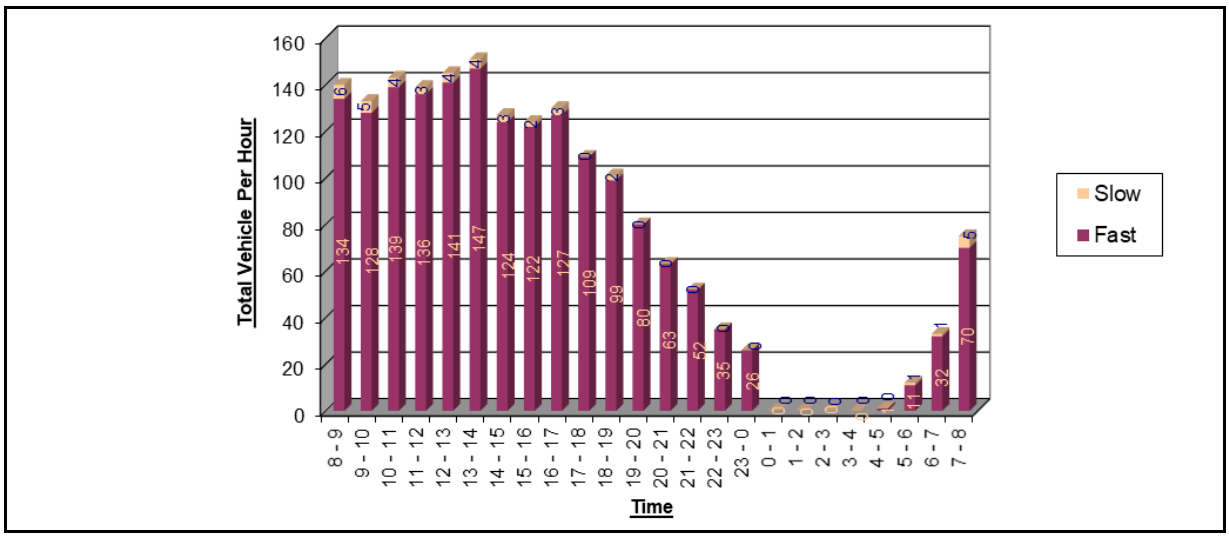


Figure 3.5: Total Vehicle per hour near Kishtwar at Ex. Km 104+400

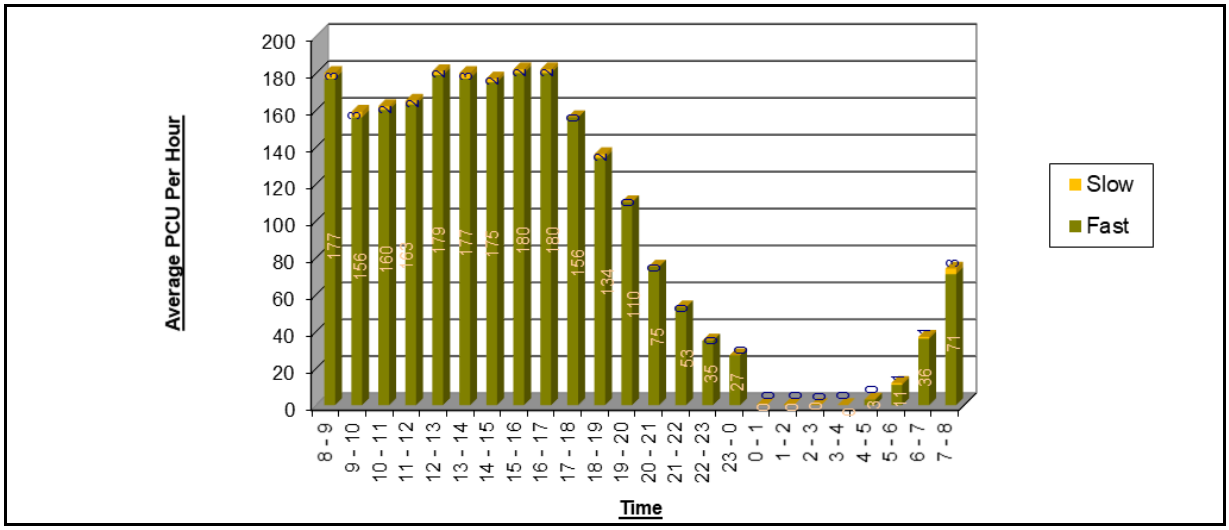


Figure 3.6: Average PCU per hour near Kishtwar at Ex. Km 104+400

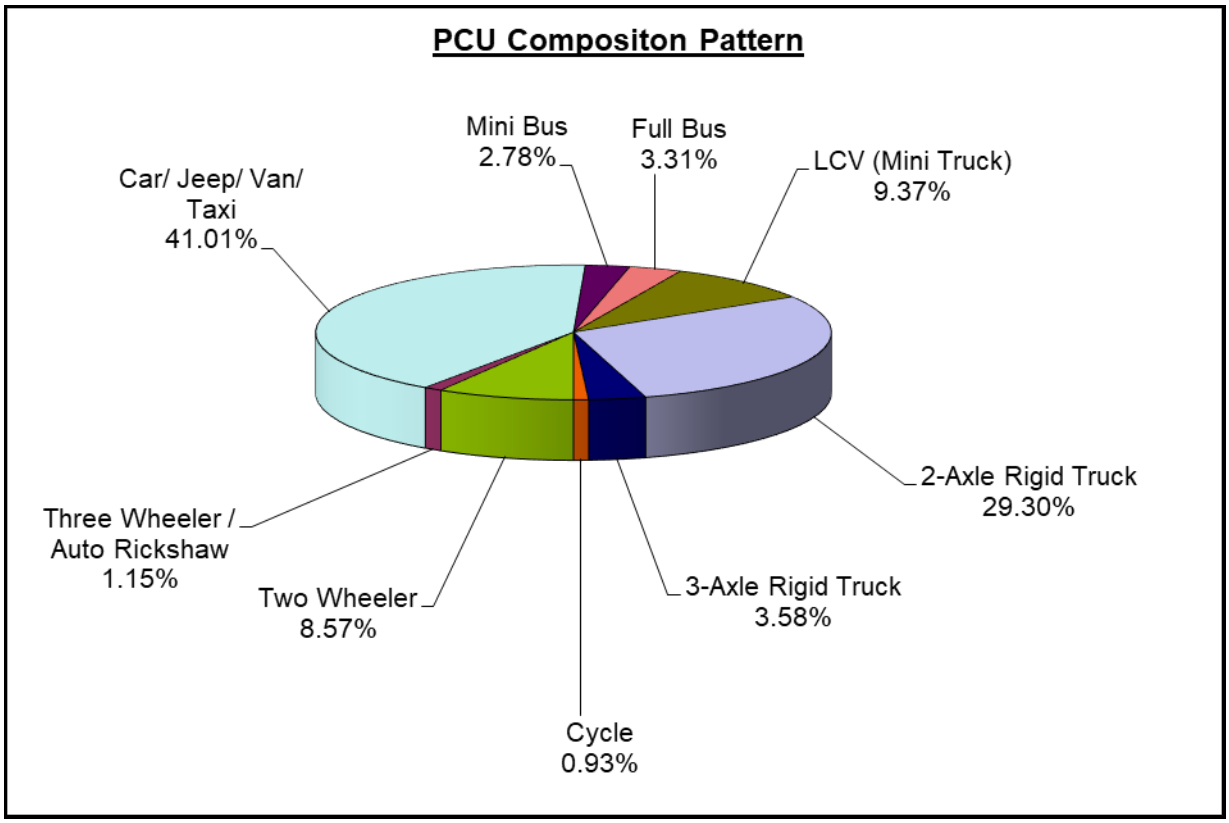


Figure 3.7: PCU composition of Total traffic near Kishtwar at Ex. Km 104+400

Average Daily Traffic at Kishtwar																							
		Motorised Vehicle																		Non-motorised Vehicles			
		Two-Wheeler		Three-Wheeler / Auto Rickshaw		Car/ Jeep/ Van/ Taxi		Bus				LCV (Mini Truck)		Truck				Total Motorised Vehicles		Cycle		Total Non-motorised Vehicles	
								Mini		Full				2-Axle Rigid Truck		3-Axle Rigid Truck							
Equivalency Factor		0.5		1.0		1.0		3.0		3.0		1.5		3.0		3.0				0.5			
Time Period		*No.*	*PCU*	*No.*	*PCU*	*No.*	*PCU*	*No.*	*PCU*	*No.*	*PCU*	*No.*	*PCU*	*No.*	*PCU*	*No.*	*PCU*	*No.*	*PCU*	*No.*	*PCU*	*No.*	*PCU*
21-Jul-19	**(Day-1)**	352	176	15	15	873	873	13	39	19	57	120	181	187	561	15	45	**1594**	**1947**	42	21	**42**	**21**
22-Jul-19	**(Day-2)**	390	196	25	25	962	962	16	48	24	72	137	206	215	645	21	63	**1790**	**2217**	47	24	**47**	**24**
23-Jul-19	**(Day-3)**	374	188	33	33	979	979	22	66	30	90	149	224	241	723	30	90	**1858**	**2393**	38	19	**38**	**19**
24-Jul-19	**(Day-4)**	411	206	21	21	927	927	20	60	25	75	161	242	228	684	27	81	**1820**	**2296**	54	28	**54**	**28**
25-Jul-19	**(Day-5)**	385	193	29	29	938	938	29	87	33	99	156	234	250	750	38	114	**1858**	**2444**	35	18	**35**	**18**
26-Jul-19	**(Day-6)**	423	212	37	37	957	957	24	72	23	69	140	211	237	711	35	105	**1876**	**2374**	40	21	**40**	**21**
27-Jul-19	**(Day-7)**	366	183	22	22	860	860	19	57	21	63	126	189	191	573	24	72	**1629**	**2019**	31	16	**31**	**16**
Directional Split (%)	**Up**	**55**		**50**		**52**		**48**		**44**		**39**		**49**		**52**		**51**		**54**		**54**	
	Down	**45**		**50**		**48**		**52**		**56**		**61**		**51**		**48**		**49**		**46**		**46**	
Average Daily Traffic (Up+Down)	**No. & PCU**	**386**	**194**	**26**	**26**	**928**	**928**	**21**	**63**	**25**	**75**	**141**	**212**	**221**	**663**	**27**	**81**	**1775**	**2242**	**41**	**21**	**41**	**21**
	Total No.	**1816**																					
	Total PCU	**2263**																					

c) Near Poochal Village at Ex. Km 126+000

Classified Volume count survey was carried out at Ex. Km 126+000 near Poochal Village.

Total ADT at this station were recorded as 783 in terms of number and 787 in terms of PCU. Fast moving vehicles were recorded as 100% of the total traffic (in No.). Peak hour traffic flow of 83 nos. formed around 10% of the total traffic of that day. Peak hour is identified during 08:00-09:00 hours. The directional distribution for all vehicles observed is 52 percent flow towards up direction and 48 percent towards down direction.

Table 3.6: Summary of Classified Volume Count Survey at all count stations

Sr. No.	Location	Fast Moving Vehicles (PCU)	Slow Moving Vehicles (PCU)	Total ADT (No)	Total ADT (PCU)	Directional Distribution (%)		Peak Traffic (vol)	Peak Hour	Peak Traffic (%)
						Up	Down			
1	Near Poochhal Village	783	0	783	787	52.0	48.0	83	08:00-09:00	10

Location wise Average daily traffic is shown in **Annexure 3.1(c) & 3.2 (c).** Survey has been carried out for seven days 24 hours continuously; the traffic flow on all the days in the week will not be same. There will be variation of traffic for each day. The daily and hourly variation of traffic is presented graphically in **Figure 3.8, 3.9 and 3.10.**

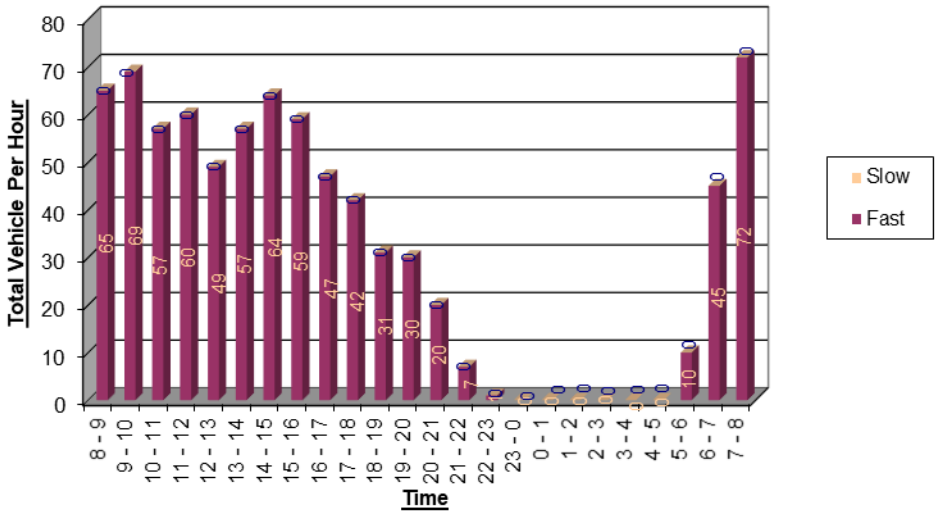


Figure 3.8: Total Vehicle per hour near Poochhal at Ex. Km 126+000

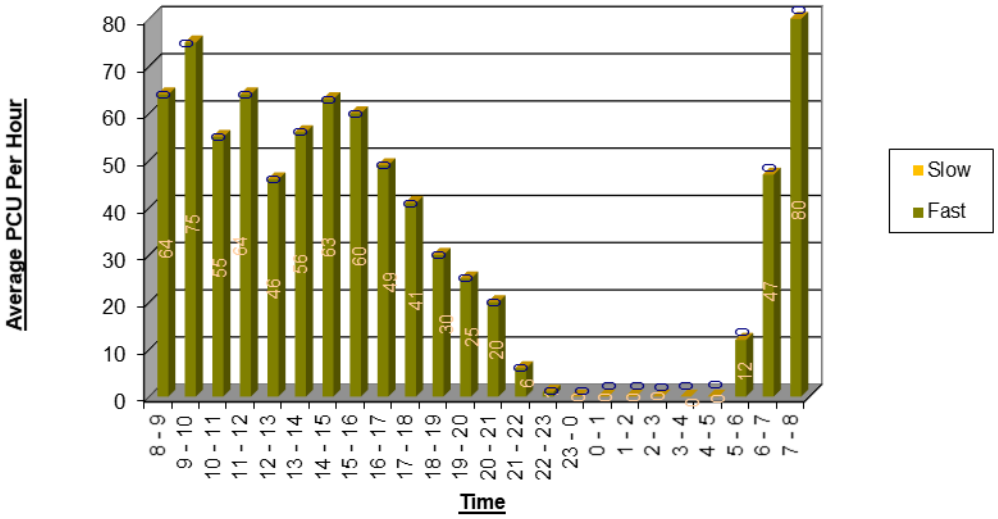


Figure 3.9: Average PCU per hour near Poochhal at Ex. Km 126+000

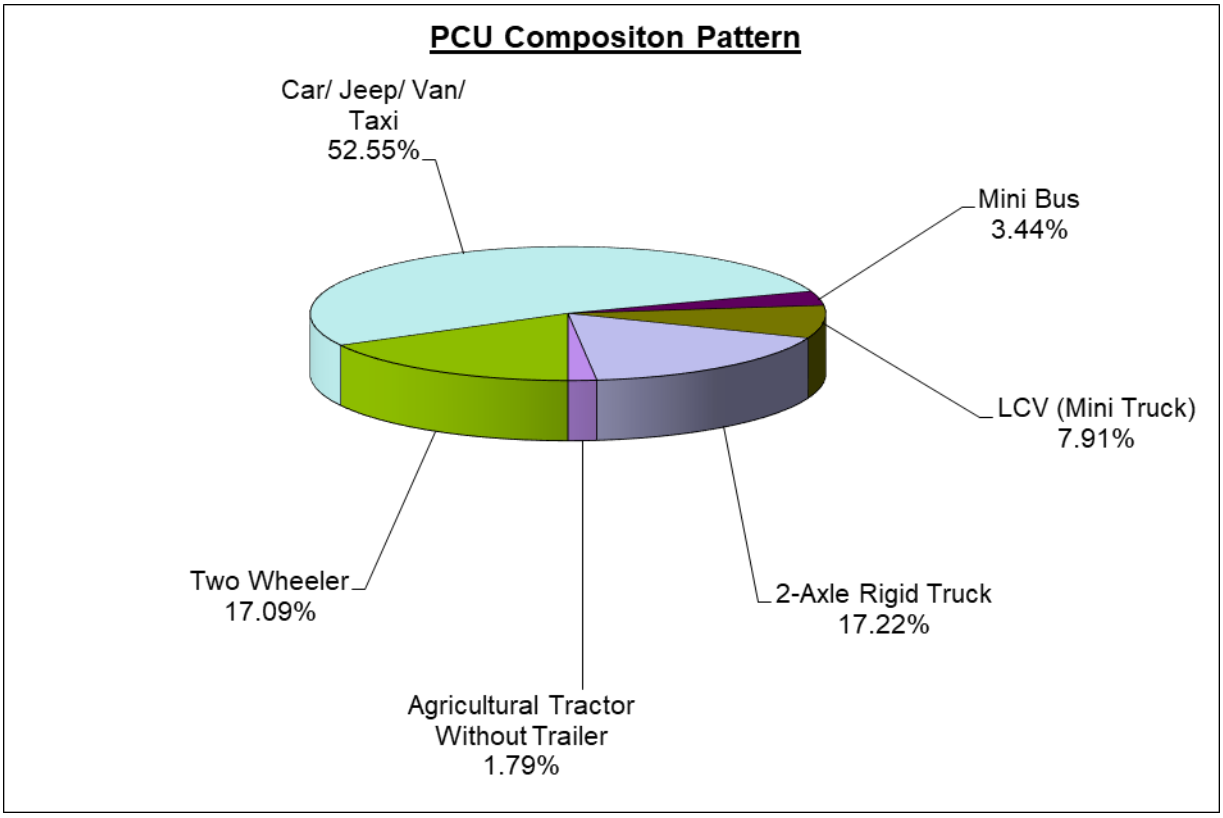


Figure 3.10: PCU composition of Total traffic near Poochhal at Ex. Km 126+000

Average Daily Traffic in Both Directions at Poochal Village															
		Motorised Vehicle													
		Two-Wheeler		Car/ Jeep/ Van/ Taxi		Bus – Mini		LCV (Mini Truck)		Truck – 2-Axle Rigid Truck		Agricultural Tractor – Without Trailer		Total Motorised Vehicles	
Equivalency Factor		0.5		1.0		3.0		1.5		3.0		1.5			
Time Period		No.	PCU	No.	PCU	No.	PCU	No.	PCU	No.	PCU	No.	PCU	No.	PCU
28-Apr-19	(Day-1)	235	118	380	380	6	18	30	46	28	84	4	6	**683**	**652**
29-Apr-19	(Day-2)	256	128	426	426	7	21	23	35	38	114	8	12	**758**	**736**
30-Apr-19	(Day-3)	283	142	445	445	10	30	40	61	50	150	13	20	**841**	**848**
1-May-19	(Day-4)	259	130	403	403	9	27	52	79	46	138	11	17	**780**	**794**
2-May-19	(Day-5)	270	136	436	436	14	42	48	72	64	192	10	15	**842**	**893**
3-May-19	(Day-6)	297	149	417	417	11	33	59	89	59	177	15	23	**858**	**888**
4-May-19	(Day-7)	265	133	378	378	8	24	36	54	33	99	6	9	**726**	**697**
Directional Split (%)	Up	48		54		56		49		51		50		52	
	Down	52		46		44		51		49		40		48	
ADT (Up+Down)	No. & PCU	266	134	412	412	9	28	41	62	45	136	10	15	783.00	787
	Total No.	783													
	Total PCU	787													

3.10 Annual Average Daily Traffic (AADT)

The seasonal correction factors presented above are used to convert Average Daily Traffic (ADT) to Annual Average Daily Traffic (AADT). Location wise Annual Average daily traffic is shown in **Annexure 3.2(a-c)**.

Table 3.7- Annual Average Daily Traffic near Doda, Ex. Km 80+650.

Annual Average Daily Traffic (AADT)

Road : NH 244 **Starting Date :** 20-Jul-19

Location : Pull Doda **Ending Date :** 27-Jul-19

Type of Vehicle			ADT (Up+Dn)		Annual Average Daily Traffic (AADT)	
			No.	PCU	No.	PCU
Fast / Motorised Vehicles		Two Wheeler	476	238	**428**	**214**
		Three Wheeler / Auto Rickshaw	44	44	**40**	**40**
		Motorized Van	0	0	**0**	**0**
		Car/ Jeep/ Van/ Taxi	1571	1571	**1445**	**1445**
	Bus	Mini	28	84	**25**	**75**
	Bus	Full	31	93	**28**	**83**
		LCV (Mini Truck)	128	193	**114**	**172**
	Truck	2-Axle Rigid Truck	191	573	**170**	**510**
	Truck	3-Axle Rigid Truck	16	48	**14**	**43**
	Truck	Multi-Axle Rigid Truck	0	0	**0**	**0**
	Truck	Truck Trailer (Artic/ Semi-artic)	0	0	**0**	**0**
		Tractor With Trailer	0	0	**0**	**0**
		Tractor Without Trailer	0	0	**0**	**0**
Slow / Non-motorisedVehicles		Cycle	43	22	**43**	**22**
		Cycle Rickshaw	0	0	**0**	**0**
		Bullock Cart	0	0	**0**	**0**
		Horse Drawn Vehicle	0	0	**0**	**0**

Total Motorised Vehicles	2485	2844	**2264**	**2582**
Total Non-motorised Vehicles	43	22	**43**	**22**
Total Vehicles	2528		**2307**	
Total PCU	2866		**2604**	
Commercial Vehicles per Day (CVPD)	394		**351**	

Average Seasonal Correction Factor

For vehicles operated on **Diesel** = **0.89** [For Bus, LCV, Truck & Tractor]

For vehicles operated on **Petrol** = **0.92** [For 3-wheeler, Motorised Van & 4-whee

For vehicle operated on both **Petrol & Diesel** = **0.90** [For 2-wheeler]

Table 3.8 - Annual Average Daily Traffic at Kishtwar, Ex. Km 104+400

Annual Average Daily Traffic (AADT)

Road : NH 244 **Starting Date :** 21-Jul-19

Location : Kishtwar **Ending Date :** 28-Jul-19

Type of Vehicle			ADT (Up+Dn)		Annual Average Daily Traffic (AADT)	
			No.	PCU	No.	PCU
Fast / Motorised Vehicles		Two Wheeler	386	194	**347**	**175**
		Three Wheeler / Auto Rickshaw	26	26	**24**	**24**
		Motorized Van	0	0	**0**	**0**
		Car/ Jeep/ Van/ Taxi	928	928	**854**	**854**
	Bus	Mini	21	63	**19**	**56**
	Bus	Full	25	75	**22**	**67**
		LCV (Mini Truck)	141	212	**125**	**189**
	Truck	2-Axle Rigid Truck	221	663	**197**	**590**
	Truck	3-Axle Rigid Truck	27	81	**24**	**72**
	Truck	Multi-Axle Rigid Truck	0	0	**0**	**0**
	Truck	Truck Trailer (Artic/ Semi-artic)	0	0	**0**	**0**
		Tractor With Trailer	0	0	**0**	**0**
		Tractor Without Trailer	0	0	**0**	**0**
Slow / Non-motorisedVehicles		Cycle	41	21	**41**	**21**
		Cycle Rickshaw	0	0	**0**	**0**
		Bullock Cart	0	0	**0**	**0**
		Horse Drawn Vehicle	0	0	**0**	**0**

Total Motorised Vehicles	1775	2242	**1612**	**2027**
Total Non-motorised Vehicles	41	21	**41**	**21**
Total Vehicles	1816		**1653**	
Total PCU	2263		**2048**	
Commercial Vehicles per Day (CVPD)	435		**387**	

Average Seasonal Correction Factor

For vehicles operated on **Diesel** = **0.89** [For Bus, LCV, Truck & Tractor]

For vehicles operated on **Petrol** = **0.92** [For 3-wheeler, Motorised Van & 4-whee

For vehicle operated on both **Petrol & Diesel** = **0.90** [For 2-wheeler]

Table 3.9- Annual Average Daily Traffic near Doda, Ex. Km 80+650.

Annual Average Daily Traffic (AADT)

Road : NH-244
Location : Poochal

Starting Date : 20 July 2019
Ending Date : 27 July 2019

Type of Vehicle			ADT (Up+ Down)		Annual Average daily Traffic (AADT)	
			No.	PCU	No.	PCU
Fast/Motorised vehicle	Two Wheeler		266	134	240	120
	Three Wheeler/ Auto rickshaw		0	0	0	0
	Motorized Van		0	0	0	0
	Car/Jeep/Van/Taxi		412	412	379	379
	Bus	Mini	9	28	8	25
		Full	0	0	0	0
	LCV (Mini Truck)		41	62	37	55
	Truck	2 Axle Rigid Truck	45	136	40	121
		3 Axle Rigid Truck	0	0	0	0
		Multi Axle Rigid Truck	0	0	0	0
		Truck Trailer (Artic / Semi Artic)	0	0	0	0
	Tractor with Trailer		0	0	0	0
	Tractor without Trailer		10	15	9	13
Slow / Non Motorised Vehicle	Cycle		0	0	0	0
	Cycle Rickshaw		0	0	0	0
	Bullock Cart		0	0	0	0
	Horse Drawn vehicle		0	0	0	0

Total Motorised Vehicle	783	787	713	713
Total Non Motorised Vehicle	0	0	0	0
Total Vehicle	783		713	
Total PCU	787		713	
Commercial Vehicles per Day	95		85	

Average Seasonal Correction Factor

For Vehicles Operated on Diesel	0.89 (for Buses , LCV, Trucks & Tractor)
For Vehicles Operated on Petrol	0.92 (For 3-Wheelers, Motorised Van and 4 Wheeler)
For Vehicles operated on both Petrol & Diesel	0.9 (For 2 Wheeler)

3.11 Estimation of Seasonal Correction Factor

Seasonal Correction factors by vehicle types are required to account for variations in the pattern of traffic volume on the project road sections over different seasons of the year. Seasonal correction trends were assessed based on the sale of automobile fuels i.e. petrol and diesel data along the project road.

Seasonal correction factors were worked out to arrive at Annual Average Daily Traffic (AADT). The monthly petrol and diesel sales data were collected from fuel station on the project road. The SCF was calculated separately for petrol and diesel driven vehicles. The calculated SCF based on monthly fuel consumption are presented in the following **Table 3.10.**

Table 3.10: Seasonal Correction Factors (SCF) Based on Fuel Consumption

	Petrol	Diesel
For Whole Section	0.92	0.89

Since traffic volume count surveys were carried out in the month of June 2019, the computed seasonal variation factors of 0.89 for Diesel driven and 0.92 for Petrol driven vehicles have been adopted for estimation of AADT.

3.12 Past traffic Counts - PWD

There are no Past count stations on the project road.

3.13 Axle Load Survey

To estimate vehicle loading spectrum on project road, and to determine vehicle damage factor for the commercial vehicles, the axle load surveys have been carried out at identified locations. The data collected from the Axle Load Survey has been compiled and analysed through "Fourth power" pavement damage rule to arrive at the vehicles damage factor (VDF). The survey is analysed to obtain Vehicle Damage Factor (VDF) and is presented below:

i) Near Doda

Table 3.11: Calculated VDF by Homogeneous Sections

SUMMARY of VDF near Doda at Ex. Km 80+650	
Vehicle Type	**VDF**
LCV	1.546
Bus	1.385
2 Axle Truck	2.929
3 Axle Truck	8.247

The equivalent single axle loads (ESALs) have been calculated assuming that the project road will be opened to traffic in the beginning of year 2023. VDF Details are provided in **Annexure 3.3 (a) and MSA details are provided in Annexure 8.4(a).**

Table 3.12- Equivalent Axle load calculation

Year	Bus	LCV	2 Axle	3 Axle	Yearly Design ESA	Cumulative Design ESA	MSA	Design Period
VDF	1.39	1.546	2.929	8.25				
2019	53	114	170	14	157506		Base Year	
2020	56	120	179	15	165381			
2021	58	126	187	15	173650			
2022	61	132	197	16	182333			
2023	64	139	207	17	191449	191449	**0.191**	**1-year**
2024	68	145	217	18	201022	392471		
2025	71	153	228	19	211073	603544		
2026	75	160	239	20	221626	825170		
2027	78	168	251	21	232708	1057878	**1.058**	**5-years**
2028	82	177	264	22	244343	1302221		
2029	86	186	277	23	256560	1558781		
2030	91	195	291	24	269388	1828170		
2031	95	205	305	25	282858	2111028		
2032	100	215	321	26	297001	2408028	**2.408**	**10-years**
2033	105	226	337	28	311851	2719879		
2034	110	237	353	29	327443	3047322		
2035	116	249	371	31	343815	3391137		
2036	121	261	390	32	361006	3752144		
2037	128	274	409	34	379056	4131200	**4.131**	**15-years**
2038	134	288	430	35	398009	4529209		
2039	141	302	451	37	417910	4947119		
2040	148	318	474	39	438805	5385924		
2041	155	333	497	41	460745	5846670		
2042	163	350	522	43	483783	6330452	**6.330**	**20-years**

ii) At Kishtwar

Table 3.13: Calculated VDF by Homogeneous Sections

SUMMARY of VDF near Kishtwar at Ex.104+400	
Vehicle Type	**VDF**
LCV	0.143
Bus	0.811
2 Axle Truck	2.548
3 Axle Truck	3.710

The equivalent single axle loads (ESALs) have been calculated assuming that the project road will be opened to traffic in the beginning of year 2023. VDF Details are provided in **Annexure 3.3 (b) and MSA details are provided in Annexure 8.4(b).**

Table 3.14- Equivalent Axle load calculation

Year	Bus	LCV	2 Axle	3 Axle	Yearly Design ESA	Cumulative Design ESA	MSA	Design Period
VDF	0.81	0.143	2.548	3.71				
2019	**41**	**125**	**197**	**24**	117175		**Base Year**	
2020	43	131	207	25	123034			
2021	45	138	217	26	129185			
2022	47	145	228	28	135644			
2023	50	152	239	29	142427	142427	**0.142**	**1-year**
2024	52	160	251	31	149548	291975		
2025	55	168	264	32	157025	449000		
2026	58	176	277	34	164877	613877		
2027	61	185	291	35	173121	786998	**0.787**	**5-years**
2028	64	194	306	37	181777	968774		
2029	67	204	321	39	190865	1159640		
2030	70	214	337	41	200409	1360048		
2031	74	224	354	43	210429	1570477		
2032	77	236	371	45	220951	1791428	**1.791**	**10-years**
2033	81	247	390	48	231998	2023426		
2034	85	260	410	50	243598	2267024		
2035	89	273	430	52	255778	2522802		
2036	94	287	452	55	268567	2791369		
2037	99	301	474	58	281995	3073364	**3.073**	**15-years**
2038	104	316	498	61	296095	3369459		
2039	109	332	523	64	310900	3680358		
2040	114	348	549	67	326445	4006803		
2041	120	366	576	70	342767	4349570		
2042	126	384	605	74	359905	4709475	**4.709**	**20-years**

iii) At Poochal Village

Table 3.15: Calculated VDF by Homogeneous Sections

SUMMARY of VDF at Poochal Village at Ex. Km 126+000	
Vehicle Type	**VDF**
LCV	1.550
Bus	0.592
2 Axle Truck	3.616

The equivalent single axle loads (ESALs) have been calculated assuming that the project road will be opened to traffic in the beginning of year 2023. VDF Details are provided in **Annexure 3.3 (c) and MSA details are provided in Annexure 8.4(c).**

Table 3.16- Equivalent Axle load calculation

Year	Mini Bus	LCV	2 Axle	Yearly Design ESA	Cumulative Design ESA	MSA	Design Period
VDF	0.592	1.550	3.616				
2019	8	37	40	37727		Base Year	
2020	8	39	42	39614			
2021	9	41	44	41595			
2022	9	43	46	43674			
2023	10	45	49	45858	45858	**0.046**	**1-year**
2024	10	47	51	48151	94009		
2025	11	50	54	50558	144567		
2026	11	52	56	53086	197654		
2027	12	55	59	55741	253394	**0.253**	**5-years**
2028	12	57	62	58528	311922		
2029	13	60	65	61454	373376		
2030	14	63	68	64527	437903		
2031	14	66	72	67753	505656		
2032	15	70	75	71141	576797	**0.577**	**10-years**
2033	16	73	79	74698	651495		
2034	17	77	83	78433	729928		
2035	17	81	87	82354	812282		
2036	18	85	92	86472	898754		
2037	19	89	96	90796	989550	**0.990**	**15-years**
2038	20	93	101	95336	1084885		
2039	21	98	106	100102	1184988		
2040	22	103	111	105107	1290095		
2041	23	108	117	110363	1400458		
2042	25	114	123	115881	1516339	**1.516**	**20-years**

The equivalent single axle loads (ESALs) have been calculated assuming that the project road will be opened to traffic in the beginning of year 2023. MSA for the homogeneous sections is worked out for 20 years excluding construction period. As per clause no. 5.4.1 of IRC: SP:73-2018, Flexible pavement shall be designed for a minimum design period of 20 years, subject to the condition that design traffic shall not be less than 20 MSA. Therefore, design MSA is adopted to be of **20 MSA**

regardless of calculated MSA of 6.330, 4.709 and 1.516 at different locations of Doda, Kishtwar and Poochal village respectively.

Table 3.17 : Summary of MSA

Location	Existing Chainage	Calculated MSA	Design MSA (2025-2039)
Doda	80+650	6.330	20
Kishtwar	104+400	4.709	
Poochal	126+000	1.516	

3.14 Analysis of Origin-Destination (O-D) & Commodity Movement Survey

3.14.1 General

Origin and Destination survey was conducted by roadside interview method at two locations. This survey has been used to obtain the travel characteristics of goods and passenger vehicles and to determine the through and local traffic.

The purpose of the OD survey is to determine the existing travel pattern of the road user on the corridor & the project influence area. The road users were asked questions to determine their flow path along the project corridor, trip purpose, trip length, commodity type. Axle load survey was also carried along with the OD survey to analyse the loading pattern and Vehicle Damage Factor, VDF.

The survey has been carried out by deploying a group of enumerators under the supervision of engineers. The questionnaire prepared for the O-D survey was filled up by the enumerators by stopping the vehicles and interviewing the road users. Resentment to answer the questions was observed at both the locations.

3.14.2 Zoning System

To analyse O-D Data the entire study corridor has been divided into local traffic zones and rest of the locations had been divided into external zones. The number of trips originating from and destined to any zone represents the influence of that zone in traffic generation/attraction. Based on the study of collected O-D data, project corridor was divided into 10 zones. Table below represents O-D Zoning system used for the analysis.

Table 3.18: Traffic Area Zoning System

Traffic Zones for O-D Survey

Zone Code	Zone Name
1	Kishtwar
2	Rest of Kishtwar District
3	Doda
4	Thathri
5	Rest of Doda District
6	Jammu District
7	Pulwama District
8	Udhampur District
9	Ramban District
10	Anantnag District

The Internal zones are the ones which are along or in immediate vicinity of the project road and the external zones are various towns & adjoining states.

Development of Origin Destination Matrices

The data collected regarding the origin and destination of the vehicle is coded into different zones. The zonal movement of vehicles is presented as pivot table for quick & easy interpretation of the zone movement and summarizing the zones with maximum movement of vehicles and soon. The pivot table is prepared for the survey location and for each vehicle category. **Annexure 3.5** presents the matrix for passenger and freight vehicles at Kishtwar.

Travel pattern of vehicular trips observed at the survey location is studied for the following categories:

- External-to-External Trips: Traffic using Full Length of project road i.e. traffic neither originated nor destined along/near the project corridor.
- Internal-to-Internal Trips: Traffic using Partial length of the project road i.e. traffic either originated or destined along/near the project corridor.
- Internal-to-External Trips: Traffic using either Full or partial Length of project road i.e. traffic either originated or destined along/near the project corridor.

O-D Traffic was analysed for above category of movements for the location separately

for freight and passenger vehicles shown in **Table 3.19 Table 3.20** below.

Table 3.19: Travel Pattern for Freight Vehicles at Kishtwar

Origin - Destination Matrix
Doda - Kishtwar Road
For Goods Vehicles (in Number)

Place of Survey : Kishtwar **Date :** 22-Jul-19

Number of Sample : 132 **Weather :** Clear & Sunny

		DESTINATION ZONES										
	O\D	1	2	3	4	5	6	7	8	9	10	Total
ORIGIN ZONES	1			13	10	6	26		13			68
	2				3							3
	3	3						2			2	7
	4	6						2			3	11
	5	13	4									17
	6	4	2								2	8
	7			3	3							6
	8	6										6
	9	3										3
	10			3								3
	Total	35	6	19	16	6	26	4	13	0	7	132

Zone Influence Factor of Goods Vehicles				
Zone Code	Name of Zone	Trip Production	Trip Attraction	ZIF (%)
1	Kishtwar	68	35	39.0
2	Rest of Kishtwar District	3	6	3.4
3	Doda	7	19	9.8
4	Thathri	11	16	10.2
5	Rest of Doda District	17	6	8.7
6	Jammu District	8	26	12.9
7	Pulwama District	6	4	3.8
8	Udhampur District	6	13	7.2
9	Ramban District	3	0	1.1
10	Anantnag District	3	7	3.8
Total		132	132	100

Table 3.20: Travel Pattern for Passengers Vehicles at Kishtwar

Origin - Destination Matrix
Doda - Kishtwar Road
For Passenger Vehicles (in Number)

Place of Survey : Kishtwar **Date :** 22-Jul-19

Number of Sample : 277 **Weather :** Clear & Sunny

		DESTINATION ZONES										
	O\D	1	2	3	4	5	6	7	8	9	10	Total
ORIGIN ZONES	1			38	21		34		17			110
	2											0
	3	28										28
	4	16						14			2	32
	5	30										30
	6	28										28
	7				18	17						35
	8											0
	9	14										14
	10											0
	Total	116	0	38	39	17	34	14	17	0	2	277

Zone Influence Factor of Passenger Vehicles				
Zone Code	Name of Zone	Trip Production	Trip Attraction	ZIF (%)
1	Kishtwar	110	116	40.8
2	Rest of Kishtwar District	0	0	0.0
3	Doda	28	38	11.9
4	Thathri	32	39	12.8
5	Rest of Doda District	30	17	8.5
6	Jammu District	28	34	11.2
7	Pulwama District	35	14	8.8
8	Udhampur District	0	17	3.1
9	Ramban District	14	0	2.5
10	Anantnag District	0	2	0.4
Total		277	277	100

3.15 Analysis of Intersection Volume Count Survey

The intersection volume count survey at three major intersections have been carried out during identified peak periods for 12 hours. The category-wise traffic is counted for all direction in a 15 - minute interval. The counts were recorded in the specified survey formats.

The survey data have been analysed to obtain the morning and evening peak hours with flow of vehicles in each direction. The peak hour traffic flow diagrams are provided in **Annexure 3.6(a-c).** The summary of peak hour traffic flow through intersections are given in the following tables.

At Badherwah Highway Junction TMC was conducted for a duration of 12 hours in which total PCU count is found to be 2248, while peak hour PCU is 291 for the hour 11:00-12:00.

Table 3.21 (a): Peak Hour Traffic at Intersections Bhaderwah Highway Junction

Sr. No.	Name	Existing Chainage	Peak Hour	Peak Hour Flow (PCU)		
				Fast Moving	Slow Moving	Total
1	Bhaderwah Highway Junction	53+950	11:00-12:00	291	0	291

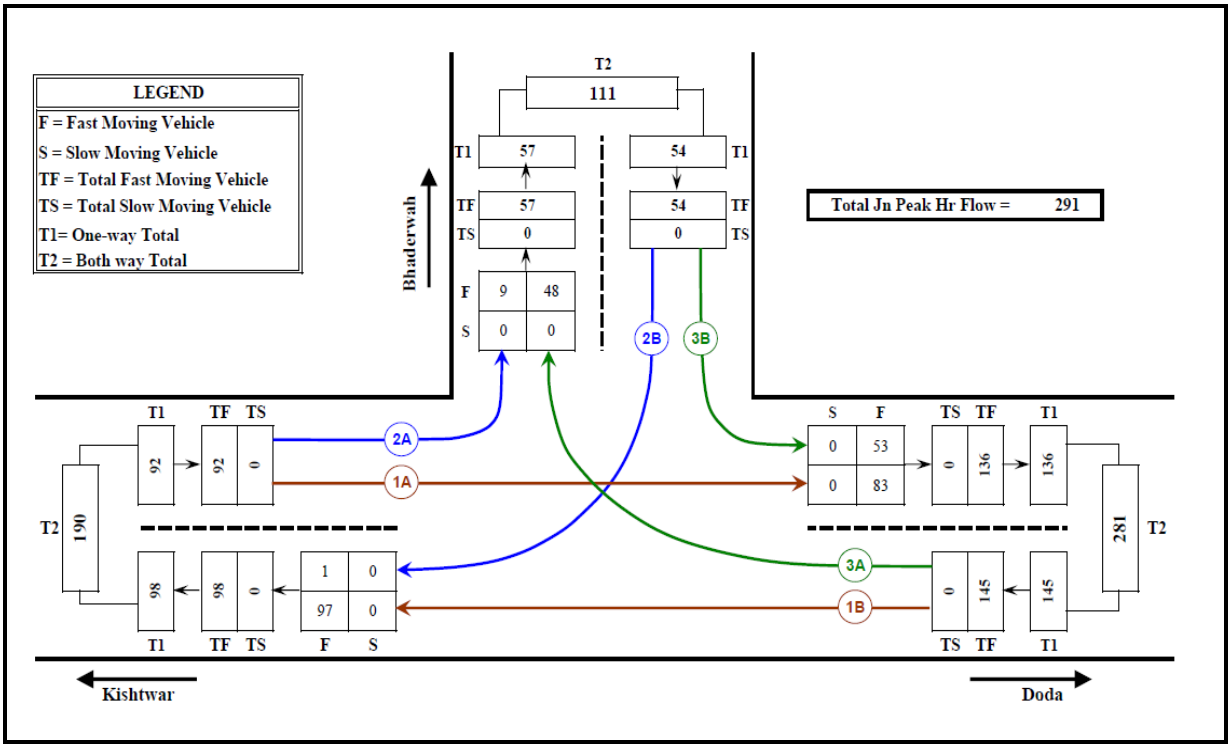


Figure: 3.11 Peak Hour traffic Flow Diagram at Badherwah Highway Junction

At New Thatri-Gandoh Junction TMC was conducted for a duration of 12 hours in which total PCU count is found to be 2082, while peak hour PCU is 273 for the hour 11:00-12:00.

Table 3.21 (b): Peak Hour Traffic at Intersections

Sr. No.	Name	Design Chainage	Peak Hour	Peak Hour Flow (PCU)		
				Fast Moving	Slow Moving	Total
1	New Thatri To Gandoh junction	82+700	11:00-12:00	273	0	273

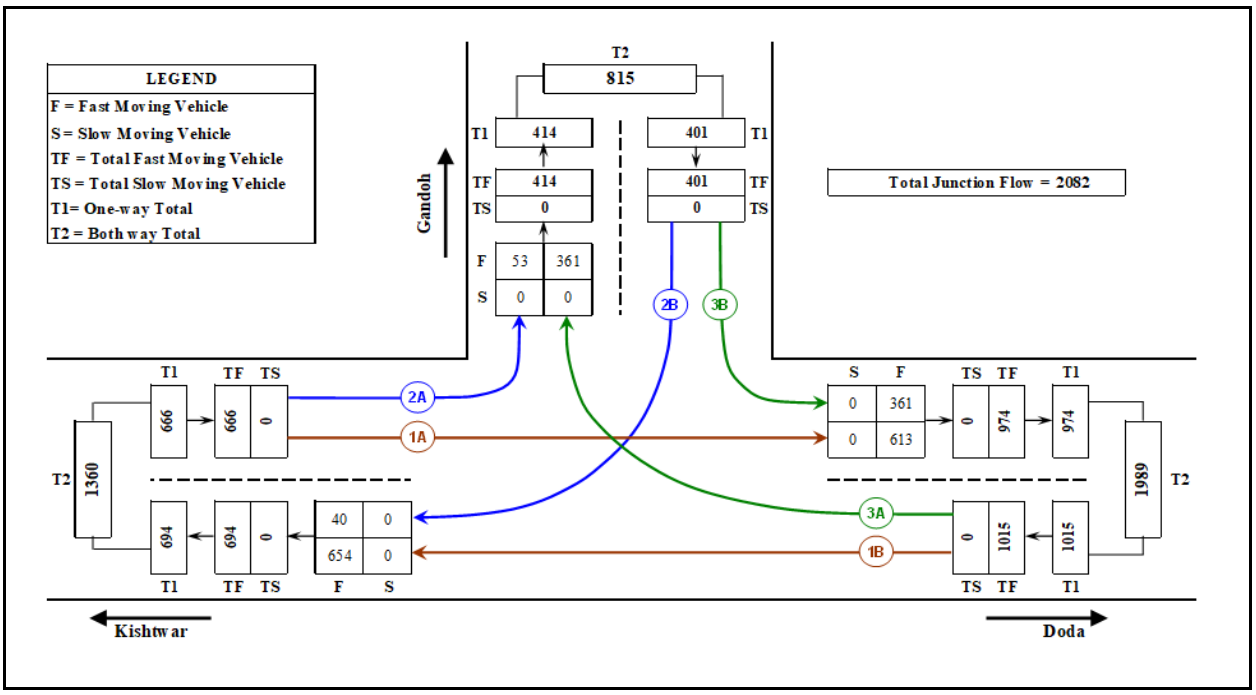


Figure: 3.12 Peak Hour traffic Flow Diagram at New Thatri- Gandoh Junction

At Kishtwar Junction TMC was conducted for the duration of 12 Hours. In the survey total intersection PCU count is found to be 10925 while the peak hour is observed to be 10:00-11:00 in the morning having PCU count equals to 1212.

Table 3.21 (c): Peak Hour Traffic at Intersections

Sr. No.	Name	Design Chainage	Peak Hour	Peak Hour Flow (PCU)		
				Fast Moving	Slow Moving	Total
1	Kishtwar Junction	110+525	10:00-11:00	1212	0	1212

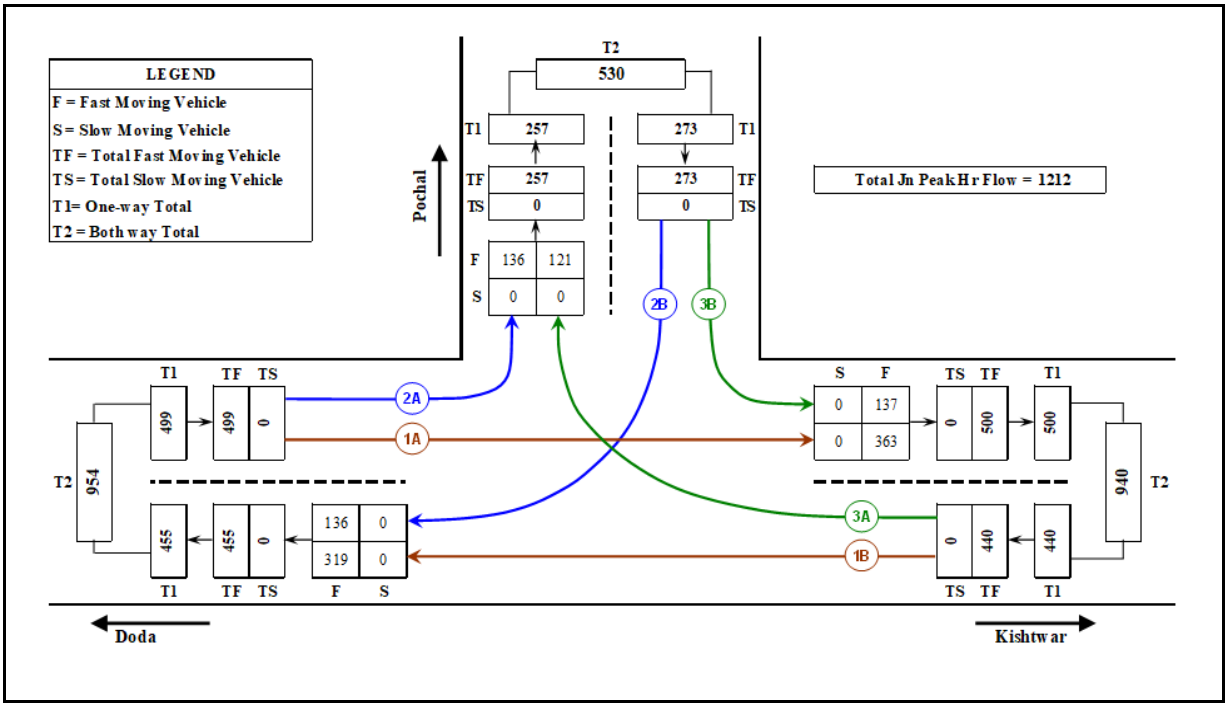


Figure: 3.13 Peak Hour traffic Flow Diagram at Kishtwar Junction

3.16 Analysis of Speed & Delay Survey

The vehicle operation cost and the time taken for a trip will depend mainly upon the journey speed and the type of surface on the road. Hence the journey speed data is needed to estimate the road user cost on the existing road and to compare the same with the road user cost on the improved facility. Speed and delay surveys by Moving car surveys were conducted to find the journey speeds on the existing project.

Round trip was made on entire project road during identified peak period using new technology vehicle. The survey vehicle was kept maintaining the speed of existing traffic flow. Start time, delay occurred, distance covered, and end time were recorded on the specified survey format. The data thus obtained is analysed and presented below **Table 3.22**.

Table 3.22: Summary of Speed-Delay Survey

Section		Distance (Km)	Average travel Time during off-peak (minutes)	Average speed during off-peak (km/hr)	Travel Time during peak (minutes)	Average speed during peak hours (km/hr)	Delay (minutes)	Reason for delay
From	To							
Khellani	Chhatroo	96+370	231 min	25	289 min	20	57	Delay due to road condition & traffic

The dominant reason for delay in Khellani - Chhatroo section is vehicular movements

during peak hours and landslides prone areas along the project road. In the built up like Kishtwar and others, it was observed during speed delay study that traffic was slow due to movement of light vehicles. Also, due to absurd geometric condition of existing project road, traffic movement was found to be slower.

Chapter 4

Engineering Survey, Material Investigation & Pavement Design

4.0 Engineering Survey, Material Investigation & Pavement Design

4.1 General

A sound engineering approach has been developed based on the requirement enumerated in Terms of Reference for conducting the required field surveys. Following data were collected from site and detailed desk study has been carried out to formulate a systematic and meticulous approach towards the present assignment. Following primary field surveys and investigations have been carried out on the project road:

- Inventory
  - *Road*
  - *Bridge and Cross Drainage Structures*
- Condition Surveys
  - *Pavement condition and Roughness survey*
  - *Bridges and Cross Drainage Structures*
- Topographic Survey
  - *Longitudinal alignment*
  - *Cross sections at 50m interval*
  - *Cross section of Bridges & Cross Drainage Structures*
- Pavement Investigations
  - *Trial Pit Investigation*
  - *Sub-grade Investigation*
  - *Axle load Survey*
- Material Survey
  - *Soil Borrow Area*
  - *Aggregate Sources*
  - *Sand Sources*
  - *Other construction Material like Cement, Bitumen etc.*

4.2 Inventory and Condition Survey of Road and Pavement

The scope of improvement measures and economic justification thereon depend on the condition of the existing road and its associated inventory. To collect the inventory of the existing road and allied features of road and structure, inventory surveys were carried out.

4.2.1 Road Inventory Survey

While conducting Inventory Survey of Road the existing physical features and surrounding condition of the project road was ascertained. The details collected are

discussed in **Annexure 4.1.** Road Inventory of this report**.** Some of the salient features of the existing road has been described under following paragraphs.

The information collected, analysed and cross-checked, constitute the core database for formulating improvement proposals for further validation and finalisation considering results of detailed topographical survey and investigations. The information has been utilised to decide the following:

- Decision on the widening of the carriageway is concentric for through the project road.
- Formulate the best-fit cross section with due consideration to terrain conditions, available land width and roadside features.
- Treatment to be given to congested built-up stretches.
- Number of trees to be affected by road improvement/construction works, the anticipated environmental impacts and extent of rehabilitation and resettlement.
- Provision of wayside amenities.
- Existing utility lines by type, location and extent that would require relocation.

4.2.1.1 Existing Carriageway

Project stretch is generally two-lane Carriageway having 3.5 m – 10 m width throughout project road. The existing road has earthen shoulder of about 1.0 m on either side of the project road. ROW available for most of the length of the project road is 12 m to 20 m as per inventory.

Table 4.1: Existing Carriageway Width

Chainage		Formation Width	Carriageway		Shoulder width	
From	To		Type	Width	Left	Right
44+500	44+600	9	BT	7	1	1
44+600	44+700	9	BT	7	1	1
44+700	44+800	9	BT	7	1	1
44+800	44+900	9	BT	7	1	1
44+900	45+000	9	BT	7	1	1
45+000	45+100	9	BT	7	1	1
45+100	45+200	9	BT	7	1	1
45+200	45+300	9	BT	7	1	1
45+300	45+400	9	BT	7	1	1
45+400	45+500	9	BT	7	1	1
45+500	45+600	9	BT	7	1	1
45+600	45+700	9	BT	7	1	1
45+700	45+800	9	BT	7	1	1
45+800	45+900	9	BT	7	1	1
45+900	46+000	9	BT	7	1	1

Chainage		Formation Width	Carriageway		Shoulder width	
From	To		Type	Width	Left	Right
46+000	46+100	9	BT	7	1	1
46+100	46+200	9	BT	7	1	1
46+200	46+300	9	BT	7	1	1
46+300	46+400	9	BT	7	1	1
46+400	46+500	9	BT	7	1	1
46+500	46+600	9	BT	7	1	1
46+600	46+700	9	BT	7	1	1
46+700	46+800	9	BT	7	1	1
46+800	46+900	9	BT	7	1	1
46+900	47+000	9	BT	7	1	1
47+000	47+100	9	BT	7	1	1
47+100	47+200	9	BT	7	1	1
47+200	47+300	9	BT	7	1	1
47+300	47+400	9	BT	7	1	1
47+400	47+500	9	BT	7	1	1
47+500	47+600	9	BT	7	1	1
47+600	47+700	9	BT	7	1	1
47+700	47+800	9	BT	7	1	1
47+800	47+900	9	BT	7	1	1
47+900	48+000	9	BT	7	1	1
48+000	48+100	9	BT	7	1	1
48+100	48+200	9	BT	7	1	1
48+200	48+300	9	BT	7	1	1
48+300	48+400	9	BT	7	1	1
48+400	48+500	9	BT	7	1	1
48+500	48+600	9	BT	7	1	1
48+600	48+700	9	BT	7	1	1
48+700	48+800	9	BT	7	1	1
48+800	48+900	9	BT	7	1	1
48+900	49+000	9	BT	7	1	1
49+000	49+100	9	BT	7	1	1
49+100	49+200	9	BT	7	1	1
49+200	49+300	9	BT	7	1	1
49+300	49+400	9	BT	7	1	1
49+400	49+500	9	BT	7	1	1
49+500	49+600	9	BT	7	1	1
49+600	49+700	9	BT	7	1	1
49+700	49+800	9	BT	7	1	1
49+800	49+900	9	BT	7	1	1
49+900	50+000	9	BT	7	1	1
50+000	50+100	9	BT	7	1	1
50+100	50+200	9	BT	7	1	1
50+200	50+300	9	BT	7	1	1
50+300	50+400	9	BT	7	1	1
50+400	50+500	9	BT	7	1	1
50+500	50+600	9	BT	7	1	1
50+600	50+700	9	BT	7	1	1
50+700	50+800	9	BT	7	1	1

Chainage		Formation Width	Carriageway		Shoulder width	
From	To		Type	Width	Left	Right
50+800	50+900	9	BT	7	1	1
50+900	51+000	9	BT	7	1	1
51+000	51+100	9	BT	7	1	1
51+100	51+200	9	BT	7	1	1
51+200	51+300	9	BT	7	1	1
51+300	51+400	9	BT	7	1	1
51+400	51+500	9	BT	7	1	1
51+500	51+600	9	BT	7	1	1
51+600	51+700	9	BT	7	1	1
51+700	51+800	9	BT	7	1	1
51+800	51+900	9	BT	7	1	1
51+900	52+000	9	BT	7	1	1
52+000	52+100	9	BT	7	1	1
52+100	52+200	9	BT	7	1	1
52+200	52+300	9	BT	7	1	1
52+300	52+400	9	BT	7	1	1
52+400	52+500	9	BT	7	1	1
52+500	52+600	9	BT	7	1	1
52+600	52+700	9	BT	7	1	1
52+700	52+800	9	BT	7	1	1
52+800	52+900	9	BT	7	1	1
52+900	53+000	9	BT	7	1	1
53+000	53+100	9	BT	7	1	1
53+100	53+200	9	BT	7	1	1
53+200	53+300	9	BT	7	1	1
53+300	53+400	9	BT	7	1	1
53+400	53+500	9	BT	7	1	1
53+500	53+600	9	BT	7	1	1
53+600	53+700	9	BT	7	1	1
53+700	53+800	9	BT	7	1	1
53+800	53+900	9	BT	7	1	1
53+900	54+000	9	BT	7	1	1
54+000	54+100	9	BT	7	1	1
54+100	54+200	9	BT	7	1	1
54+200	54+300	9	BT	7	1	1
54+300	54+400	9	BT	7	1	1
54+400	54+500	9	BT	7	1	1
54+500	54+600	9	BT	7	1	1
54+600	54+700	9	BT	7	1	1
54+700	54+800	9	BT	7	1	1
54+800	54+900	9	BT	7	1	1
54+900	55+000	9	BT	7	1	1
55+000	55+100	9	BT	7	1	1
55+100	55+200	9	BT	7	1	1
55+200	55+300	9	BT	7	1	1
55+300	55+400	9	BT	7	1	1
55+400	55+500	9	BT	7	1	1
55+500	55+600	9	BT	7	1	1

Chainage		Formation Width	Carriageway		Shoulder width	
From	To		Type	Width	Left	Right
55+600	55+700	9	BT	7	1	1
55+700	55+800	9	BT	7	1	1
55+800	55+900	9	BT	7	1	1
55+900	56+000	9	BT	7	1	1
56+000	56+100	9	BT	7	1	1
56+100	56+200	9	BT	7	1	1
56+200	56+300	9	BT	7	1	1
56+300	56+400	9	BT	7	1	1
56+400	56+500	9	BT	7	1	1
56+500	56+600	9	BT	7	1	1
56+600	56+700	9	BT	7	1	1
56+700	56+800	9	BT	7	1	1
56+800	56+900	9	BT	7	1	1
56+900	57+000	9	BT	7	1	1
57+000	57+100	9	BT	7	1	1
57+100	57+200	9	BT	7	1	1
57+200	57+300	9	BT	7	1	1
57+300	57+400	9	BT	7	1	1
57+400	57+500	9	BT	7	1	1
57+500	57+600	9	BT	7	1	1
57+600	57+700	9	BT	7	1	1
57+700	57+800	9	BT	7	1	1
57+800	57+900	9	BT	7	1	1
57+900	58+000	9	BT	7	1	1
58+000	58+100	9	BT	7	1	1
58+100	58+200	9	BT	7	1	1
58+200	58+300	9	BT	7	1	1
58+300	58+400	9	BT	7	1	1
58+400	58+500	9	BT	7	1	1
58+500	58+600	9	BT	7	1	1
58+600	58+700	9	BT	7	1	1
58+700	58+800	9	BT	7	1	1
58+800	58+900	9	BT	7	1	1
58+900	59+000	9	BT	7	1	1
59+000	59+100	9	BT	7	1	1
59+100	59+200	9	BT	7	1	1
59+200	59+300	9	BT	7	1	1
59+300	59+400	9	BT	7	1	1
59+400	59+500	9	BT	7	1	1
59+500	59+600	9	BT	7	1	1
59+600	59+700	9	BT	7	1	1
59+700	59+800	9	BT	7	1	1
59+800	59+900	9	BT	7	1	1
59+900	60+000	9	BT	7	1	1
60+000	60+100	9	BT	7	1	1
60+100	60+200	9	BT	7	1	1
60+200	60+300	9	BT	7	1	1
60+300	60+400	9	BT	7	1	1

Chainage		Formation Width	Carriageway		Shoulder width	
From	To		Type	Width	Left	Right
60+400	60+500	9	BT	7	1	1
60+500	60+600	9	BT	7	1	1
60+600	60+700	9	BT	7	1	1
60+700	60+800	9	BT	7	1	1
60+800	60+900	9	BT	7	1	1
60+900	61+000	9	BT	7	1	1
61+000	61+100	9	BT	7	1	1
61+100	61+200	9	BT	7	1	1
61+200	61+300	9	BT	7	1	1
61+300	61+400	9	BT	7	1	1
61+400	61+500	9	BT	7	1	1
61+500	61+600	9	BT	7	1	1
61+600	61+700	9	BT	7	1	1
61+700	61+800	9	BT	7	1	1
61+800	61+900	9	BT	7	1	1
61+900	62+000	9	BT	7	1	1
62+000	62+100	9	BT	7	1	1
62+100	62+200	9	BT	7	1	1
62+200	62+300	9	BT	7	1	1
62+300	62+400	9	BT	7	1	1
62+400	62+500	9	BT	7	1	1
62+500	62+600	9	BT	7	1	1
62+600	62+700	9	BT	7	1	1
62+700	62+800	9	BT	7	1	1
62+800	62+900	9	BT	7	1	1
62+900	63+000	9	BT	7	1	1
63+000	63+100	9	BT	7	1	1
63+100	63+200	9	BT	7	1	1
63+200	63+300	9	BT	7	1	1
63+300	63+400	9	BT	7	1	1
63+400	63+500	9	BT	7	1	1
63+500	63+600	9	BT	7	1	1
63+600	63+700	9	BT	7	1	1
63+700	63+800	9	BT	7	1	1
63+800	63+900	9	BT	7	1	1
63+900	64+000	9	BT	7	1	1
64+000	64+100	9	BT	7	1	1
64+100	64+200	9	BT	7	1	1
64+200	64+300	9	BT	7	1	1
64+300	64+400	9	BT	7	1	1
64+400	64+500	9	BT	7	1	1
64+500	64+600	9	BT	7	1	1
64+600	64+700	9	BT	7	1	1
64+700	64+800	9	BT	7	1	1
64+800	64+900	9	BT	7	1	1
64+900	65+000	9	BT	7	1	1
65+000	65+100	9	BT	7	1	1
65+100	65+200	9	BT	7	1	1

Chainage		Formation Width	Carriageway		Shoulder width	
From	To		Type	Width	Left	Right
65+200	65+300	9	BT	7	1	1
65+300	65+400	9	BT	7	1	1
65+400	65+500	9	BT	7	1	1
65+500	65+600	9	BT	7	1	1
65+600	65+700	9	BT	7	1	1
65+700	65+800	9	BT	7	1	1
65+800	65+900	9	BT	7	1	1
65+900	66+000	9	BT	7	1	1
66+000	66+100	9	BT	7	1	1
66+100	66+200	9	BT	7	1	1
66+200	66+300	9	BT	7	1	1
66+300	66+400	9	BT	7	1	1
66+400	66+500	9	BT	7	1	1
66+500	66+600	9	BT	7	1	1
66+600	66+700	9	BT	7	1	1
66+700	66+800	9	BT	7	1	1
66+800	66+900	9	BT	7	1	1
66+900	67+000	9	BT	7	1	1
67+000	67+100	9	BT	7	1	1
67+100	67+200	9	BT	7	1	1
67+200	67+300	9	BT	7	1	1
67+300	67+400	9	BT	7	1	1
67+400	67+500	9	BT	7	1	1
67+500	67+600	9	BT	7	1	1
67+600	67+700	9	BT	7	1	1
67+700	67+800	9	BT	7	1	1
67+800	67+900	9	BT	7	1	1
67+900	68+000	9	BT	7	1	1
68+000	68+100	9	BT	7	1	1
68+100	68+200	9	BT	7	1	1
68+200	68+300	9	BT	7	1	1
68+300	68+400	9	BT	7	1	1
68+400	68+500	9	BT	7	1	1
68+500	68+600	9	BT	7	1	1
68+600	68+700	9	BT	7	1	1
68+700	68+800	9	BT	7	1	1
68+800	68+900	9	BT	7	1	1
68+900	69+000	9	BT	7	1	1
69+000	69+100	9	BT	7	1	1
69+100	69+200	9	BT	7	1	1
69+200	69+300	9	BT	7	1	1
69+300	69+400	9	BT	7	1	1
69+400	69+500	9	BT	7	1	1
69+500	69+600	9	BT	7	1	1
69+600	69+700	9	BT	7	1	1
69+700	69+800	9	BT	7	1	1
69+800	69+900	9	BT	7	1	1
69+900	70+000	9	BT	7	1	1

Chainage		Formation Width	Carriageway		Shoulder width	
From	To		Type	Width	Left	Right
70+000	70+100	9	BT	7	1	1
70+100	70+200	9	BT	7	1	1
70+200	70+300	9	BT	7	1	1
70+300	70+400	9	BT	7	1	1
70+400	70+500	9	BT	7	1	1
70+500	70+600	9	BT	7	1	1
70+600	70+700	9	BT	7	1	1
70+700	70+800	9	BT	7	1	1
70+800	70+900	9	BT	7	1	1
70+900	71+000	9	BT	7	1	1
71+000	71+100	9	BT	7	1	1
71+100	71+200	9	BT	7	1	1
71+200	71+300	9	BT	7	1	1
71+300	71+400	9	BT	7	1	1
71+400	71+500	9	BT	7	1	1
71+500	71+600	9	BT	7	1	1
71+600	71+700	9	BT	7	1	1
71+700	71+800	9	BT	7	1	1
71+800	71+900	9	BT	7	1	1
71+900	72+000	9	BT	7	1	1
72+000	72+100	9	BT	7	1	1
72+100	72+200	9	BT	7	1	1
72+200	72+300	9	BT	7	1	1
72+300	72+400	9	BT	7	1	1
72+400	72+500	9	BT	7	1	1
72+500	72+600	9	BT	7	1	1
72+600	72+700	9	BT	7	1	1
72+700	72+800	9	BT	7	1	1
72+800	72+900	9	BT	7	1	1
72+900	73+000	9	BT	7	1	1
73+000	73+100	9	BT	7	1	1
73+100	73+200	9	BT	7	1	1
73+200	73+300	9	BT	7	1	1
73+300	73+400	9	BT	7	1	1
73+400	73+500	9	BT	7	1	1
73+500	73+600	9	BT	7	1	1
73+600	73+700	9	BT	7	1	1
73+700	73+800	9	BT	7	1	1
73+800	73+900	9	BT	7	1	1
73+900	74+000	9	BT	7	1	1
74+000	74+100	9	BT	7	1	1
74+100	74+200	9	BT	7	1	1
74+200	74+300	9	BT	7	1	1
74+300	74+400	9	BT	7	1	1
74+400	74+500	9	BT	7	1	1
74+500	74+600	9	BT	7	1	1
74+600	74+700	9	BT	7	1	1
74+700	74+800	9	BT	7	1	1

Chainage		Formation Width	Carriageway		Shoulder width	
From	To		Type	Width	Left	Right
74+800	74+900	9	BT	7	1	1
74+900	75+000	9	BT	7	1	1
75+000	75+100	9	BT	7	1	1
75+100	75+200	9	BT	7	1	1
75+200	75+300	9	BT	7	1	1
75+300	75+400	9	BT	7	1	1
75+400	75+500	9	BT	7	1	1
75+500	75+600	9	BT	7	1	1
75+600	75+700	9	BT	7	1	1
75+700	75+800	9	BT	7	1	1
75+800	75+900	9	BT	7	1	1
75+900	76+000	9	BT	7	1	1
76+000	76+100	9	BT	7	1	1
76+100	76+200	9	BT	7	1	1
76+200	76+300	9	BT	7	1	1
76+300	76+400	9	BT	7	1	1
76+400	76+500	9	BT	7	1	1
76+500	76+600	9	BT	7	1	1
76+600	76+700	9	BT	7	1	1
76+700	76+800	9	BT	7	1	1
76+800	76+900	9	BT	7	1	1
76+900	77+000	9	BT	7	1	1
77+000	77+100	9	BT	7	1	1
77+100	77+200	9	BT	7	1	1
77+200	77+300	9	BT	7	1	1
77+300	77+400	9	BT	7	1	1
77+400	77+500	9	BT	7	1	1
77+500	77+600	9	BT	7	1	1
77+600	77+700	9	BT	7	1	1
77+700	77+800	9	BT	7	1	1
77+800	77+900	9	BT	7	1	1
77+900	78+000	9	BT	7	1	1
78+000	78+100	9	BT	7	1	1
78+100	78+200	9	BT	7	1	1
78+200	78+300	9	BT	7	1	1
78+300	78+400	9	BT	7	1	1
78+400	78+500	9	BT	7	1	1
78+500	78+600	9	BT	7	1	1
78+600	78+700	9	BT	7	1	1
78+700	78+800	9	BT	7	1	1
78+800	78+900	9	BT	7	1	1
78+900	79+000	9	BT	7	1	1
79+000	79+100	9	BT	7	1	1
79+100	79+200	9	BT	7	1	1
79+200	79+300	9	BT	7	1	1
79+300	79+400	9	BT	7	1	1
79+400	79+500	9	BT	7	1	1
79+500	79+600	9	BT	7	1	1

Chainage		Formation Width	Carriageway		Shoulder width	
From	To		Type	Width	Left	Right
79+600	79+700	9	BT	7	1	1
79+700	79+800	9	BT	7	1	1
79+800	79+900	9	BT	7	1	1
79+900	80+000	9	BT	7	1	1
80+000	80+100	9	BT	7	1	1
80+100	80+200	9	BT	7	1	1
80+200	80+300	9	BT	7	1	1
80+300	80+400	9	BT	7	1	1
80+400	80+500	9	BT	7	1	1
80+500	80+600	10	BT	10	-	-
80+600	80+700	10	BT	10	-	-
80+700	80+800	10	BT	10	-	-
80+800	80+900	10	BT	10	-	-
80+900	81+000	10	BT	10	-	-
81+000	81+100	10	BT	10	-	-
81+100	81+200	10	BT	10	-	-
81+200	81+300	10	BT	10	-	-
81+300	81+400	10	BT	10	-	-
81+400	81+500	10	BT	10	-	-
81+500	81+600	10	BT	10	-	-
81+600	81+700	10	BT	10	-	-
81+700	81+800	10	BT	10	-	-
81+800	81+900	10	BT	10	-	-
81+900	82+000	10	BT	10	-	-
82+000	82+100	10	BT	10	-	-
82+100	82+200	10	BT	10	-	-
82+200	82+300	10	BT	10	-	-
82+300	82+400	10	BT	10	-	-
82+400	82+500	10	BT	10	-	-
82+500	82+600	10	BT	10	-	-
82+600	82+700	12	BT	10	1	1
82+700	82+800	9	BT	7	1	1
82+800	82+900	9	BT	7	1	1
82+900	83+000	9	BT	7	1	1
83+000	83+100	9	BT	7	1	1
83+100	83+200	9	BT	7	1	1
83+200	83+300	9	BT	7	1	1
83+300	83+400	9	BT	7	1	1
83+400	83+500	9	BT	7	1	1
83+500	83+600	9	BT	7	1	1
83+600	83+700	9	BT	7	1	1
83+700	83+800	9	BT	7	1	1
83+800	83+900	9	BT	7	1	1
83+900	84+000	9	BT	7	1	1
84+000	84+100	9	BT	7	1	1
84+100	84+200	9	BT	7	1	1
84+200	84+300	9	BT	7	1	1
84+300	84+400	9	BT	7	1	1

Chainage		Formation Width	Carriageway		Shoulder width	
From	To		Type	Width	Left	Right
84+400	84+500	9	BT	7	1	1
84+500	84+600	9	BT	7	1	1
84+600	84+700	9	BT	7	1	1
84+700	84+800	9	BT	7	1	1
84+800	84+900	9	BT	7	1	1
84+900	85+000	9	BT	7	1	1
85+000	85+100	9	BT	7	1	1
85+100	85+200	9	BT	7	1	1
85+200	85+300	9	BT	7	1	1
85+300	85+400	9	BT	7	1	1
85+400	85+500	9	BT	7	1	1
85+500	85+600	9	BT	7	1	1
85+600	85+700	9	BT	7	1	1
85+700	85+800	9	BT	7	1	1
85+800	85+900	9	BT	7	1	1
85+900	86+000	9	BT	7	1	1
86+000	86+100	9	BT	7	1	1
86+100	86+200	9	BT	7	1	1
86+200	86+300	9	BT	7	1	1
86+300	86+400	9	BT	7	1	1
86+400	86+500	9	BT	7	1	1
86+500	86+600	9	BT	7	1	1
86+600	86+700	9	BT	7	1	1
86+700	86+800	7	BT	7	-	-
86+800	86+900	7	BT	7	-	-
86+900	87+000	7	BT	7	-	-
87+000	87+100	7	BT	7	-	-
87+100	87+200	7	BT	7	-	-
87+200	87+300	9	BT	7	1	1
87+300	87+400	9	BT	7	1	1
87+400	87+500	9	BT	7	1	1
87+500	87+600	9	BT	7	1	1
87+600	87+700	9	BT	7	1	1
87+700	87+800	9	BT	7	1	1
87+800	87+900	9	BT	7	1	1
87+900	88+000	9	BT	7	1	1
88+000	88+100	9	BT	7	1	1
88+100	88+200	9	BT	7	1	1
88+200	88+300	9	BT	7	1	1
88+300	88+400	9	BT	7	1	1
88+400	88+500	9	BT	7	1	1
88+500	88+600	9	BT	7	1	1
88+600	88+700	9	BT	7	1	1
88+700	88+800	9	BT	7	1	1
88+800	88+900	9	BT	7	1	1
88+900	89+000	9	BT	7	1	1
89+000	89+100	9	BT	7	1	1
89+100	89+200	9	BT	7	1	1

Chainage		Formation Width	Carriageway		Shoulder width	
From	To		Type	Width	Left	Right
89+200	89+300	9	BT	7	1	1
89+300	89+400	9	BT	7	1	1
89+400	89+500	9	BT	7	1	1
89+500	89+600	9	BT	7	1	1
89+600	89+700	9	BT	7	1	1
89+700	89+800	9	BT	7	1	1
89+800	89+900	9	BT	7	1	1
89+900	90+000	9	BT	7	1	1
90+000	90+100	9	BT	7	1	1
90+100	90+200	9	BT	7	1	1
90+200	90+300	9	BT	7	1	1
90+300	90+400	9	BT	7	1	1
90+400	90+500	9	BT	7	1	1
90+500	90+600	7.5	BT	6.5	0	1
90+600	90+700	6.5	BT	5.5	0	1
90+700	90+800	6.5	BT	5.5	0	1
90+800	90+900	6.75	BT	5.75	0	1
90+900	91+000	6.75	BT	5.75	0	1
91+000	91+100	6.75	BT	5.75	0	1
91+100	91+200	6.75	BT	5.75	0	1
91+200	91+300	6.75	BT	5.75	0	1
91+300	91+400	6.75	BT	5.75	0	1
91+400	91+500	9	BT	7	1	1
91+500	91+600	9	BT	7	1	1
91+600	91+700	9	BT	7	1	1
91+700	91+800	9	BT	7	1	1
91+800	91+900	9	BT	7	1	1
91+900	92+000	9	BT	7	1	1
92+000	92+100	9	BT	7	1	1
92+100	92+200	9	BT	7	1	1
92+200	92+300	9	BT	7	1	1
92+300	92+400	9	BT	7	1	1
92+400	92+500	9	BT	7	1	1
92+500	92+600	9	BT	7	1	1
92+600	92+700	9	BT	7	1	1
92+700	92+800	9	BT	7	1	1
92+800	92+900	9	BT	7	1	1
92+900	93+000	9	BT	7	1	1
93+000	93+100	9	BT	7	1	1
93+100	93+200	9	BT	7	1	1
93+200	93+300	9	BT	7	1	1
93+300	93+400	9	BT	7	1	1
93+400	93+500	9	BT	7	1	1
93+500	93+600	9	BT	7	1	1
93+600	93+700	7.75	BT	5.75	1	1
93+700	93+800	7.75	BT	5.75	1	1
93+800	93+900	7.75	BT	5.75	1	1
93+900	94+000	7.75	BT	5.75	1	1

Chainage		Formation Width	Carriageway		Shoulder width	
From	To		Type	Width	Left	Right
94+000	94+100	7.75	BT	5.75	1	1
94+100	94+200	7.75	BT	5.75	1	1
94+200	94+300	7.75	BT	5.75	1	1
94+300	94+400	7.75	BT	5.75	1	1
94+400	94+500	7.75	BT	5.75	1	1
94+500	94+600	7.75	BT	5.75	1	1
94+600	94+700	7.75	BT	5.75	1	1
94+700	94+800	7.75	BT	5.75	1	1
94+800	94+900	7.75	BT	5.75	1	1
94+900	95+000	7.75	BT	5.75	1	1
95+000	95+100	7.75	BT	5.75	1	1
95+100	95+200	7.75	BT	5.75	1	1
95+200	95+300	7.75	BT	5.75	1	1
95+300	95+400	7.75	BT	5.75	1	1
95+400	95+500	7.75	BT	5.75	1	1
95+500	95+600	7.75	BT	5.75	1	1
95+600	95+700	7.75	BT	5.75	1	1
95+700	95+800	7.75	BT	5.75	1	1
95+800	95+900	7.75	BT	5.75	1	1
95+900	96+000	7.75	BT	5.75	1	1
96+000	96+100	7.75	BT	5.75	1	1
96+100	96+200	7.75	BT	5.75	1	1
96+200	96+300	7.75	BT	5.75	1	1
96+300	96+400	7.75	BT	5.75	1	1
96+400	96+500	7.75	BT	5.75	1	1
96+500	96+600	7.75	BT	5.75	1	1
96+600	96+700	7.75	BT	5.75	1	1
96+700	96+800	7.75	BT	5.75	1	1
96+800	96+900	7.75	BT	5.75	1	1
96+900	97+000	7.75	BT	5.75	1	1
97+000	97+100	8.5	BT	6.5	1	1
97+100	97+200	8.5	BT	6.5	1	1
97+200	97+300	8.5	BT	6.5	1	1
97+300	97+400	8.5	BT	6.5	1	1
97+400	97+500	8.5	BT	6.5	1	1
97+500	97+600	8.5	BT	6.5	1	1
97+600	97+700	8.5	BT	6.5	1	1
97+700	97+800	8.5	BT	6.5	1	1
97+800	97+900	8.5	BT	6.5	1	1
97+900	98+000	8.5	BT	6.5	1	1
98+000	98+100	8.5	BT	6.5	1	1
98+100	98+200	8.5	BT	6.5	1	1
98+200	98+300	8.5	BT	6.5	1	1
98+300	98+400	8.5	BT	6.5	1	1
98+400	98+500	8.5	BT	6.5	1	1
98+500	98+600	8.5	BT	6.5	1	1
98+600	98+700	8.5	BT	6.5	1	1
98+700	98+800	8.5	BT	6.5	1	1

Chainage		Formation Width	Carriageway		Shoulder width	
From	To		Type	Width	Left	Right
98+800	98+900	8.5	BT	6.5	1	1
98+900	99+000	8.5	BT	6.5	1	1
99+000	99+100	8.5	BT	6.5	1	1
99+100	99+200	8.5	BT	6.5	1	1
99+200	99+300	8.5	BT	6.5	1	1
99+300	99+400	8.5	BT	6.5	1	1
99+400	99+500	8.5	BT	6.5	1	1
99+500	99+600	8.5	BT	6.5	1	1
99+600	99+700	8.5	BT	6.5	1	1
99+700	99+800	7.5	BT	5.5	1	1
99+800	99+900	7.5	BT	5.5	1	1
99+900	100+000	7.5	BT	5.5	1	1
100+000	100+100	7.5	BT	5.5	1	1
100+100	100+200	7.5	BT	5.5	1	1
100+200	100+300	7.5	BT	5.5	1	1
100+300	100+400	7.5	BT	5.5	1	1
100+400	100+500	7.5	BT	5.5	1	1
100+500	100+600	7.5	BT	5.5	1	1
100+600	100+700	7.5	BT	5.5	1	1
100+700	100+800	7.5	BT	5.5	1	1
100+800	100+900	7.5	BT	5.5	1	1
100+900	101+000	7.5	BT	5.5	1	1
101+000	101+100	7.5	BT	5.5	1	1
101+100	101+200	7.5	BT	5.5	1	1
101+200	101+300	7.5	BT	5.5	1	1
101+300	101+400	7.5	BT	5.5	1	1
101+400	101+500	7.5	BT	5.5	1	1
101+500	101+600	7.5	BT	5.5	1	1
101+600	101+700	7.5	BT	5.5	1	1
101+700	101+800	7.5	BT	5.5	1	1
101+800	101+900	7.5	BT	5.5	1	1
101+900	102+000	7.5	BT	5.5	1	1
102+000	102+100	7.5	BT	5.5	1	1
102+100	102+200	7.5	BT	5.5	1	1
102+200	102+300	7.5	BT	5.5	1	1
102+300	102+400	7.5	BT	5.5	1	1
102+400	102+500	7.5	BT	5.5	1	1
102+500	102+600	7.5	BT	5.5	1	1
102+600	102+700	7.5	BT	5.5	1	1
102+700	102+800	7.5	BT	5.5	1	1
102+800	102+900	7.5	BT	5.5	1	1
102+900	103+000	7.5	BT	5.5	1	1
103+000	103+100	7.5	BT	5.5	1	1
103+100	103+200	7.5	BT	5.5	1	1
103+200	103+300	7.5	BT	5.5	1	1
103+300	103+400	7.5	BT	5.5	1	1
103+400	103+500	7.5	BT	5.5	1	1
103+500	103+600	7.5	BT	5.5	1	1

Chainage		Formation Width	Carriageway		Shoulder width	
From	To		Type	Width	Left	Right
103+600	103+700	7.5	BT	5.5	1	1
103+700	103+800	7.5	BT	5.5	1	1
103+800	103+900	7.5	BT	5.5	1	1
103+900	104+000	7.5	BT	5.5	1	1
104+000	104+100	7.5	BT	5.5	1	1
104+100	104+200	7.5	BT	5.5	1	1
104+200	104+300	7.5	BT	5.5	1	1
104+300	104+400	7.5	BT	5.5	1	1
104+400	104+500	7.5	BT	5.5	1	1
104+500	104+600	7.5	BT	5.5	1	1
104+600	104+700	7.5	BT	5.5	1	1
104+700	104+800	7.5	BT	5.5	1	1
104+800	104+900	7.5	BT	5.5	1	1
104+900	105+000	7.5	BT	5.5	1	1
105+000	105+100	7.5	BT	5.5	1	1
105+100	105+200	7.5	BT	5.5	1	1
105+200	105+300	7.5	BT	5.5	1	1
105+300	105+400	7.5	BT	5.5	1	1
105+400	105+500	7.5	BT	5.5	1	1
105+500	105+600	7.5	BT	5.5	1	1
105+600	105+700	7.5	BT	5.5	1	1
105+700	105+800	7.5	BT	5.5	1	1
105+800	105+900	7.5	BT	5.5	1	1
105+900	106+000	7.5	BT	5.5	1	1
106+000	106+100	7.5	BT	5.5	1	1
106+100	106+200	7.5	BT	5.5	1	1
106+200	106+300	7.5	BT	5.5	1	1
106+300	106+400	7.5	BT	5.5	1	1
106+400	106+500	7.5	BT	5.5	1	1
106+500	106+600	7.5	BT	5.5	1	1
106+600	106+700	7.5	BT	5.5	1	1
106+700	106+800	7.5	BT	5.5	1	1
106+800	106+900	7.5	BT	5.5	1	1
106+900	107+000	7.5	BT	5.5	1	1
107+000	107+100	7.5	BT	5.5	1	1
107+100	107+200	7.5	BT	5.5	1	1
107+200	107+300	7.5	BT	5.5	1	1
107+300	107+400	7.5	BT	5.5	1	1
107+400	107+500	7.5	BT	5.5	1	1
107+500	107+600	7.5	BT	5.5	1	1
107+600	107+700	7.5	BT	5.5	1	1
107+700	107+800	12	BT	10	1	1
107+800	107+900	12	BT	10	1	1
107+900	108+000	12	BT	10	1	1
108+000	108+100	12	BT	10	1	1
108+100	108+200	12	BT	10	1	1
108+200	108+300	12	BT	10	1	1
108+300	108+400	12	BT	10	1	1

Chainage		Formation Width	Carriageway		Shoulder width	
From	To		Type	Width	Left	Right
108+400	108+500	12	BT	10	1	1
108+500	108+600	12	BT	10	1	1
108+600	108+700	12	BT	10	1	1
108+700	108+800	12	BT	10	1	1
108+800	108+900	12	BT	10	1	1
108+900	109+000	12	BT	10	1	1
109+000	109+100	12	BT	10	1	1
109+100	109+200	12	BT	10	1	1
109+200	109+300	12	BT	10	1	1
109+300	109+400	12	BT	10	1	1
109+400	109+500	12	BT	10	1	1
109+500	109+600	12	BT	10	1	1
109+600	109+700	12	BT	10	1	1
109+700	109+800	12	BT	10	1	1
109+800	109+900	12	BT	10	1	1
109+900	110+000	10	BT	10	0	0
110+000	110+100	10	BT	10	0	0
110+100	110+200	10	BT	10	0	0
110+200	110+300	10	BT	10	0	0
110+300	110+400	10	BT	10	0	0
110+400	110+500	10	BT	10	0	0
110+500	110+600	10	BT	8	1	1
110+600	110+700	10	BT	8	1	1
110+700	110+800	10	BT	8	1	1
110+800	110+900	10	BT	8	1	1
110+900	111+000	10	BT	8	1	1
111+000	111+100	9	BT	7	1	1
111+100	111+200	9	BT	7	1	1
111+200	111+300	9	BT	7	1	1
111+300	111+400	9	BT	7	1	1
111+400	111+500	9	BT	7	1	1
111+500	111+600	9	BT	7	1	1
111+600	111+700	9	BT	7	1	1
111+700	111+800	9	BT	7	1	1
111+800	111+900	9	BT	7	1	1
111+900	112+000	9	BT	7	1	1
112+000	112+100	9	BT	7	1	1
112+100	112+200	9	BT	7	1	1
112+200	112+300	9	BT	7	1	1
112+300	112+400	9	BT	7	1	1
112+400	112+500	9	BT	7	1	1
112+500	112+600	9	BT	7	1	1
112+600	112+700	9	BT	7	1	1
112+700	112+800	9	BT	7	1	1
112+800	112+900	9	BT	7	1	1
112+900	113+000	9	BT	7	1	1
113+000	113+100	9	BT	7	1	1
113+100	113+200	9	BT	7	1	1

Chainage		Formation Width	Carriageway		Shoulder width	
From	To		Type	Width	Left	Right
113+200	113+300	9	BT	7	1	1
113+300	113+400	9	BT	7	1	1
113+400	113+500	9	BT	7	1	1
113+500	113+600	9	BT	7	1	1
113+600	113+700	9	BT	7	1	1
113+700	113+800	9	BT	7	1	1
113+800	113+900	9	BT	7	1	1
113+900	114+000	9	BT	7	1	1
114+000	114+100	9	BT	7	1	1
114+100	114+200	9	BT	7	1	1
114+200	114+300	9	BT	7	1	1
114+300	114+400	9	BT	7	1	1
114+400	114+500	9	BT	7	1	1
114+500	114+600	9	BT	7	1	1
114+600	114+700	9	BT	7	1	1
114+700	114+800	9	BT	7	1	1
114+800	114+900	9	BT	7	1	1
114+900	115+000	9	BT	7	1	1
115+000	115+100	9	BT	7	1	1
115+100	115+200	7.75	BT	5.75	1	1
115+200	115+300	7.75	BT	5.75	1	1
115+300	115+400	7.75	BT	5.75	1	1
115+400	115+500	7.75	BT	5.75	1	1
115+500	115+600	7.75	BT	5.75	1	1
115+600	115+700	7.75	BT	5.75	1	1
115+700	115+800	7.75	BT	5.75	1	1
115+800	115+900	7.75	BT	5.75	1	1
115+900	116+000	7.75	BT	5.75	1	1
116+000	116+100	7.75	BT	5.75	1	1
116+100	116+200	7.75	BT	5.75	1	1
116+200	116+300	7.75	BT	5.75	1	1
116+300	116+400	7.75	BT	5.75	1	1
116+400	116+500	7.75	BT	5.75	1	1
116+500	116+600	7.75	BT	5.75	1	1
116+600	116+700	7.75	BT	5.75	1	1
116+700	116+800	7.75	BT	5.75	1	1
116+800	116+900	7.75	BT	5.75	1	1
116+900	117+000	7.75	BT	5.75	1	1
117+000	117+100	7.75	BT	5.75	1	1
117+100	117+200	7.75	BT	5.75	1	1
117+200	117+300	7.75	BT	5.75	1	1
117+300	117+400	7.75	BT	5.75	1	1
117+400	117+500	7.75	BT	5.75	1	1
117+500	117+600	7.75	BT	5.75	1	1
117+600	117+700	7.75	BT	5.75	1	1
117+700	117+800	7.75	BT	5.75	1	1
117+800	117+900	7.75	BT	5.75	1	1
117+900	118+000	7.75	BT	5.75	1	1

Chainage		Formation Width	Carriageway		Shoulder width	
From	To		Type	Width	Left	Right
118+000	118+100	7.75	BT	5.75	1	1
118+100	118+200	4.5	BT	3.5	0.5	0.5
118+200	118+300	4.5	BT	3.5	0.5	0.5
118+300	118+400	4.5	BT	3.5	0.5	0.5
118+400	118+500	4.5	BT	3.5	0.5	0.5
118+500	118+600	4.5	BT	3.5	0.5	0.5
118+600	118+700	4.5	BT	3.5	0.5	0.5
118+700	118+800	4.5	BT	3.5	0.5	0.5
118+800	118+900	4.5	BT	3.5	0.5	0.5
118+900	119+000	4.5	BT	3.5	0.5	0.5
119+000	119+100	4.5	BT	3.5	0.5	0.5
119+100	119+200	4.5	BT	3.5	0.5	0.5
119+200	119+300	4.5	BT	3.5	0.5	0.5
119+300	119+400	4.5	BT	3.5	0.5	0.5
119+400	119+500	4.5	BT	3.5	0.5	0.5
119+500	119+600	4.5	BT	3.5	0.5	0.5
119+600	119+700	4.5	BT	3.5	0.5	0.5
119+700	119+800	4.5	BT	3.5	0.5	0.5
119+800	119+900	4.5	BT	3.5	0.5	0.5
119+900	120+000	4.5	BT	3.5	0.5	0.5
120+000	120+100	4.5	BT	3.5	0.5	0.5
120+100	120+200	4.5	BT	3.5	0.5	0.5
120+200	120+300	4.5	BT	3.5	0.5	0.5
120+300	120+400	4.5	BT	3.5	0.5	0.5
120+400	120+500	4.5	BT	3.5	0.5	0.5
120+500	120+600	7.5	BT	5.5	1	1
120+600	120+700	7.5	BT	5.5	1	1
120+700	120+800	7.5	BT	5.5	1	1
120+800	120+900	7.5	BT	5.5	1	1
120+900	121+000	7.5	BT	5.5	1	1
121+000	121+100	7.5	BT	5.5	1	1
121+100	121+200	7.5	BT	5.5	1	1
121+200	121+300	7.5	BT	5.5	1	1
121+300	121+400	7.5	BT	5.5	1	1
121+400	121+500	7.5	BT	5.5	1	1
121+500	121+600	7.5	BT	5.5	1	1
121+600	121+700	7.5	BT	5.5	1	1
121+700	121+800	7.5	BT	5.5	1	1
121+800	121+900	7.5	BT	5.5	1	1
121+900	122+000	7.5	BT	5.5	1	1
122+000	122+100	7.5	BT	5.5	1	1
122+100	122+200	7.5	BT	5.5	1	1
122+200	122+300	7.5	BT	5.5	1	1
122+300	122+400	7.5	BT	5.5	1	1
122+400	122+500	7.5	BT	5.5	1	1
122+500	122+600	7.5	BT	5.5	1	1
122+600	122+700	7.5	BT	5.5	1	1
122+700	122+800	7.5	BT	5.5	1	1

Chainage		Formation Width	Carriageway		Shoulder width	
From	To		Type	Width	Left	Right
122+800	122+900	7.5	BT	5.5	1	1
122+900	123+000	7	BT	5	1	1
123+000	123+100	7	BT	5	1	1
123+100	123+200	7	BT	5	1	1
123+200	123+300	7	BT	5	1	1
123+300	123+400	7	BT	5	1	1
123+400	123+500	7	BT	5	1	1
123+500	123+600	7	BT	5	1	1
123+600	123+700	7	BT	5	1	1
123+700	123+800	7	BT	5	1	1
123+800	123+900	7	BT	5	1	1
123+900	124+000	7	BT	5	1	1
124+000	124+100	7	BT	5	1	1
124+100	124+200	7	BT	5	1	1
124+200	124+300	7	BT	5	1	1
124+300	124+400	7	BT	5	1	1
124+400	124+500	7.5	BT	5.5	1	1
124+500	124+600	7.5	BT	5.5	1	1
124+600	124+700	7.5	BT	5.5	1	1
124+700	124+800	7.5	BT	5.5	1	1
124+800	124+900	7.5	BT	5.5	1	1
124+900	125+000	7.5	BT	5.5	1	1
125+000	125+100	7.5	BT	5.5	1	1
125+100	125+200	7.5	BT	5.5	1	1
125+200	125+300	7.5	BT	5.5	1	1
125+300	125+400	7.5	BT	5.5	1	1
125+400	125+500	7.5	BT	5.5	1	1
125+500	125+600	7.5	BT	5.5	1	1
125+600	125+700	7.5	BT	5.5	1	1
125+700	125+800	7.5	BT	5.5	1	1
125+800	125+900	7.5	BT	5.5	1	1
125+900	126+000	7.5	BT	5.5	1	1
126+000	126+100	7.5	BT	5.5	1	1
126+100	126+200	7.5	BT	5.5	1	1
126+200	126+300	7.5	BT	5.5	1	1
126+300	126+400	7.5	BT	5.5	1	1
126+400	126+500	7.5	BT	5.5	1	1
126+500	126+600	7.5	BT	5.5	1	1
126+600	126+700	7.5	BT	5.5	1	1
126+700	126+800	7.5	BT	5.5	1	1
126+800	126+900	7.5	BT	5.5	1	1
126+900	127+000	7.5	BT	5.5	1	1
127+000	127+100	7.5	BT	5.5	1	1
127+100	127+200	7.5	BT	5.5	1	1
127+200	127+300	7.5	BT	5.5	1	1
127+300	127+400	7.5	BT	5.5	1	1
127+400	127+500	7.5	BT	5.5	1	1
127+500	127+600	7.5	BT	5.5	1	1

Chainage		Formation Width	Carriageway		Shoulder width	
From	To		Type	Width	Left	Right
127+600	127+700	7.5	BT	5.5	1	1
127+700	127+800	7.5	BT	5.5	1	1
127+800	127+900	7.5	BT	5.5	1	1
127+900	128+000	7.5	BT	5.5	1	1
128+000	128+100	7.5	BT	5.5	1	1
128+100	128+200	7.5	BT	5.5	1	1
128+200	128+300	7.5	BT	5.5	1	1
128+300	128+400	7.5	BT	5.5	1	1
128+400	128+500	7.75	BT	5.75	1	1
128+500	128+600	7.75	BT	5.75	1	1
128+600	128+700	7.75	BT	5.75	1	1
128+700	128+800	7.75	BT	5.75	1	1
128+800	128+900	7.75	BT	5.75	1	1
128+900	129+000	7.75	BT	5.75	1	1
129+000	129+100	7.75	BT	5.75	1	1
129+100	129+200	7.75	BT	5.75	1	1
129+200	129+300	7.75	BT	5.75	1	1
129+300	129+400	7.75	BT	5.75	1	1
129+400	129+500	7.75	BT	5.75	1	1
129+500	129+600	7.75	BT	5.75	1	1
129+600	129+700	7.75	BT	5.75	1	1
129+700	129+800	7.75	BT	5.75	1	1
129+800	129+900	7.75	BT	5.75	1	1
129+900	130+000	7.75	BT	5.75	1	1
130+000	130+100	7.75	BT	5.75	1	1
130+100	130+200	7.75	BT	5.75	1	1
130+200	130+300	7.75	BT	5.75	1	1
130+300	130+400	7.75	BT	5.75	1	1
130+400	130+500	7.75	BT	5.75	1	1
130+500	130+600	7.75	BT	5.75	1	1
130+600	130+700	7.75	BT	5.75	1	1
130+700	130+800	7.75	BT	5.75	1	1
130+800	130+900	7.75	BT	5.75	1	1
130+900	131+000	7.75	BT	5.75	1	1
131+000	131+100	7.75	BT	5.75	1	1
131+100	131+200	7.75	BT	5.75	1	1
131+200	131+300	7.75	BT	5.75	1	1
131+300	131+400	7.75	BT	5.75	1	1
131+400	131+500	7.75	BT	5.75	1	1
131+500	131+600	7.75	BT	5.75	1	1
131+600	131+700	7.75	BT	5.75	1	1
131+700	131+800	7.75	BT	5.75	1	1
131+800	131+900	7.75	BT	5.75	1	1
131+900	132+000	7.75	BT	5.75	1	1
132+000	132+100	7.75	BT	5.75	1	1
132+100	132+200	7.75	BT	5.75	1	1
132+200	132+300	7.75	BT	5.75	1	1
132+300	132+400	7.75	BT	5.75	1	1

Chainage		Formation Width	Carriageway		Shoulder width	
From	To		Type	Width	Left	Right
132+400	132+500	7.75	BT	5.75	1	1
132+500	132+600	7.75	BT	5.75	1	1
132+600	132+700	7.75	BT	5.75	1	1
132+700	132+800	7.75	BT	5.75	1	1
132+800	132+900	7.75	BT	5.75	1	1
132+900	133+000	7.75	BT	5.75	1	1
133+000	133+100	7.75	BT	5.75	1	1
133+100	133+200	7.5	BT	5.5	1	1
133+200	133+300	7.5	BT	5.5	1	1
133+300	133+400	7.5	BT	5.5	1	1
133+400	133+500	7.5	BT	5.5	1	1
133+500	133+600	7.5	BT	5.5	1	1
133+600	133+700	7.5	BT	5.5	1	1
133+700	133+800	7.5	BT	5.5	1	1
133+800	133+900	7.5	BT	5.5	1	1
133+900	134+000	7.5	BT	5.5	1	1
134+000	134+100	7.5	BT	5.5	1	1
134+100	134+200	7.5	BT	5.5	1	1
134+200	134+300	7.5	BT	5.5	1	1
134+300	134+400	7.5	BT	5.5	1	1
134+400	134+500	7.5	BT	5.5	1	1
134+500	134+600	7.5	BT	5.5	1	1
134+600	134+700	7.5	BT	5.5	1	1
134+700	134+800	7.5	BT	5.5	1	1
134+800	134+900	7.5	BT	5.5	1	1
134+900	135+000	7.5	BT	5.5	1	1
135+000	135+100	7.5	BT	5.5	1	1
135+100	135+200	7.5	BT	5.5	1	1
135+200	135+300	7.5	BT	5.5	1	1
135+300	135+400	7.5	BT	5.5	1	1
135+400	135+500	7.5	BT	5.5	1	1
135+500	135+600	7.5	BT	5.5	1	1
135+600	135+700	7.5	BT	5.5	1	1
135+700	135+800	7.5	BT	5.5	1	1
135+800	135+900	7.5	BT	5.5	1	1
135+900	136+000	7.5	BT	5.5	1	1
136+000	136+100	7.5	BT	5.5	1	1
136+100	136+200	7.5	BT	5.5	1	1
136+200	136+300	7.5	BT	5.5	1	1
136+300	136+400	7.5	BT	5.5	1	1
136+400	136+500	7.5	BT	5.5	1	1
136+500	136+600	7.5	BT	5.5	1	1
136+600	136+700	7.5	BT	5.5	1	1
136+700	136+800	7.5	BT	5.5	1	1
136+800	136+900	7.5	BT	5.5	1	1
136+900	137+000	7.5	BT	5.5	1	1
137+000	137+100	7.5	BT	5.5	1	1
137+100	137+200	7.5	BT	5.5	1	1

Chainage		Formation Width	Carriageway		Shoulder width	
From	To		Type	Width	Left	Right
137+200	137+300	7.5	BT	5.5	1	1
137+300	137+400	7.5	BT	5.5	1	1
137+400	137+500	7.5	BT	5.5	1	1
137+500	137+600	7.5	BT	5.5	1	1
137+600	137+700	7.5	BT	5.5	1	1
137+700	137+800	7.5	BT	5.5	1	1
137+800	137+900	7.5	BT	5.5	1	1
137+900	138+000	7.5	BT	5.5	1	1
138+000	138+100	7.5	BT	5.5	1	1
138+100	138+200	7.5	BT	5.5	1	1
138+200	138+300	9	BT	7	1	1
138+300	138+400	9	BT	7	1	1
138+400	138+500	9	BT	7	1	1
138+500	138+600	9	BT	7	1	1
138+600	138+700	9	BT	7	1	1
138+700	138+800	9	BT	7	1	1
138+800	138+900	9	BT	7	1	1
138+900	139+000	9	BT	7	1	1
139+000	139+100	9	BT	7	1	1
139+100	139+200	9	BT	7	1	1
139+200	139+300	9	BT	7	1	1
139+300	139+400	9	BT	7	1	1
139+400	139+500	9	BT	7	1	1
139+500	139+600	9	BT	7	1	1
139+600	139+700	9	BT	7	1	1
139+700	139+800	9	BT	7	1	1
139+800	139+900	9	BT	7	1	1
139+900	140+000	9	BT	7	1	1
140+000	140+100	9	BT	7	1	1
140+100	140+200	9	BT	7	1	1
140+200	140+300	9	BT	7	1	1
140+300	140+400	9	BT	7	1	1
140+400	140+500	9	BT	7	1	1
140+500	140+600	9	BT	7	1	1
140+600	140+700	9	BT	7	1	1
140+700	140+800	9	BT	7	1	1
140+800	140+870	9	BT	7	1	1

4.2.1.2 Alignment and Geometry

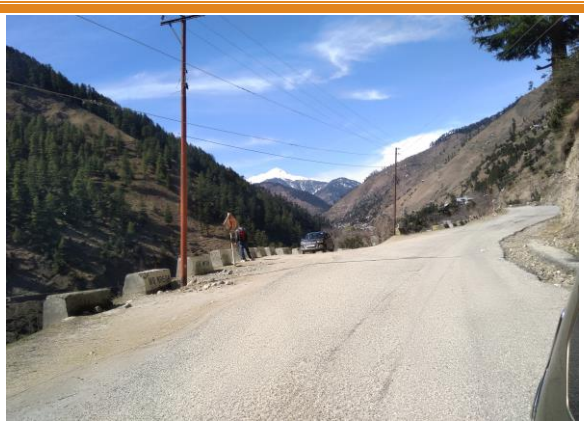
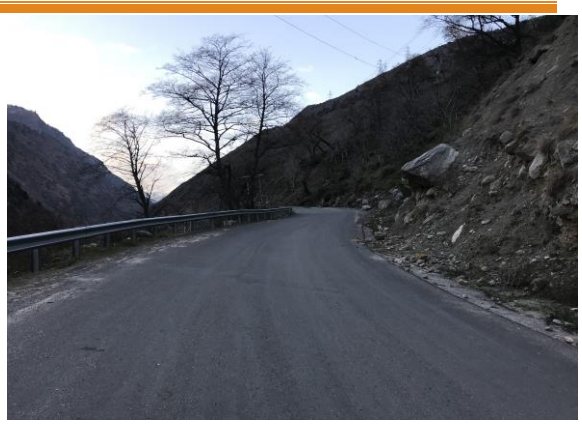
An average travel speed is 20-30 km/hr is achieved in the project stretch because of fair condition and geometry of the road. There are S curves and hair-pin bends at many places in the project stretch, which reduces the speed of the vehicle.

Built-up area on Project road

Geometry of existing road

4.2.1.3 Terrain and Land Use

Project road passes through mountainous in the entire length. The land-use pattern for the major part of the project road is open area.

Pavement condition of Project Road




Existing bridges on project road

4.2.1.4 Existing Major Intersections

The Project Road starts from Existing Km 44+500 near Khellani and ends at Km 140+870 near Chattroo. Project road passes through many minor/major junctions along the stretch.

There are 7 major intersections and 30 minor intersections sighted on the road. List of all intersections is given in **Table 4.2** below.

The important junctions along the project road are Baderwah Highway, Thatri-Gandoh road, Sarthal Road for the Kishtwar city, Keylong -Tandi-Kishtwar Road, Palmar-Ikhala Road on NH-244.

In general, no safety arrangements viz. road signs, markings, etc are provided at these intersections. No junction development has been observed in these junctions.

Table 4.2: Existing Intersections on the project road

Sr. No.	Existing Chainage	Remarks	Side	Type
1	46+910	Minor Junction	RHS	Y
2	48+150	Minor Junction	RHS	Y
3	53+082	Minor Junction	LHS	Y
4	53+950	Major Junction	RHS	Y
5	54+210	Minor Junction	LHS	Y
6	57+050	Minor Junction	RHS	Y
7	60+680	Minor Junction	RHS	Y
8	61+750	Minor Junction	RHS	Y
9	69+810	Minor Junction	RHS	Y
10	72+045	Minor Junction	LHS	Y
11	77+315	Minor Junction	RHS	Y
12	80+590	Minor Junction	RHS	Y
13	81+205	Minor Junction	LHS	Y
14	82+680	Major Junction	RHS	T
15	86+725	Minor Junction	RHS	Y
16	87+233	Minor Junction	RHS	Y
17	100+680	Minor Junction	LHS	Y
18	102+750	Minor Junction	RHS	Y
19	105+347	Minor Junction	LHS	Y
20	107+080	Major Junction	LHS	Y/Hair Pin
21	107+700	Minor Junction	RHS	Y
22	108+800	Minor Junction	LHS	Left Hand Curve/Y
23	109+050	Minor Junction	LHS	Y
24	109+350	Minor Junction	LHS+RHS(staggered)	X (staggered)
25	111+000	Major Junction	RHS	Y
26	111+200	Minor Junction	RHS	Y
27	112+420	Minor Junction	RHS	Y
28	112+965	Minor Junction	RHS	Y
29	113+580	Major Junction	LHS+RHS(staggered)	X (staggered)
30	123+170	Minor Junction	RHS	T
31	124+385	Minor Junction	LHS	T
32	127+870	Minor Junction	LHS	T
33	131+680	Minor Junction	LHS	T
34	132+155	Minor Junction	LHS	T

Sr. No.	Existing Chainage	Remarks	Side	Type
35	133+770	Minor Junction	LHS	T
36	136+900	Major Junction	LHS	Y
37	140+870	Major Junction	END OF PROJECT	

4.2.1.5 Embankment and Surface Drainage

The project road passes through cut and fill sections through mountainous terrain. The facilities such as roadside drainage is generally not available.

4.2.1.6 Existing Railway Crossings/ROB

There are no existing Railway Level crossings in the project road.

4.2.2 Pavement Condition Survey

4.2.2.1 Condition Survey of Pavement

It is the most important data needed for deciding upon the maintenance. The basic measurement of pavement condition is existing distresses. The information required is on the type, severity and amount of distress. The most commonly occurring distress forms are:

1	Bleeding	6	Patch deterioration
2	Block cracking	7	Polishing of aggregate
3	Corrugation	8	Ravelling
4	Depressions	9	Rutting
5	Pothole		

Pavement condition survey consists of observing and recording the various distresses like cracks, pothole, rutting, ravelling etc of the existing carriageway, pavement shoulders and embankment. The details collected from pavement condition survey form the basis to decide strategy for adequate strengthening / rehabilitation measure of Existing pavement.

4.2.2.2 Pavement Condition Survey by Visual Inspection

a) General observation

Pavement condition of the Project stretch can be summarized as given below. The detail is given in **Annexure 4.2.**

Table 4.3: Percentage wise distribution of Good Fair and Poor Road

Sr. No.	Condition	Length (Km)	% Condition
1	Fair	94.5	97%
2	Good	2	3%

According to Maintenance Manual of Primary, Secondary and Urban Roads, Published by MoRT&H, pavement condition data can be analysed in terms of Good, Fair and

Poor with the following criteria.

Table 4.4: Criteria wise distribution of Good Fair and Poor Road

Defects	Range of Distress, Percent				
Cracking (%)	> 30%	21 to 30	11 to 20	5 to 10	<5
Ravelling (%)	>30%	11 to 30	6 to 10	1 to 5	0
Potholes (%)	>1%	0.6 to 1.0	0.1 to 0.5	0.10%	0
Shoving (%)	>1%	0.6 to 1.0	0.1 to 0.5	0.10%	0
Patch (%)	>30%	16 to 30	6 to 15	2 to 5	<2
Settlement & deprn. (%)	>5%	3 to 5	Up to 2	Up to 1	<0
Rutting (mm)	>50	21 to 50	11 to 20	5 to 10	<5
Rating scale	1	2	3	4	5
Condition Description	V. poor	Poor	Fair	Good	V.good

4.3 Topographic Survey

Topographical surveys have been carried out as per IRC: SP 19-2001, ''Manual for Survey, Investigation and Preparation of Road Project'' and as per TOR, for the preparation of alignment plans, strip plans, longitudinal sections, cross sections and other details like drainage works, earth retaining structures, control points and reference pillars required in view of consideration of vertical and horizontal alignments. Surveys were carried out as follows:

(a) Planimetric Control

The co-ordinates of basic plan control points were established by GPS in interval of 5km on RCC pillars as primary control station. Between two control points, benchmarks were fixed in interval of 250m on RCC pillars, which serve the purpose of starting and closing bearings for Total Station Traverse. The data collected through GPS survey is presented vide **Annexure 4.3 (a) and (b).**

(b) Height Control

Double tertiary levelling was done along the entire stretch with precision automatic level connecting benchmarks and reference control points established near the project road. The misclosures were all seen to be below the tolerance limit of 0.12mm k, where k is the length of the levelling line in km in between the starting and closing benchmarks. The misclosures were adjusted and height available at, given to all benchmarks was connected to BMs established by contracting GTS Benchmark available near the project road.

(c) Detailed Survey

The detail of project influence area is up to minimum (building line) in case of urban

area and 60m in case of realignments. The limit was extended further in case of anticipated junction improvement along the finalised centre line which were surveyed by running Total Station Traverse X, Y and Z coordinates of relevant points of survey to establish ground profile captured by this Total Station Traverse besides other details like electric/telephone poles, tree, building, well, visible property line etc.

(d) Creation of DTM

Data collected through topographical survey clubbed with the findings of inventory surveys have been used to develop a Digital Terrain Model (DTM) in Mx-Roads Software. Supplemented with the silting of important cross drainage structures along with their desired deck levels, horizontal and vertical profile of each road has been finalised after the careful application of the relevant design standard.

Traverse and LS/CS surveys were fed into computer to carry out the followings:

(i) Sort out the geometric (horizontal) deficiencies in the existing alignment.

(ii) Design the best fit centre line of the existing alignment considering all obligatory/nodal points with relevant design standards.

(iii) Examine the feasibility of proposed laning requirement within existing available ROW or proposal of bypass if any.

(iv) As far as possible obviate existing buildings, functional infrastructure facilities within the proposed ROW to minimise utility relocation.

(v) Examine each existing junction for its usefulness and determine the improvement measures.

4.4 Pavement Investigation

4.4.1 General

Pavement Investigation comprise of carrying out Sub grade characteristics and strength, investigation of required Sub-grade and sub soil characteristics, Pavement composition by excavating trial pits, evaluate Sub-grade strength, Pavement condition Surveys, Pavement Structural strength by conducting Deflection test by Benkelman Beam on existing road, DCP test and various laboratory tests.

4.4.2 Roughness Survey

Roughness survey has been carried out with “Towed Fifth Wheel Bump Integrator”. The equipment was run on the entire road stretch under study for all the 2 lanes for each wheel path and the average value of Unevenness Index (UI) is expressed in terms of mm/ Km. The survey was conducted, in such a way that, vehicle runs along both lanes of the carriageway. Bump Integrator was towed at a constant speed of

32+/-0.5 Kmph. Readings are taken at every 1000 m interval. The values obtained were corrected by using the calibration equation.

Equipment used and Calibration: -

The survey was carried out by using bump integrator (Automatic Road Unevenness Recorder) No. STECO-320, duly calibrated by CRRI, New Delhi vide certificate dated March 2016 – March 2018.

The calibration equation for Automatic Road Unevenness Recorder (ARUR) given by CRRI, New Delhi:

$Y= 1.061X+636.6$

R^2 (Regression Coefficient) =0.992

Where, Y= Calibrated roughness value, mm/km

X= Observed roughness value by ARUR, mm/km

Recommended Standard for Roughness Values:

The maximum permissible value of surface roughness measured with bump integrator for different surfaces are given in Table-1 as per IRC- SP: 16:2004

Newly constructed surface are expected to give roughness value corresponding to 'Good' category while the values under 'Average' and 'Poor' category indicate level –of-service and intervention level for maintenance. Surfaces with very low roughness values loose skid resistance and are not desirable from safety considerations. Such surfacing should prompt attention for restoring frictional resistance. The roughness index values is **Annexure 4.4**.

Maximum Permissible Values of roughness (mm/km)

for Road Surface

S. No.	Type of surface	Condition of Road Surface		
		Good	Average	Poor
1	Surface dressing	<3500	3500-4500	>4500
2	Open graded premix carpet	<3000	3000-4000	>4000
3	Mix seal surfacing	<3000	3000-4000	>4000
4	Semi-dense bituminous concrete	<2500	2500-3500	>3500
5	Bituminous concrete	<2000	2000-3000	>3000
6	Cement concrete	< 2200	2200-3000	>3000

Table 4.5: Roughness Index Values for Project Section

Chainage, Km		Roughness Index (mm/Km)		Pavement Condition	
From	To	Left	Right	Left	Right
44+500	45+500	2389	2115	Fair	Fair
45+500	46+500	2386	2673	Fair	Fair
46+500	47+500	1529	1554	Good	Good
47+500	48+500	1763	1961	Good	Fair
48+500	49+500	1525	1914	Fair	Good
49+500	50+500	2147	2815	Fair	Fair
50+500	51+500	2679	2991	Fair	Fair
51+500	52+500	1847	1946	Good	Good
52+500	53+500	1933	1933	Good	Fair
53+500	54+500	2856	2636	Fair	Fair
54+500	55+500	1924	1869	Good	Good
55+500	56+500	2183	2128	Fair	Fair
56+500	57+500	2870	2895	Fair	Fair
57+500	58+500	1932	1729	Good	Good
58+500	59+500	2182	2330	Good	Fair
59+500	60+500	2247	2885	Fair	Fair
60+500	61+500	2147	2087	Fair	Fair
61+500	62+500	2171	2059	Fair	Fair
62+500	63+500	2241	2350	Fair	Fair
63+500	64+500	2348	2097	Fair	Fair
64+500	65+500	1842	1875	Good	Good
65+500	66+500	2915	2438	Fair	Fair
66+500	67+500	2663	2017	Fair	Fair
67+500	68+500	2556	2073	Fair	Fair
68+500	69+500	2881	2163	Fair	Fair
69+500	70+500	2388	2332	Fair	Fair
70+500	71+500	1811	1928	Fair	Good
71+500	72+500	1500	1964	Good	Good
72+500	73+500	2611	2808	Fair	Fair
73+500	74+500	2015	2049	Fair	Fair
74+500	75+500	2082	2617	Fair	Fair
75+500	76+500	1896	1896	Good	Fair
76+500	77+500	1661	1528	Good	Good
77+500	78+500	1680	1806	Good	Good

Chainage, Km		Roughness Index (mm/Km)		Pavement Condition	
78+500	79+500	6302	5740	Good	Good
79+500	80+500	2080	2207	Good	Good
80+500	81+500	3427	3119	Fair	Fair
81+500	82+500	5454	5560	Fair	Fair
82+500	83+500	5156	5220	Fair	Fair
83+500	84+500	5294	5358	Poor	Poor
84+500	85+500	7321	6918	Fair	Fair
85+500	86+500	5910	5772	Fair	Fair
86+500	87+500	5061	5422	Fair	Fair
87+500	88+500	3109	2950	Fair	Fair
88+500	89+500	3003	3395	Fair	Fair
89+500	90+500	4191	4053	Fair	Fair
90+500	91+500	4233	4265	Fair	Fair
91+500	92+500	3501	3438	Fair	Fair
92+500	93+500	3586	3671	Fair	Fair
93+500	94+500	4859	5125	Poor	Poor
94+500	95+500	3024	3056	Fair	Fair
95+500	96+500	3714	3989	Fair	Fair
96+500	97+500	3321	3321	Fair	Fair
97+500	98+500	3533	3873	Fair	Fair
98+500	99+500	3618	4159	Fair	Fair
99+500	100+500	3607	3788	Fair	Fair
100+500	101+500	3416	3735	Fair	Fair
101+500	102+500	3385	3194	Good	Good
102+500	103+500	2695	2186	Good	Good
103+500	104+500	2504	2408	Good	Good
104+500	105+500	2568	2398	Good	Good
105+500	106+500	2897	2727	Fair	Fair
106+500	107+500	2971	2408	Fair	Fair
107+500	108+500	1984	1963	Fair	Fair
108+500	109+500	2217	2345	Fair	Fair
109+500	110+500	3427	3480	Fair	Fair
110+500	111+500	3873	4106	Fair	Fair
111+500	112+500	10950	11692	Fair	Fair
112+500	113+500	4117	3968	Fair	Fair
113+500	114+500	3321	5528	Fair	Fair

Chainage, Km		Roughness Index (mm/Km)		Pavement Condition	
114+500	115+500	3225	3788	Fair	Fair
115+500	116+500	3968	4626	Fair	Fair
116+500	117+500	4541	2663	Fair	Fair
117+500	118+500	4446	3024	Fair	Fair
118+500	119+500	3989	3119	Fair	Fair
119+500	120+500	4011	4573	Fair	Fair
120+500	121+500	4902	4435	Fair	Fair
121+500	122+500	5156	2769	Fair	Fair
122+500	123+500	3639	4308	Fair	Fair
123+500	124+500	3427	4382	Fair	Fair
124+500	125+500	3915	4106	Fair	Fair
125+500	126+500	6111	3660	Fair	Fair
126+500	127+500	4934	3671	Fair	Fair
127+500	128+500	4106	2504	Fair	Fair
128+500	129+500	4477	2451	Fair	Fair
129+500	130+500	3788	3247	Fair	Fair
130+500	131+500	3926	3363	Fair	Fair
131+500	132+500	3989	3544	Fair	Fair
132+500	133+500	4393	3968	Fair	Fair
133+500	134+500	3533	2780	Fair	Fair
134+500	135+500	3915	3873	Fair	Fair
135+500	136+500	3554	3586	Fair	Fair
136+500	137+500	3639	3586	Fair	Fair
137+500	138+500	3692	4456	Fair	Fair
138+500	139+500	3247	3660	Fair	Fair
139+500	140+870	3321	4806	Fair	Fair

4.5 Sub grade Investigations

The subgrade conditions of existing pavement structure have been investigated by means of test pits excavated at every 5 kilometres along the road. They have been carefully dug from the pavement surface up to sub-grade level. Samples of natural ground have also been collected and tested in lab for its properties. Pavement structural composition of existing pavement at the chainages of every test pit is noted. Representative samples of subgrade soil have also been collected in bulk, in gunny bag for laboratory testing listed above. The laboratory test results for the existing subgrade is provided in **Annexure 4.7.** The key observations are however given below:

The predominant soil used in existing subgrade construction is sand and silty sand with some pockets of clay at some discrete locations

Free swelling Index varies from 5.0 to 30.0.

4 days soaked CBR varies from 9.3% to 13.5%

The following laboratory tests were conducted on the soil samples collected from each pit and borrow areas.

The details of tests is enclosed as **Annexure 4.7**.

a. Grain Size Distribution (%age)
b. Maximum dry density (MDD) (gm/cc)
c. Optimum moisture content (OMC) (%age)
d. Atterberg's Limit (LL and PL) (%age)
e. Free swelling index (%age)
f. 4 days soaked CBR (%age)

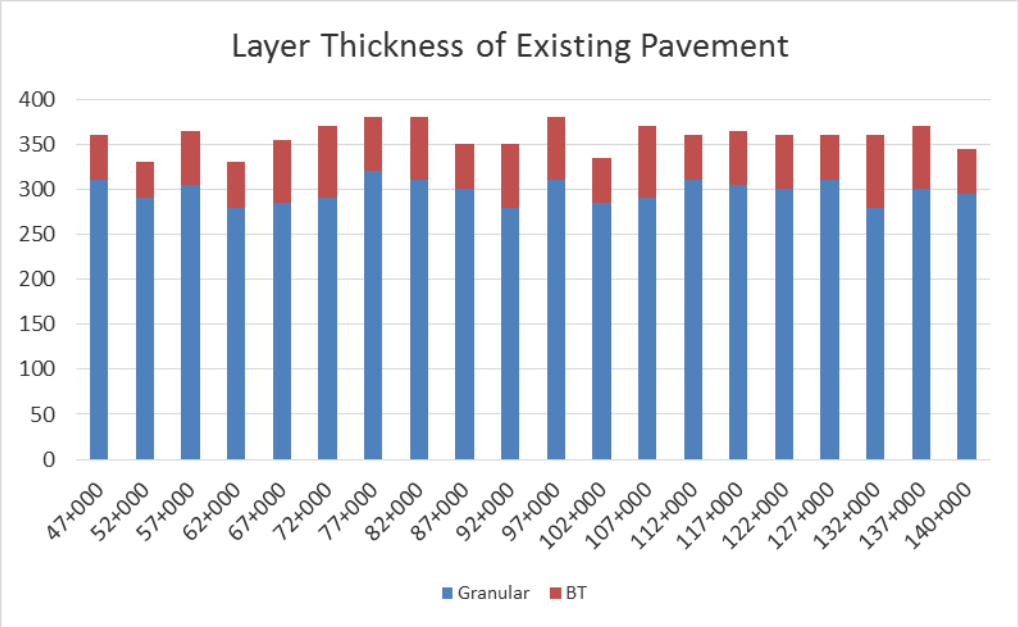
4.5.1 Existing Pavement Composition

A total of 20 pits were dug all along the road and crust noted along with other field tests. Crust composition found at different pits is tabulated below. It can be seen from data that bituminous thickness varies from 40 mm to 80 mm. Granular thickness varies from 280 mm to 320 mm. Existing pavement composition data is presented in **Annexure 4.5**. Summary of crust thickness is given in **Table 4.6**.

Table 4.6: Summary of Existing Pavement Crust Thickness

Sr. No.	Chainage	Granular	BT	Total
1	47+000	310	50	360
2	52+000	290	40	330
3	57+000	305	60	365
4	62+000	280	50	330
5	67+000	285	70	355
6	72+000	290	80	370
7	77+000	320	60	380
8	82+000	310	70	380
9	87+000	300	50	350
10	92+000	280	70	350
11	97+000	310	70	380
12	102+000	285	50	335
13	107+000	290	80	370
14	112+000	310	50	360
15	117+000	305	60	365
16	122+000	300	60	360
17	127+000	310	50	360

Sr. No.	Chainage	Granular	BT	Total
18	132+000	280	80	360
19	137+000	300	70	370
20	140+000	295	50	345



4.5.1.1 Field Density of Existing Subgrade

Bulk filed density was found out at site by sand replacement method on soils of each pit and finally dry filed density was calculated by using field moisture content. Results are tabulated in **Annexure 4.6.**

The soil Lab Test Reports are also tabulated in **Annexure 4.7.**

4.5.1.2 Borrow Areas and its Evaluation

In initial analysis we found that there is no requirement of additional borrow areas, as the demand for the filling materials can be accommodated by cutting soil.

4.5.1.3 Aggregates (coarse and fine)

4 samples (coarse aggregates), 4 crushed sand sample (fine aggregates) and 1 rock sample were collected and tested for following tests in laboratory. AIV, water absorption and specific gravity were carried out on coarse aggregates samples whereas grain size analysis, fineness modulus, water absorption and specific gravity were conducted on sand sample. The results are enclosed in **Annexure 4.10** and some details are tabulated below-

Coarse Aggregate				
Sample ID	**AIV***	**Water absorption**	**Specific Gravity**	**FI & EI**
Agg-01/10 mm	24	1.05	2.62	74.4
Agg-01/20 mm	23	0.9	2.658	48.6
Agg-02/10 mm	21	1	2.642	67.4

Coarse Aggregate				
Sample ID	**AIV***	**Water absorption**	**Specific Gravity**	**FI & EI**
Agg-02/20 mm	23	0.85	2.689	38.9
Agg-03/10 mm	23	0.95	2.652	51.8
Agg-03/20 mm	25	0.8	2.724	44.1
Agg-03/40 mm	26	0.5	2.859	44.9
Agg-04/10 mm	25	0.9	2.702	46.2
Agg-04/20 mm	22	0.75	2.583	28.7
Agg-04/40 mm	26	0.6	2.732	16.1

Fine Aggregates											
Sample ID	**IS Sieve Size in mm (For Sand Gradation)**							**FM**	**Silt & Clay Content (%)**	**Water Absorption (%)**	**Specific Gravity**
	10	**4.75**	**2.36**	**1.18**	**0.6**	**0.3**	**0.15**				
Sand-01	100	98	93	75	61	32	9	2.3	8.5	1.25	2.63
Sand-02	99	91	81	67	43	13	3	3.4	2.5	1.02	2.72
Sand-03	100	96	88	71	51	27	9	2.5	8.9	1.21	2.52
Sand-04	100	98	86	73	63	34	10	2.2	10	1.31	2.68

4.6 Source of Material

4.6.1 Type of Materials

The various construction materials are listed below.

- Aggregate
- Sand
- Bitumen
- Steel
- Cement

4.7 Axle Load Survey

Axle Load Survey is required to know the existing loading characteristics of the vehicles. The roadside direct interview method was adopted. A portable wheel load weighing pad, duly calibrated was used for measuring the axle loads. Axle Load measuring points were arranged on shoulder approaches with adequate sight distance to the on coming and going vehicles. These approaches were away from the main carriageway and wide enough to accommodate the lined up sampled vehicles for questioning and allow safe passage for un-sampled vehicles during the progress of the survey. The vehicles were stopped systematically at random based on their arrival with the help of police. These Vehicles were guided to mount on the axle load pad, axle-wise, in the order of front most axle to the rear most axles. Axle load of

commercial vehicles, i.e. LCVs, 2-Axle, 3-Axle, Multi Axle Trucks and Buses were recorded in approved formats. Representative samples were captured uniformly over the entire period of survey for each category of goods vehicles.

4.7.1 Analysis of Axle Load Survey

To estimate vehicle loading spectrum on project road, and to determine vehicle damage factor for the commercial vehicles, the axle load surveys have been carried out at Km 80+650(near Doda),104+400(Kishtwar) and 126+000(Poochal village).

Design of Pavement is based on the cumulative number of 8.16 tonne equivalent standard axle (ESA) that will pass per lane during the analysis period. The categories of traffic which apply significant loads to the pavement are bus, minibus 2–Axle, 3–Axle and multi-axle vehicles. In calculating ESA, the standard axle loads taken are as under:

i) Single Axle dual type = 8.1 tonnes

ii) Tandem Axle dual type =15.1 Tonne

The ESA for each axle has been calculated using the fourth Power low, as under

$$ESA = \left[\frac{Actual\ Axle\ Load}{S\tan dard\ Axle\ Load} \right]^4$$

The Vehicle Damage Factor is a multiplier to convert the number of commercial vehicles of different axle loads and axle configuration to the number of standard axle load repetitions.

Table 4.7: Calculated VDF by Homogeneous Sections

SUMMARY of VDF near Doda at Ex. Km 80+650	
Vehicle Type	**VDF**
LCV	1.546
Bus	1.385
2 Axle Truck	2.929
3 Axle Truck	8.247

SUMMARY of VDF near Kishtwar at Ex.104+400	
Vehicle Type	**VDF**
LCV	0.143
Bus	0.811
2 Axle Truck	2.548
3 Axle Truck	3.710

SUMMARY of VDF at Poochal Village at Ex. Km 126+000	
Vehicle Type	**VDF**
LCV	1.55

SUMMARY of VDF at Poochal Village at Ex. Km 126+000	
Vehicle Type	**VDF**
Bus	0.592
2 Axle Truck	3.616

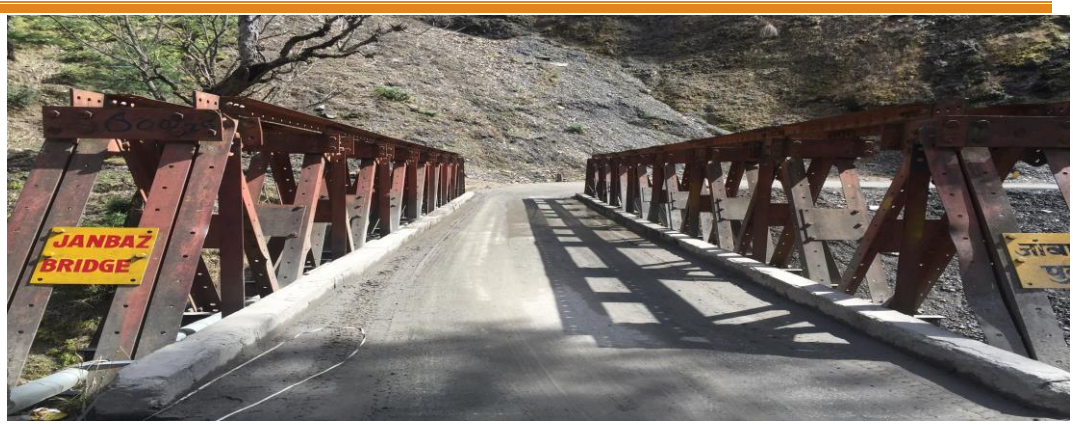
The equivalent single axle loads (ESALs) have been calculated assuming that the project road will be opened to traffic in the beginning of year 2023. MSA for the homogeneous sections is worked out for 20 years excluding construction period. As per clause no. 5.4.1 of IRC: SP:73-2018, Flexible pavement shall be designed for a minimum design period of 20 years, subject to the condition that design traffic shall not be less than 20 MSA. Therefore, design MSA is adopted to be of 20 MSA regardless of calculated MSA of 6.330, 4.709 and 1.516.

4.8 Inventory and Condition Survey of Bridges and Culverts

It is observed that the land along the existing alignment are open land passing through major Towns and Terrain is mostly mountainous and hilly. Brief details of existing CD structures along the project alignment are as below.

4.8.1 Minor and Major Bridges

There are 1 major bridges & 20 minor bridges which crosses either River, Nalla or small streams. Photographic representations are some of minor bridges are described as below. Detailed inventory and condition survey of bridges are presented vide **Annexure 4.10.**



4.8.2 Inventory of Culverts

There are 187 Culverts and 2 causeways culverts on project road. Detailed inventory and condition survey of culverts are presented vide **Annexure 4.11**.

Table 4.8: Existing Major and Minor Bridges

Sr. No.	Existing Chainage	Type of Bridge	Span Arrangement	Existing Carriageway Width	Overall Width	Type of Structure	Retained/Reconstruction /Abandoned/ widen
1	53+800	Major Bridge	1x70	8.3	13.25	Steel Truss	Abandoned due to Realignment
2	63+050	Minor Bridge	1x9.0	7.0	10.5	Solid Slab	Reconstruction due to highway geometry improvement
3	64+875	Minor Bridge	1x22.5	7.0	8.7	Semi Through type Truss	Abandoned due to Realignment
4	68+050	Minor Bridge	1x24.5	7.0	8.9	Semi Through type Truss	Abandoned due to Realignment
5	72+550	Minor	1x7.5	7.0	12.2	Solid Slab	abandoned due to

Sr. No.	Existing Chainage	Type of Bridge	Span Arrangement	Existing Carriageway Width	Overall Width	Type of Structure	Retained/Reconstruction /Abandoned/ widen
		Bridge					Realignment
6	74+360	Minor Bridge	1x7.5	7.0	12.2	Solid Slab	abandoned due to Realignment
7	78+970	Minor Bridge	1x11.5	7.0	11.0	Solid Slab	abandoned due to Realignment
8	79+710	Minor Bridge	1x24.5	7.0	8.2	Semi Through type Truss	abandoned due to Realignment
9	82+025	Minor Bridge	1x7.0	7.0	8.5	Solid Slab	abandoned due to New Thatri Bypass
10	82+690	Minor Bridge	1x38	7.0	8.3	PSC -T Beam	abandoned due to New Thatri Bypass
11	87+230	Minor Bridge	1x38.3	7.0	8.3	PSC -T Beam	Retained without Widening
12	91+270	Minor Bridge	1x32.7	7.0	8.3	PSC -T Beam	Abandoned due to realignment
13	91+540	Minor Bridge	1x6.5	7.0	9.0	Solid Slab	Abandoned due to realignment
14	96+970	Minor Bridge	1x36	7.0	8.3	PSC -T Beam	Reconstruction because of highway geometry improvement
15	105+410	Minor Bridge	1x7.5	6.6	10.2	Solid Slab	abandoned due to Kishtwar Bypass
16	113+150	Minor Bridge	1x7	5.5	8.2	Solid Slab	abandoned due to Kishtwar Bypass
17	121+550	Minor Bridge	1x50.4	7.5	8.9	Steel Truss	abandoned due to Kishtwar Bypass
18	123+800	Minor Bridge	1x50.2	3.6	5.2	Steel Truss	abandoned due to Kishtwar Bypass
19	127+900	Minor Bridge	1x32.6	4.0	5.2	Semi through Truss	abandoned due to realignment
20	130+690	Minor Bridge	1x39.6	3.3	4.9	Bailey Bridge	abandoned due to realignment
21	139+300	Minor Bridge	1x8.1	7.0	12.0	Solid Slab	abandoned due to realignment

Table 4.9: Details of Existing Culverts

Sr. No.	Survey Chainage	Type of Structure	Span Arrangement		Carriageway Width	Total Length (m)	Width of Culvert	Overall Condition
			No	Clear span (m)				
1	0.400	Slab	1	1.60	7.00	2.80	10.50	Fair
2	0.600	Slab	1	2.00	7.30	3.00	10.30	Fair
3	1.000	Slab	1	2.00	7.00	3.00	9.80	Poor
4	1.300	Slab	1	1.20	7.00	2.90	10.00	Fair
5	1.400	Slab	1	2.00	7.00	2.60	10.90	Good

Sr. No.	Survey Chainage	Type of Structure	Span Arrangement		Carriageway Width	Total Length (m)	Width of Culvert	Overall Condition
			No	Clear span (m)				
6	1.500	Slab	1	1.00	7.00	2.00	9.60	Poor
7	1.800	Slab	1	2.00	7.00	2.60	10.30	Poor
8	2.300	Slab	1	2.00	7.00	3.00	13.00	Poor
9	2.600	Slab	1	2.00	7.00	2.60	10.20	Poor
10	2.700	Slab	1	2.00	7.00	2.60	10.20	Fair
11	3.000	Slab	1	2.00	7.00	2.60	10.30	Poor
12	3.300	Slab	1	3.00	7.00	3.00	10.30	Poor
13	3.350	Slab	1	2.00	7.00	2.60	10.30	Poor
14	4.000	Slab	1	1.60	7.00	2.30	10.20	Poor
15	4.100	Slab	1	1.60	7.00	2.30	10.20	Poor
16	4.200	Slab	1	1.60	7.00	2.30	10.20	Poor
17	4.350	Slab	1		7.00			
18	4.400	Slab	1	2.00	7.00	2.60	10.30	Poor
19	4.500	Slab	1	1.60	7.00	2.30	10.20	Poor
20	4.600	Slab	1	2.20	7.00	3.20	10.20	Poor
21	4.800	Slab	1	2.00	7.00	2.60	10.20	Poor
22	5.100	Slab	1	2.00	7.00	2.80	10.30	Good
23	5.500	Slab	1	2.00	7.00	2.00	10.20	Good
24	5.800	Slab	1	2.00	7.00	2.60	10.30	Fair
25	6.000	Slab	1	2.00	7.00	2.60	10.30	Good
26	6.100	Slab	1	3.00	7.00	3.60	10.20	Good
27	6.250	Slab	1	2.20	7.00	3.20	10.30	Fair
28	6.400	Slab	1	2.00	7.00	3.00	10.20	Fair
29	6.600	Slab	1	2.00	7.00	2.60	10.30	Fair
30	6.700	Slab	1	2.00	7.00	2.60	10.20	Poor
31	7.900	Slab	1		7.00			
32	8.200	Slab	1	1.00	7.00	1.80	10.20	Good
33	8.300	Slab	1	3.00	7.00	3.80	10.20	Good
34	8.750	Slab	1	2.00	7.00	2.60	10.00	Good
35	9.300	Causeway	1	4.00	7.00			Poor
36	9.764	Slab	1	2.00	7.00	2.60	12.00	Good
37	12.400	Slab	1	2.00	7.00	2.60	10.30	Fair
38	12.760	Slab	1	2.00	7.00	2.60	12.00	Fair
39	12.900	Pipe	2	0.90	7.00	2.00	10.20	Poor
40	13.250	Slab	1	2.00	7.00	2.60	10.20	Fair
41	13.770	Slab	1	2.00	7.00	2.60	10.30	Fair
42	13.905	Pipe	1	0.60	7.00	1.00	10.20	Poor
43	14.040	Causeway	1	4.00	7.00	4.00	10.20	Fair
44	14.350	Slab	1	3.00	7.00	3.50	10.30	Fair
45	14.580	Slab	1	2.00	7.00	2.60	10.20	Fair
46	14.750	Slab	1	3.00	7.00	4.00	10.20	Good
47	15.070	Slab	1	3.00	7.00	4.00	10.20	Good
48	15.600	Slab	1	1.00	7.00	1.60	10.30	Poor
49	15.870	Pipe	1	0.60	7.00	1.00	10.20	Poor
50	16.175	Slab	1	2.00	7.00	3.00	10.30	Fair
51	16.670	Slab	1	3.00	7.00	4.00	10.20	Fair
52	17.010	Slab	1	2.00	7.00	2.60	10.20	Fair
53	17.285	Pipe	1	0.60	7.00	1.00	10.20	Fair
54	17.675	Slab	1	2.00	7.00	2.60	10.30	Fair

Sr. No.	Survey Chainage	Type of Structure	Span Arrangement		Carriageway Width	Total Length (m)	Width of Culvert	Overall Condition
			No	Clear span (m)				
55	18.020	Slab	1	2.00	7.00	2.60	10.30	Fair
56	18.270	Pipe/Slab	1	0.6/1.6	7.00	2.00	10.30	Fair
57	18.765	Slab	1	2.00	7.00	2.60	10.20	Fair
58	19.090	Pipe	1	0.60	7.00	1.00	10.20	Fair
59	19.160	Slab	1	1.50	7.00	2.00	10.20	Fair
60	19.255	Slab	1	1.50	7.00	2.00	10.30	Fair
61	19.445	Slab	1	2.00	7.00	2.60	10.20	Fair
62	20.915	Slab	1	1.50	7.00	2.00	10.30	Fair
63	21.000	Slab	1	2.80	7.00	3.60	10.20	Fair
64	21.275	Slab	1	2.80	7.00	3.60	10.20	Fair
65	21.550	Slab	1	2.80	7.00	3.60	10.20	Fair
66	22.200	Slab	1	2.80	7.00	3.60	10.20	Fair
67	24.280	Slab	1	2.00	7.00	2.60	10.20	Fair
68	24.480	Slab	1	2.00	7.00	2.60	10.20	Fair
69	25.215	Slab	1	3.30	7.00	4.00	10.30	Fair
70	25.750	Slab	1	2.80	7.00	3.60	10.20	Fair
71	26.400	Slab	1	2.00	7.00	2.60	10.30	Fair
72	27.305	Slab	1	3.30	7.00	4.00	10.30	Fair
73	27.800	Slab	1	2.80	7.00	3.60	10.20	Fair
74	27.927	Slab	1	5.50	7.00	7.00	10.30	Fair
75	28.250	Slab	1	2.00	7.00	2.60	10.20	Fair
76	28.750	Slab	1	2.00	7.00	2.60	10.20	Fair
77	28.890	Slab	1	2.00	7.00	2.60	10.30	Fair
78	29.195	Slab	1	5.80	7.00	7.40	10.30	Good
79	29.470	Slab	1	3.00	7.00	3.60	10.20	Fair
80	29.725	Slab	1	2.00	7.00	2.60	10.30	Fair
81	30.050	Slab	1	2.00	7.00	2.60	10.30	Fair
82	30.165	Slab	1	2.00	7.00	2.60	10.30	Fair
83	31.050	Slab	1	2.00	7.00	2.60	10.30	Fair
84	31.150	Slab	1	3.00	7.00	3.60	10.20	Fair
85	32.350	Slab	1	3.00	7.00	3.60	10.30	Fair
86	33.150	Slab	1	2.00	7.00	2.60	10.20	Fair
87	35.090	Slab	1	2.00	7.00	2.60	10.30	Fair
88	35.300	Slab	1	2.00	7.00	2.60	10.20	Fair
89	36.400	Slab	1	2.00	7.00	2.60	10.20	Fair
90	36.900	Slab	1	2.00	7.00	2.60	10.20	Fair
91	37.000	Slab	1	2.00	7.00	2.60	10.20	Fair
92	37.600	Pipe	1	0.60	7.00	1.00	10.30	Fair
93	37.800	Slab	1	2.00	7.00	2.60	10.20	Fair
94	37.900	Slab	1	2.00	7.00	2.60	10.30	Fair
95	38.000	Slab	1	3.00	7.00	3.60	10.30	Fair
96	38.750	Slab	1	2.00	7.00	2.60	10.20	Fair
97	39.215	Slab	1	2.00	7.00	2.60	10.20	Fair
98	39.500	Slab	1	2.00	7.00	2.60	10.20	Fair
99	41.440	Slab	1	2.00	7.00	2.60	10.20	Fair
100	42.230	Slab	1	2.00	7.00	2.60	10.20	Fair
101	43.575	Slab	1	2.00	7.00	2.60	10.30	Fair
102	43.950	Slab	1	2.00	7.00	2.60	10.30	Fair
103	44.025	Slab	1	2.00	7.00	2.60	10.30	Fair
104	45.850	Slab	1	2.00	7.00	2.60	10.20	Fair

Sr. No.	Survey Chainage	Type of Structure	Span Arrangement		Carriageway Width	Total Length (m)	Width of Culvert	Overall Condition
			No	Clear span (m)				
105	47.010	Slab	1	2.00	7.00	2.60	10.20	Fair
106	48.685	Slab	1	2.00	7.00	2.60	10.20	Fair
107	49.860	Slab	1	1.60	7.00	2.00	10.30	Fair
108	49.975	Slab	1	1.60	7.00	2.00	10.30	Fair
109	50.259	Slab	1	1.60	7.00	2.00	10.30	Fair
110	51.918	Slab	1	2.00	7.00	2.60	10.20	Fair
111	52.179	Slab	1	3.00	7.00	3.60	10.30	Fair
112	53.490	Slab	1	3.00	7.00	3.60	10.30	Fair
113	53.615	Slab	1	2.00	7.00	2.60	10.20	Fair
114	54.100	Slab	1	2.00	7.00	2.60	10.20	Fair
115	54.330	Slab	1	2.00	7.00	2.60	10.20	Fair
116	55.600	Slab	1	2.00	7.00	2.60	10.30	Fair
117	55.700	Slab	1	2.00	7.00	2.60	10.20	Fair
118	55.900	Slab	1	2.00	7.00	2.60	10.30	Fair
119	56.300	Slab	1	2.00	7.00	2.60	10.20	Fair
120	56.500	Slab	1	2.00	7.00	2.60	10.20	Fair
121	57.500	Slab	1	2.00	5.80	2.60	7.00	Fair
122	57.900	Slab	1	2.00	6.60	2.60	10.20	Fair
123	58.300	Slab	1	2.00	6.60	2.60	10.20	Fair
124	58.500	Slab	1	2.00	6.60	2.60	10.00	Fair
125	58.900	Slab	1	2.00	5.50	2.60	8.00	Fair
126	59.000	Slab	1	2.00	5.50	2.60	8.00	Fair
127	59.500	Slab	1	2.00	5.50	2.60	8.00	Fair
128	60.000	Slab	1	2.00	5.50	2.60	8.00	Fair
129	60.100	Slab	1	2.00	5.50	2.60	9.00	Fair
130	60.300	Slab	1	2.00	5.50	2.60	9.00	Fair
131	60.800	Slab	1	2.00	5.50	2.60	9.00	Fair
132	61.700	Slab	1	2.00	5.50	2.60	9.00	Fair
133	62.200	Slab	1	2.00	5.50	2.60	9.00	Fair
134	63.200	Slab	1	4.80	7.10	5.60	10.30	Fair
135	63.800	Slab	1	2.00	5.50	2.60	9.00	Fair
136	64.200	Slab	1	2.00	5.50	2.60	9.00	Fair
137	64.300	Slab	1	2.00	7.00	2.60	10.20	Fair
138	64.900	Slab	1	2.00	7.00	2.60	10.20	Fair
139	65.400	Slab	1	2.00	7.00	2.60	10.20	Fair
140	65.600	Slab	1	2.00	7.00	2.60	10.20	Fair
141	66.000	Slab	1	2.00	7.00	2.60	10.20	Fair
142	66.400	Slab	1	2.00	7.00	2.60	10.20	Fair
143	67.900	Slab	1	4.00	5.50	4.80	10.00	Fair
144	70.400	Slab	1	2.00	7.00	2.60	10.00	Fair
145	70.900	Slab	1	2.00	5.50	2.60	10.00	Fair
146	71.000	Slab	1	2.00	5.50	2.60	10.10	Fair
147	71.200	Slab	1	1.60	5.50	2.00	10.00	Fair
148	71.300	Slab	1	1.60	5.50	2.00	10.00	Fair
149	71.700	Slab	1	2.00	5.50	2.60	10.10	Fair
150	71.900	Slab	1	2.00	5.50	2.60	10.00	Fair
151	72.000	Slab	1	3.00	5.50	3.60	10.10	Fair
152	73.700	Slab	1	2.00	5.50	2.60	10.00	Fair
153	73.800	Slab	1	2.00	5.50	2.60	10.10	Fair
154	75.600	Slab	1	2.00	5.50	2.60	10.00	Fair
155	76.000	Slab	1	2.00	5.50	2.60	10.10	Fair

Sr. No.	Survey Chainage	Type of Structure	Span Arrangement		Carriageway Width	Total Length (m)	Width of Culvert	Overall Condition
			No	Clear span (m)				
156	76.200	Slab	1	2.00	5.50	2.60	10.00	Fair
157	77.300	Slab	1	3.00	5.50	3.60	10.10	Fair
158	78.700	Slab	1	2.00	5.50	2.60	10.00	Fair
159	79.100	Slab	1	2.00	5.50	2.60	10.10	Fair
160	79.500	Slab	1	2.00	5.50	2.60	10.00	Fair
161	80.480	Slab	1	2.00	5.50	2.60	10.10	Fair
162	81.565	Slab	1	1.20	5.50	2.00	10.10	Poor
163	82.050	Slab	1	1.00	5.50	1.60	10.00	Poor
164	82.185	Slab	1	2.00	5.50	2.60	10.00	Poor
165	82.510	Slab	1	2.00	5.50	2.60	10.00	Poor
166	82.910	Slab	1	2.00	5.50	2.60	10.00	Fair
167	82.985	Slab	1	2.00	5.50	2.60	10.00	Fair
168	83.150	Slab	1	2.00	5.50	2.60	10.00	Fair
169	83.300	Slab	1	1.00	5.50	2.00	10.00	Fair
170	83.565	Slab	1	2.00	5.50	2.60	10.00	Fair
171	83.755	Pipe	1	0.60	5.50	1.00	10.00	Damage
172	84.265	Slab	1	2.00	5.50	2.60	10.00	Fair
173	85.015	Slab	1	2.00	5.50	2.60	10.00	Poor
174	86.250	Slab	1	2.00	5.50	2.60	10.00	Fair
175	86.340	Slab	1	2.00	5.50	2.60	10.00	Fair
176	87.490	Slab	1	2.00	5.50	2.60	10.10	Fair
177	87.650	Slab	1	2.00	5.50	2.60	10.00	Poor
178	88.490	Slab	1	2.00	5.50	2.60	10.10	Fair
179	89.080	Slab	1	2.00	5.50	2.60	10.10	Fair
180	89.240	Slab	1	2.00	5.50	2.60	10.00	Fair
181	90.760	Slab	1	1.60	5.50	2.00	10.00	Poor
182	91.160	Slab	1	2.00	5.50	2.60	10.00	Poor
183	91.460	Slab	1	1.60	5.50	2.00	10.00	Poor
184	91.725	Slab	1	2.00	5.50	2.60	10.00	Poor
185	92.100	Slab	1	1.60	5.50	2.00	10.00	Poor
186	92.445	Slab	1	2.00	5.50	2.60	10.00	Poor
187	92.500	Slab	1	4.00	5.50	4.00	10.00	Poor
188	92.900	Slab	1	2.50	5.50	3.20	10.00	Fair
189	96.150	Slab	1	2.50	5.50	3.20	10.00	Fair

4.9 Manufactured Materials

Following are the manufactured materials use for the construction purpose listed below.

4.9.1 Cement

Cement will be acquired from Gurdaspur Punjab.

The lead distance is as follows:

- Package 1: 255 Km.

4.9.2 Bitumen

Bulk bitumen of the VG-10 Grade is available at Panipat, refinery. For the project road VG-10 Bitumen has been proposed

The package wise lead distance is as follows:

- Package 1: 623 Km.

4.9.3 Steel

The required type of Steel is to be procured from the Steel Plant in Jammu.

The package wise lead distance is as follows:

- Package 1: 163 Km.

4.9.4 Brick

Brick is one of the important manufactured materials to built structures for highway projects. There are numbers of brick manufacturing Kiln located in and around of the project road. Brick sample was collected from one of Kiln during material survey and tested in laboratory. The tests are carried out in accordance with the IS: 3495 (Part I): 1992.

Chapter 5

Traffic Demand Forecast

5.0 Traffic Demand Forecast

5.1 Approach

For evaluating the benefits as well as costs incurred by the project roads, it is obvious that a certain period must be considered for the overall project. Though project once implemented has a long life, if a proper maintenance is carried out from time to time, it is also understood that the project will continue to benefit the society even after the expiry of the project period. For the present project, as mentioned in the TOR, period of 30 years has been considered for traffic demand forecasting.

Traffic demand forecast was carried out up to horizon year 2049. To calculate the growth rate for traffic projections, comparative analysis has carried out for all the methods. The methods used for growth rate calculation are as follows:

1) Past trends in traffic growth (Vehicle registration Method)
2) Econometric Model Method: IRC-108:2015

5.2 Past Trends in Traffic growth

There is no permanent count station along the project road.

5.3 Past trend in growth of Registered vehicle

The vehicle registration growth also gives an indication of the traffic growth. Vehicle Registration data of Jammu and Kashmir UT has been taken for period 2004 - 2016. A growth rate for the same has been derived and the same has been shown in the **Table 5.1** below.

Table 5.1: Growth Rate based on Vehicle Registration Method (Based on Road Transport Yearbook)

S.No	Year	Cars / Jeeps			Trucks			2 Wheelers			LCV & Mini LCV			Buses		
		Number	Growth	Gr.rate (%)	Number	Growth	Gr.rate (%)	Number	Growth	Gr.rate (%)	Number	Growth	Gr.rate (%)	Number	Growth	Gr.rate (%)
1	2004-05	96590			31515			273265			13949			20735		
2	2005-06	109367	12777	13.23	33172	1657	5.26	297656	24391	8.93	16843	2894	20.75	21435	700	3.38
3	2006-07	123357	13990	12.79	35697	2525	7.61	320754	23098	7.76	20004	3161	18.77	22161	726	3.39
4	2007-08	139693	16336	13.24	38977	3280	9.19	341834	21080	6.57	22674	2670	13.35	23149	988	4.46
5	2008-09	156462	16769	12.00	41696	2719	6.98	363029	21195	6.20	24768	2094	9.24	24051	902	3.90
6	2009-10	183672	27210	17.39	35109	-6587	-15.80	407928	44899	12.37	43238	18470	74.57	23480	-571	-2.37
7	2010-11	316539	132867	72.34	35414	305	0.87	446791	38863	9.53	46792	3554	8.22	25858	2378	10.13
8	2011-12	255248	-61291	-19.36	38482	3068	8.66	480815	34024	7.62	51412	4620	9.87	25765	-93	-0.36
9	2012-13	290025	34777	13.62	40751	2269	5.90	530594	49779	10.35	56230	4818	9.37	26888	1123	4.36
10	2013-14	326990	36965	12.75	43132	2381	5.84	588207	57613	10.86	62047	5817	10.35	27947	1059	3.94
11	2014-15	364763	37773	11.55	45802	2670	6.19	644458	56251	9.56	67077	5030	8.11	29695	1748	6.25
12	2015-16	407236	42473	11.64	48124	2322	5.07	706746	62288	9.67	74598	7521	11.21	30646	951	3.20
Average yearly growth rate (%)				**15.56**			**4.16**			**9.04**			**17.62**			**3.66**

5.4 Econometric Model Method (IRC-108:2015)

The traffic forecast by vehicle type has been carried out by adopting the transport demand elasticity method, which is a well-established and proven technique and is referred in India.

Elasticity of traffic demand is defined as the rate at which traffic intensity varies due to change in the corresponding indicator selected. Hence, to estimate the elasticity of traffic demand, it is necessary to establish the relationship between the growth in number of a given category of vehicle with one of the economic variables considered, such as NSDP, per capita income and population growth. Then the data can yield econometric model and the form of equation for estimation of traffic demand elasticity as recommended in IRC: 108-2015 of the following type:

$\text{Log (P)} = \text{Ao} + A_1 \text{Log (EI)}$

Where,

P=Number of vehicles

EI= Economic indicator

Ao=Constant

A1= a coefficient (elasticity value)

5.5 Past Trends in Economy and Population

The economic indicators of Jammu & Kashmir, UT, which are used for the regression analysis is summed up in **Table 5.2** below:

Table 5.2: - Growth Rate of Economic Indicators for the State of Jammu and Kashmir

As mentioned above, to establish elasticity of traffic growth, we have regressed past vehicle registration data with past economic indicators of the state. The 'e' values for

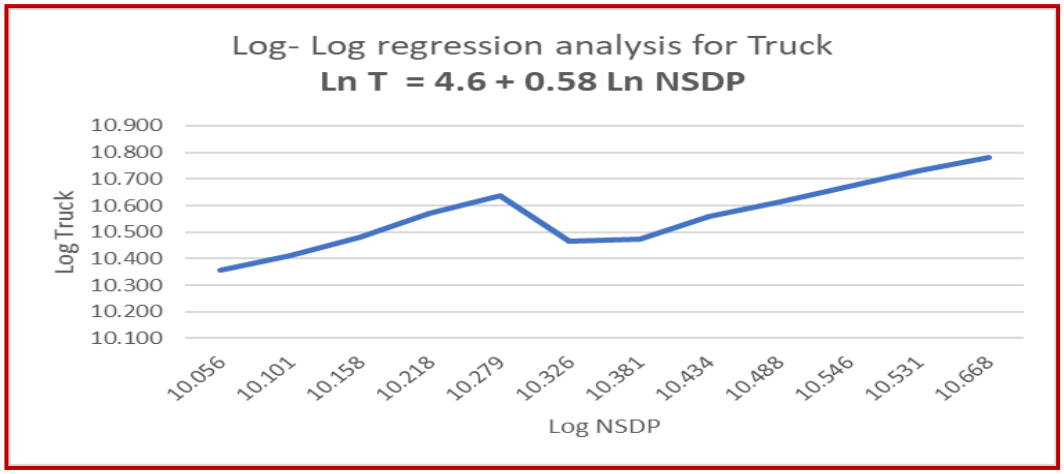
Sr. No	Year	Per Capita Income (PCI)			Population			NSDP			GSDP		
		Rs.	Growth	Gr. rate (%)	In 000's	Growth	Gr. rate (%)	Rs. (In crores)	Growth	Gr. rate (%)	Rs. (In crores)	Growth	Gr. rate (%)
1	2004-05	21734			10717			23292			27305		
2	2005-06	22406	672	3.09	10877	160	1.49	24371	1079	4.63	28883	1578	5.78
3	2006-07	23375	969	4.32	11035	158	1.45	25794	1423	5.84	30602	1719	5.95
4	2007-08	24470	1095	4.68	11192	157	1.42	27387	1593	6.18	32561	1959	6.40
5	2008-09	25641	1171	4.79	11350	158	1.41	29102	1715	6.26	34664	2103	6.46
6	2009-10	26518	877	3.42	11506	156	1.38	30512	1410	4.85	36225	1561	4.50
7	2010-11	27666	1148	4.33	11659	153	1.33	32256	1744	5.72	38270	2045	5.65
8	2011-12	28790	1124	4.06	11806	147	1.26	33990	1734	5.38	41203	2933	7.66
9	2012-13	30035	1245	4.32	11952	146	1.24	35898	1908	5.61	43402	2199	5.34
10	2013-14	31448	1413	4.70	12096	144	1.20	38039	2141	5.96	45847	2445	5.63
11	2014-15	30612	-836	-2.66	12235	139	1.15	37453	-586	-1.54	45126	-721	-1.57
12	2015-16	35034	4422	14.45	12261	26	0.21	42955	5502	14.69	51757	6631	14.69
Average yearly growth rate (%)				**4.50**			**1.23**			**5.78**			**6.05**

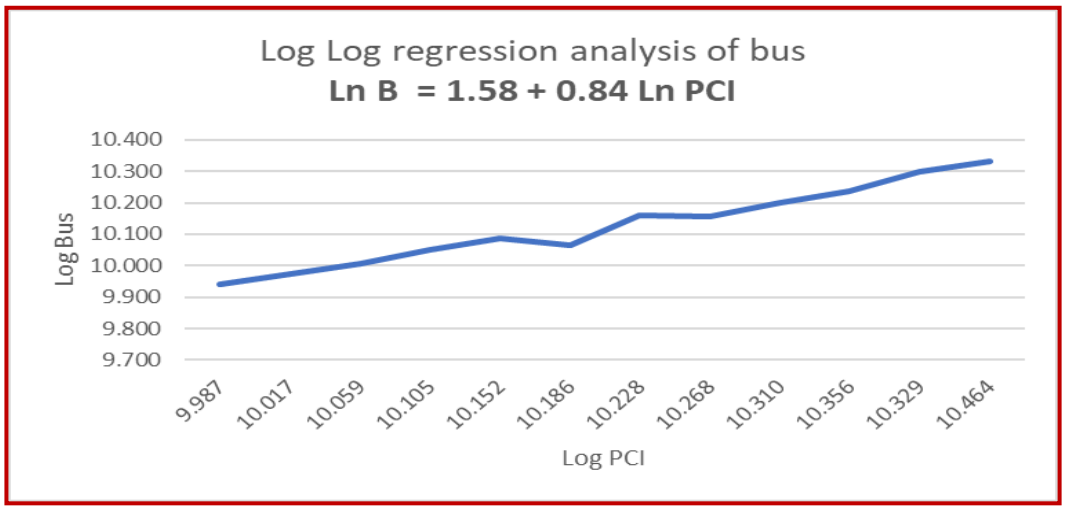
the selected economic variables With respect to different vehicle types are shown in the **Table 5.3** and are found with good fit, as reflected in their R^2 values.

Table 5.3: Transport Demand Elasticity's

Vehicle Type	Independent variable	Elasticity Coefficient (e)	R2
2-Wheelers	Per Capita Income	2.10	0.97
LSV & Mini LSV	NSDP	2.98	0.95
Car/ Jeep /Van/Taxi	Per Capita Income	3.32	0.93
Bus	Population	2.69	0.98
Trucks /Trailer	NSDP	0.58	0.73

The relationship between different vehicle types and selected Per capita income (PCI) are presented in **Figure 5.1**.





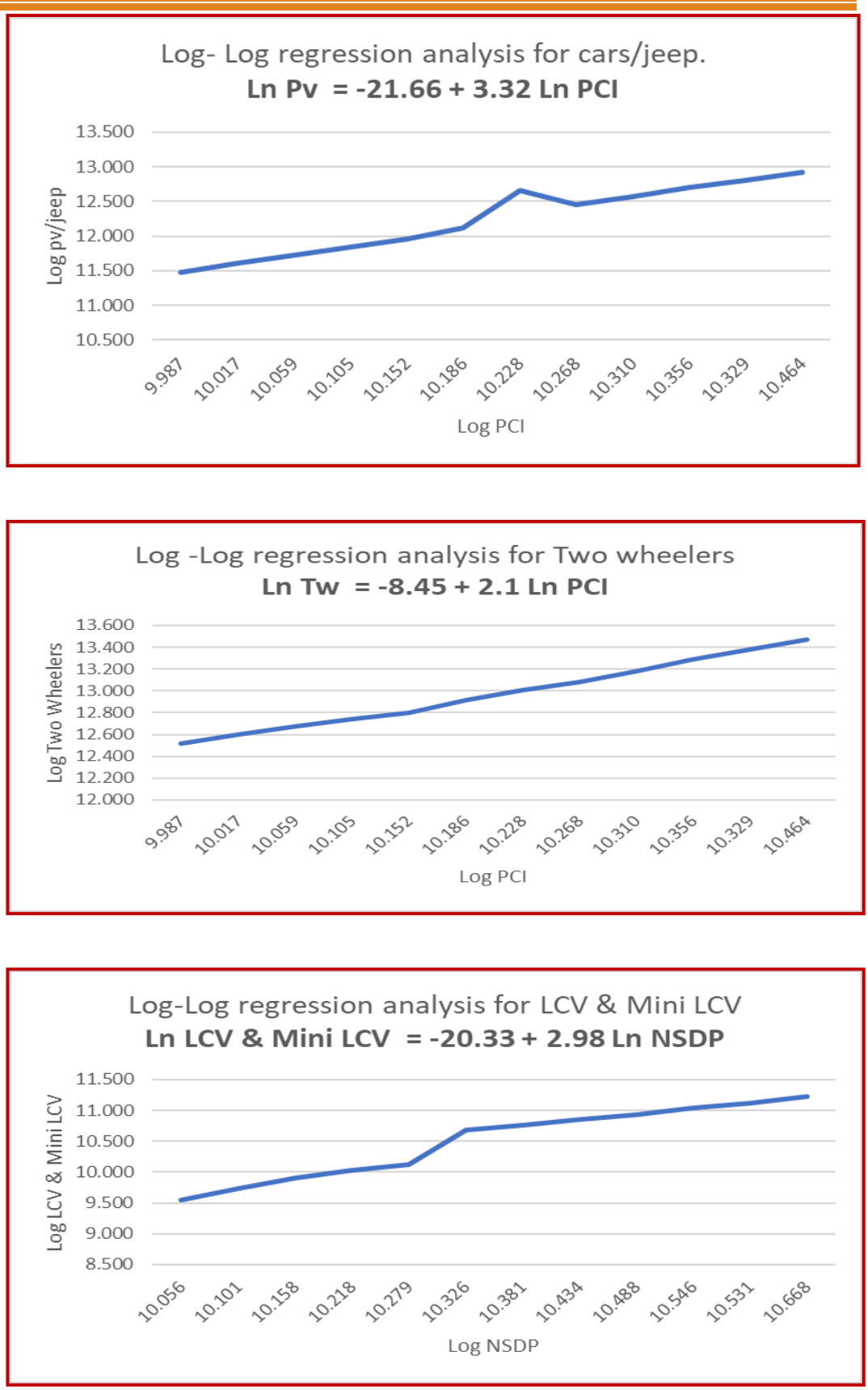


Figure 5.1: Relationship between Vehicle Types and Per capita Income (PCI)

The comparison of vehicle growth rates by vehicle registration and econometric model is as shown in **Table 5.4(a) and Table 5.4(b)**. It is appropriate to use the growth pattern that has

emerged out of the economic model, which related the economic growth with the growth in vehicle registration data

Table 5.4(a) - Growth Rates of Vehicular Traffic for the state of Jammu and Kashmir.

Sr. no.	Description	2 Wheelers	Cars/jeeps	Buses	Trucks	LCV and Mini LCV
1	Trend Growth of Vehicles	9.04	15.56	3.66	4.16	17.62
2	Growth from regression analysis	9.45	14.95	3.31	3.33	17.21
3	Considered for Revenue/Capacity	9.24	15.26	3.49	3.75	17.42

Table 5.4(b) – Adopted Growth Rates for Vehicular Traffic

S. no.	Period	2 Wheelers	Cars/jeeps	Buses	Trucks			LCV and Mini LCV
					2 Axle	3 Axle	M Axle	
1	Up to 2020	10.0	10.0	5.0	5.0	5.0	5.0	5.0
2	2021 -2025	9.0	9.0	5.0	5.0	5.0	5.0	5.0
3	2026 – 2030	8.0	8.0	5.0	5.0	5.0	5.0	5.0
4	2031 – 2035	7.0	7.0	5.0	5.0	5.0	5.0	5.0
5	Beyond 2035	6.0	6.0	5.0	5.0	5.0	5.0	5.0

5.6 Estimation of Corridor Traffic and Projection

Consultant has adopted growth rate of 5 % provided that annual rate of growth of commercial vehicles shall not be less than 5% for traffic projection and pavement design.

Traffic demand projections for the horizon year (2049) on homogeneous sections are shown in **Annexure 5 ,** The following **Table 5.5** shows the summary of projected traffic volume for homogeneous sections as per adopted realistic growth rates.

Table 5.5 – Summary of projected traffic volume

Homogeneous Section	Locations	Year 2019	Year 2024	Year 2030	Year 2031	Year 2036	Year 2040	Year 2049
Khellani (Km 44+500) to Gandoh Junction (Km 82+710)	Doda at Ex 80+650	2603	3783	5743	6112	8300	10377	17532

5.7 Capacity Analysis and Level of Services

Capacity analysis is fundamental to the planning, design and operation of roads. It is a valuable tool for evaluation of the investment needed for the future improvements. The capacity figures used for determining the desired carriageway width in differing terrain w.r.t. traffic volume and composition are as per IRC: 64-1990. As per IRC 64:1990, it is recommended that on major arterial routes LOS-B should be adopted for the design purpose. On other roads under exceptional circumstances, LOS-C could also be adopted for design. For LOS C, Design service volume can be taken as 40 % higher than those for LOS B.

For two lane highway, as per IRC: SP:73-2018 and MoRT&H circular dated 26th May 2016, the traffic at which the upgradation from two lane to four lane will trigger is shown in **Table 5.6.**

For four lane highway, as per IRC:SP:84-2014, the project highway shall be widened to six lane when total traffic including the traffic of service road, if any, reaches the design service volume corresponding to Level of Service 'C' of 4-lane highway shown in **table 5.6.**

Table 5.6: Design Service Volume for Different Lane Configurations

Lane Configuration	Terrain	Design Service Volume (PCUs per day)
2-Lane with 2.5 m Paved Shoulder	Plain	10000
	Rolling	8500
	Mountainous/Steep	6000

Lane Configuration	Terrain	Design Service Volume (PCUs per day)	Design Service Volume (PCUs per day)
		Level of Service B	***Level of Service C***
4-Lane with 1.5m Paved Shoulder	Plain/Rolling	40000	60000
	Mountainous/Steep	20000	30000

5.8 Lane Requirements

Based on the assessment of the traffic demand on the various homogeneous sections of the Project Highway, the Consultant have carried out detailed option analysis for Two- lane with paved shoulders. Based on the estimated Capacity & Design Service

Volume, the number of lanes required for the project road is worked out for LOS B which is presented in **Table 5.7** below.

Table 5.7: Lanning Requirement for the Project Corridor

Homogeneous Sections	Terrain	2-Lane with Paved Shoulder	2-Lane with Paved Shoulder	4-Lane with Paved Shoulder	4-Lane with Paved Shoulder
		LOS B	LOS C	LOS B	LOS C
Khellani (Km 44+500) to Gandoh Junction (Km 82+710)	Mountainous	Up to 2030	Up to 2035	Beyond analysis period	Beyond analysis period

5.9 Lane Improvement Proposals

Capacity analysis and lanning requirements have been carried out separately for the homogeneous sections as per the traffic demand and travel characteristics.

Lane capacity of the Khellani (Km 44+500) to Gandoh Junction (Km 82+710) will exhaust the 2 lane capacity highway in year 2030 .

It is revealed from the capacity analysis results and considering future growth, the project road requires **2 lanes with paved shoulder** for capacity augmentation and efficient movement of traffic up to project horizon year 2049 for the above mentioned Homogeneous sections .

5.10 Intersection Improvement Proposals

Intersections are an important part of the highway because it controls the efficiency, the safety and the capacity. All intersections falling on the project corridor have been studied for the improvement to allow a safe connection to the corridor and minimum interference to the through traffic. The traffic on the connected road for major intersections have been studied and projections have been made for its future development. Before recommending the improvement, all available options in order of their importance as enumerated ahead have been considered:

- At grade Intersections
- Grade separated Intersections
- Major junction with acceleration and deceleration lanes.
- Major junction with channelization of traffic or Rotary.
- Minor Junction as 'Left In & Left Out'

The intersection volume count survey at one major intersection has been carried out during identified peak periods. As per traffic projection for intersections will require at grade improvements. However as per latest Manual **Table 5.8.**

Table 5.8: Traffic Movement and Improvement Proposals at Major Intersection

at Bhaderwah Highway

Sr. No.	Name	Chainage (km)	Peak hour	Peak Hour Flow (PCU)		
				Fast	Slow	Total
1	Near Bhaderwah highway (Pul Doda)	53+950	24-07-2019 11:00 to 12:00	291	0	291

With the increased traffic flow, it is anticipated that the saturation capacity of few intersections along the project road is going to impede smooth traffic flow.

As per IRC: SP 73-2018 and 2 lanning manual, grade separation should be provided at intersection of junction with all the NH and SH.

5.11 Pedestrians Crossing Facilities

Pedestrian movement along any road is always expected near built up areas, bus bays and intersections. Safe crossing facilities for pedestrians are proposed at major intersections and bus bays. These facilities are planned in accordance with the relevant provisions contained in IRC-11, IRC-17 and IRC-103. At intersections, controlled form of crossing is achieved through provision of 3 m wide zebra crossing, accompanied by STOP line. Pedestrian guard rail has also been proposed at locations to safeguard the pedestrian movement at urban locations.

Chapter 6

Social Impact Assessment of the Project Influence Area

6.0 Social Impact Assessment of the Project Influence Area

6.1 Introduction

National Highways & Infrastructure Development Corporation Limited (NHIDCL), Ministry of Road, Transport & Highways, Govt. of India has been assigned the work of preparation of feasibility study / DPR and providing pre-construction services of road stretches/ corridors for up-gradation to two/four laning with paved shoulder according to NH Configuration.

In pursuance of the above, **M/S Rodic Consultants Pvt. Ltd., New Delhi** in joint venture with **M/S Monarch Surveyors and Engineering consultant Pvt. Ltd**. have been appointed as Consultants to carry out the "**Consultancy Services for Feasibility Study, Preparation of Detailed Project Report and providing Pre-Construction Services for upgradation to 2 lane with paved shoulder from (i) Km 44.500 to Km 142.000 of Chattroo Village & (ii) Km 235.000 (Vailoo Village) to Km 269.000 (Khanabal) of Khellani – Kishtwar – Chattroo - Khanabal Section of NH 244 in the state of Jammu and Kashmir**. The agreement was signed on 4th June 2019.

This section of project deals with Khellani – Chattroo section from ex. Km. 44+500 to Km. 140+870. [Proposed Chainage km 31+449 (End of Khellani Tunnel) to km 111+086 (Chattroo). The total project length is 78.347 Km {Excluding Chainage 83 Tunnel project of Length 1.270 Km (From Design Ch. Km 66+535 to Km 67+805) and link road length of 1.871 Km)}.

Since, the project of Vailoo tunnel and its approach road meets this project of Khellani – Chhatroo at ex. chainage 140+870. Hence, the project of Khellani - Chattroo starts from **Ex Km. 44+500 and ends at Ex Km 140+870** and has a total existing length of 96.370 Km.

The project has been divided into five packages which are as follows:

Package-I from km 31+449 to Km 51+700 =20.251 km

Package-II from km 51+700 to Km 66+535 =14.835 km

Package-III from km 67+805 to Km 80+675=12.870 km

Package-IV from km 80+675 to Km 95+550 (Kishtwar Bypass) =14.875 km

Package-V from km 95+550 to Km 111+066 =15.516 km

A Link Road connecting Kishtwar town of length 1.871 Km.

This report deals with the details of Package-I from Design CH. Km 31+449 to Km 51+700 =20.251 km

6.2 Objectives

The main objectives of Social Analysis and Design are to improve decision making and to ensure that the highway improvement options under consideration are socially sound, sustainable and contribute to the development of social development goals. The main objectives of the Resettlement Action Plan are to provide for resettlement policy framework and includes comprehensive mitigation measures to ensure that the affected and displaced persons are appropriately resettled and rehabilitated i.e. to improve their livelihoods and standards of living or at least to restore them, in real terms. The Social Impact Assessment involves undertaking full baseline information, in such a manner as to ensure compliance with State, GOI and World Bank social/environmental guidelines and regulations. Both GOI and the Bank have elaborated guidelines and regulations for social impact assessment. The analysis, studies and reporting requirements to be undertaken under this TOR must conform to these guidelines and regulations.

6.2.1 Scope of Work

The scope of work comprises the following main tasks, comprising main elements:

- Carry out a preliminary social screening in coordination with other screening exercise (environment and technical) – desk review and field visit- of the highway to determine the magnitude of actual and potential impact and ensure that social considerations are given adequate weight in the selection and design of proposed highway improvements.
- Collect information – desk review and field visit – on existing baseline conditions (include all within the proposed width or Right of Way),and undertake a preliminary evaluation of the highway selected for improvement to define, the zone of impact of such component or activities, design and management studies.
- Explore viable alternative project designs and alignments to avoid, where feasible, or minimize displacement and carry out public consultations on alternate alignments.
- Identify major and minor social impact issues and estimate the economic and social negative impacts on people and land of upgrading the highway and propose cost-effective measures to avoid and/or mitigate negative impacts;

- Carry out public consultation with the likely affected groups, NGOs, district administration and other stakeholders and document the outcomes;
- Provide a preliminary cost estimate for land acquisition, transfer and resettlement and rehabilitation and ensure inclusion in the overall project cost;
- Assets both within and outside of the right of way such structures and land will be recorded on strip maps; and
- Pre-testing of socio-economic questionnaires, checklist for focus group consultations on R&R with different social groups, administrative level and other stakeholders.

6.2.2 Project Road Appreciation

6.2.2.1 Introduction:

National Highways & Infrastructure Development Corporation Limited (NHIDCL), Ministry of Road, Transport & Highways, Govt. of India has been assigned the work of preparation of feasibility study / DPR and providing pre-construction services of road stretches/ corridors for up-gradation to two/four laning with paved shoulder according to NH Configuration.

In pursuance of the above, **M/S Rodic Consultants Pvt. Ltd., New Delhi** in joint venture with **M/S Monarch Surveyors and Engineering consultant Pvt. Ltd**. have been appointed as Consultants to carry out the "**Consultancy Services for Feasibility Study, Preparation of Detailed Project Report and providing Pre-Construction Services for upgradation to 2 lane with paved shoulder from (i) Km 44.500 to Km 142.000 of Chattroo Village & (ii) Km 235.000 (Vailoo Village) to Km 269.000 (Khanabal) of Khellani – Kishtwar – Chattroo - Khanabal Section of NH 244 in the state of Jammu and Kashmir**. The agreement was signed on 4th June 2019.

This section of project deals with Khellani – Chhatroo section from ex. Km. 44+500 to Km. 140+973. The entire project road lies in the districts of Doda and Kishtwar in the newly formed Union Territory of Jammu and Kashmir. The project road start from 33° 7.935'N & 75° 31.108'E and ends at 33° 26.351'N & 75° 36.266'E.

Fig 6.1: Key map of the project road with study area.

The Union Territory of Jammu and Kashmir covers an area of 42241 sq.km. The region is very rich in natural heritage since it is located mostly in Himalayan Mountains. Jammu and Kashmir borders with the states of Himachal Pradesh and Punjab to the south. Jammu and Kashmir has an international border with Pakistan in the west. Jammu and Kashmir consist of two divisions: Jammu & Kashmir Valley. It is further divided into 20 districts. Jammu and Kashmir is home to several valleys such as the Kashmir Valley, Tawi Valley, Chenab Valley, Poonch Valley, Sind Valley and Lidder Valley. The main Kashmir Valley is 100 km. The Indus, Tawi, Ravi and Chenab are the major rivers flowing through the state. Jammu and Kashmir is home to several Himalayan glaciers. With an average altitude of 5,753 metres (18,875 ft) above sea-level, the Siachen Glacier is 76 km (47 mi) long making it the longest Himalayan glacier which is situated in Ladakh. In the south

around Jammu, the climate is typically monsoonal. In the hot season, Jammu city is very hot and can reach up to 40 °C whilst in July and August, very heavy though erratic rainfall occurs with monthly extremes of up to 650 millimetres.

The area and population of district Doda and Kishtwar is as under:

District	Area (sq. Km)	Population
Doda	2625	409936
Kishtwar	7737	230696

6.2.2.2 Villages and Districts under the project Road

The Project Road starts from Existing Km 44+.500 near Khellani and passes through Gangalwar, Bhuta, Suigwari, Nai Basti, Premnagar,Thatri, Darabshalla, Kandiri, Kishtwar, Marwah, Kodia, Dhadhpeth, Mughal Maidan, and Udil Gurjan and terminates at Existing Km 140+973 at Chhattroo.

Table 6.1: Tehsils under the Project Road

SL	Name of District	Name of Tehsil
1	**Doda**	Doda
2		Bhaderwah
3		Gandoh
4		Thatri

SL	Name of District	Name of Tehsil
1	**Kishtwar**	Kishtwar
2		Atholi (Paddar)
3		Chattroo
4		Marwah
5		Warwan
6		Dachhan
7		Drabshalla
8		Nagseni
9		Bonjwah
10		Machail
11		Mughal Maidan

6.2.2.3 Road Width of the Project Road

Table 6.2: Road Width of the Project Road

Existing Chainage		Terrain	Roadway Width	Carriage way width	Shoulder Type	Width of Shoulder on either Side
From	To					
44+500	**80+500**	Hilly	9	7	ER	1
80+500	**82+600**	Hilly	10	10	-	-
82+600	**86+700**	Hilly	12	10	ER	1
86+700	**87+200**	Hilly	7	7	-	-

Existing Chainage		Terrain	Roadway Width	Carriage way width	Shoulder Type	Width of Shoulder on either Side
From	To					
87+200	90+500	Hilly	9	7	ER	1
90+500	90+800	Hilly	7.5	6.5	ER	1
90+800	91+400	Hilly	6.75	5.75	ER	1
91+400	93+600	Hilly	9	7	ER	1
93+600	97+000	Hilly	7.75	5.75	ER	1
97+000	99+700	Hilly	8.5	6.5	ER	1
99+700	107+700	Hilly	7.5	5.5	ER	1
107+700	109+900	Hilly	12	10	ER	1
109+900	110+500	Hilly	10	10	-	-
110+500	111+000	Hilly	10	8	ER	1
111+000	115+100	Hilly	9	7	ER	1
115+100	118+100	Hilly	7.75	5.75	ER	1
118+100	120+500	Hilly	4.5	3.5	ER	0.5
120+500	122+900	Hilly	7.5	5.5	ER	1
122+900	124+400	Hilly	7	5	ER	1
124+400	128+400	Hilly	7.5	5.5	ER	1
128+400	133+100	Hilly	7.75	5.75	ER	1
133+100	138+200	Hilly	7.5	5.5	ER	1
138+200	140+870	Hilly	9	7	ER	1

All major utilities follow the road alignment as the project road connects villages/towns Gangalwar, Bhuta, Suigwari, Nai Basti, Premnagar, Thatri, Darabshalla, Kamdiri, Kishtwar, Marwah, Kodia, Dhadhpeth, Mughal Maidan, Udil Gurian and Chhattroo.

6.2.3 Benefits envisaged from the project road:

Following are the expected benefits due to the improvement in the project road:

- Better level of service in terms of **improved riding quality** and **smooth traffic flow.**
- Faster transportation will ultimately lead to **massive savings** in the form of reduced wear and tear of vehicles, reduced vehicle operating costs (VOCs) and total reduction **in transportation costs** etc.
- With the improvement of road surface, the **traffic congestion** due to obstructed movement of vehicles will be **minimized** and thus wastage of fuel emissions from the vehicles will be reduced.
- **Increased road** landscaping and **safety** features.
- **Enhanced connectivity** between **rural & urban population** which will **benefit** the all sections of the society like **general population, small-**

medium-large scale industries, farmers, businessmen etc.

- **Improved access** to higher **education facilities & modern health facilities**.
- **Strengthening of both rural & urban economies** which in turn will improve economic scenario of the state and country.
- Improved road connectivity helps in **better implementation and management of government schemes.**
- With improvement in economy, **more generation of employment opportunities**.
- **Overall improvement of the region.**

6.3 Engineering Design guidelines

Details of Engineering Design standards is given in Chapter 08.

6.3.1 Homogeneous Section

The traffic homogeneous sections have been identified based on the major traffic generators and diversion locations along the project corridor. The passenger traffic has been observed to vary with respect to the influence of village/towns falling along the project corridor. The major traffic generators settlements and its connections (diversion) points are:

- Khellani (Km 44+500) to Gandoh Junction (Km 82+710)
- Gandoh Jn (km 82+710) to Kishtwar (Km 110+560)
- Kishtwar (Km 110+560 to Chattroo (Km 140+870)

Traffic surveys locations were selected to capture representative traffic volume on the homogeneous sections with a view to capture section wise traffic flow characteristics, the total stretch has been segmented in to two homogeneous sections, based upon the major intersections that act as main collectors or distributors (diversion) of traffic along the project road.

Analysis of Alternatives for social impacts:

Table 6.5: Analysis of alternatives

S. No	Homogenous Sections	Key environmental issues	Key Social Issues	Best design option	Adverse environmental and social Impacts	Recommended design option to avoid/minimize impacts

S. No	Homogenous Sections	Key environmental issues	Key Social Issues	Best design option	Adverse environmental and social Impacts	Recommended design option to avoid/minimize impacts
1	With project: but without any bypass /realignment	Increased Environmental pollution/vehicle operating cost/fuel usage due to congestion.	Less safety, increased accidents, loss of lives	By the analysis of alternatives, the project scenario with bypass /realignment has less negative effect on social, environmental & safety platforms.	land acquisition, Loss of agricultural land.	The project scenario with bypasses at congested areas and realignment at critical sections is recommended because it has a smaller amount of negative impact due to the project.
2	With project: but with bypass /realignment.	Somewhat less pollution / fuel usage & less accident & tree cutting	Somewhat more safety at critical sections. Less land acquisitions.			

6.4 About the Project Influence Area

The entire project road is passing within the Doda and Kishtwar district. Hence, for analysing the immediate influence area of the project road Doda and Kishtwar District in Jammu and Kashmir has been considered.

Major socio-economic benefits of the improvement of highways would be in terms of:

- Better transportation will ultimately lead to massive savings in vehicle operating costs (VOCs) which include savings in time, savings in cost of wear and tear, fuel etc. It will increase access to the villages and other small settlements with the urban areas, thus providing better connectivity to the urban infrastructure.
- Strengthening of rural economies as the rural sector/ economy is sure to get strengthened, though at a gradual pace.
- Education is one of the most dominant indicators towards the development of a region. Though primary schools are present in almost all villages, access to high schools, higher secondary schools and colleges is not so easy at present. Provision of easy access to higher education can be directly linked to the improved educational scenario.
- Indian villages are yet not well-equipped with all types of medical facilities and services like Public Health Centres (PHCs), dispensaries, hospitals. Due to inaccessibility, reaching even the nearest health centre sometimes becomes a colossal task.

Other than this, there would be inevitable **Negative impacts** that the improvement of

the concerned highway would lead to:

- **Loss of roadside structures:** People will be affected by land acquisition, which possess title or other tenured status. Consequent to the land acquisition requirements, wells, houses (pucca, semi-pucca, and kutcha) and other structures like religious places (temples, mosques), community structures like bus stand, community sitting places, hand pumps, tube wells etc are likely to be affected.
- **Loss of livelihood:** Big and small shops, roadside hotels, other small commercial developments etc. are also likely to be affected due to road improvement and widening. The people directly o/r/ indirectly dependent on these would experience an abrupt loss in their income.

6.4.1 Location and Districts involved

Location and Geography

Jammu and Kashmir

The Union Territory of Jammu and Kashmir covers an area of 42241 sq.km. The region is very rich in natural heritage since it is located mostly in Himalayan Mountains. Jammu and Kashmir borders with the states of Himachal Pradesh and Punjab to the south. Jammu and Kashmir has an international border with Pakistan in the west. Jammu and Kashmir consist of two divisions: Jammu & Kashmir Valley. It is further divided into 20 districts. Jammu and Kashmir is home to several valleys such as the Kashmir Valley, Tawi Valley, Chenab Valley, Poonch Valley, Sind Valley and Lidder Valley. The main Kashmir Valley is 100 km. The Indus, Tawi, Ravi and Chenab are the major rivers flowing through the state. Jammu and Kashmir is home to several Himalayan glaciers. With an average altitude of 5,753 metres (18,875 ft) above sea-level, the Siachen Glacier is 76 km (47 mi) long making it the longest Himalayan glacier which is situated in Ladakh . In the south around Jammu, the climate is typically monsoonal. In the hot season, Jammu city is very hot and can reach up to 40 °C whilst in July and August, very heavy though erratic rainfall occurs with monthly extremes of up to 650 millimetres..

Doda District

Doda district is extending over an area of 8912 sq. km. The Doda district lies within latitude 32°25’00’’ and 34°14’00’’ N and 75°00’’ and 76°45’30’’ E. The area is rugged and mountainous. The geomorphic forms recognized in the area are structural hills, erosional hills, plateaus, river terraces and hill slopes. The soil in the district is

generally loose and sandy with very low moisture. The rate of soil erosion is very high and roads blockage is frequent during the rainy season. Soils have therefore formed only on the gentle slopes of hills. Podzols are the dominant group of soils in the area. Paddar formation of Early Proterozoic comprises high grade schists and granitoids, gneisses, Ramban formation consist of phyllite, slate, quartzose sandstone, diamictite and lenticular bands of limestone and gypsum and Bhadarwah formation of Late Proterozoic consists of slate, phyllite and quartzite.

Kishtwar District

Kishtwar District is a newly formed district of Jammu and Kashmir. Prior to 2007, it was a part of Doda District. The canoe shaped Kishtwar Plateau area measuring about 20 sq.km lies within the Longitude 75°43'30" and 75°47'00" E; Latitude 33°17'30" and 33°22'15" N. Soil is spodosolic, undulating and prone to erosion. Most of the soils of the district Kishtwar are sandy loam to clayey loam in nature with high rate of soil loss due to erosion. Saffron of purest quality is produced in the iron rich soil at Puchhal, Matta, Lachdayaram, Berwar and Hidyal. Kishtwar Plateau lies in Higher Himalayas. The Kishtwar formation occupying the Plateau surface is an assemblage of silty material at the top (10-12m. thick) underlain by silt and angular fragments of mainly quartzites and schists (80m thick) mixed in varied proportions.

6.4.2 Administrative Setup

Jammu and Kashmir consist of two divisions: Jammu and Kashmir Valley and is further divided into 20 districts. The major cities in Jammu and Kashmir are:

Table 6.6: Major Cities of Jammu and Kashmir

Division	Districts	Area (Square-Km)	Population	Headquarters
Jammu	Kathua District	2651	616,435	Kathua
	Jammu District	2336	1,529,958	Jammu
	Samba District	1002	3,18,898	Samba
	Udhampur District	5550	554,985	Udhampur
	Reasi District	1719	314,667	Reasi
	Rajouri District	2630	642,415	Rajouri
	Poonch District	1674	476,835	Poonch
	Doda District	2625	409,936	Doda
	Ramban District	1329	283,713	Ramban
	Kishtwar District	7737	230,696	Kishtwar
	Total for division	**29253**	**5059640**	**Jammu**
Kashmir	Anantnag District	3574	1,078,692	Anantnag
	Kulgam District	1067	424,483	Kulgam
	Pulwama District	1398	560,440	Pulwama
	Shopian District	612.9	266,215	Shopian
	Budgam District	1370	753,745	Budgam

Division	Districts	Area (Square-Km)	Population	Headquarters
	Srinagar District	1979	1,236,829	Srinagar
	Ganderbal District	1979	297,446	Ganderbal
	Bandipora District	345	392,232	Bandipora
	Baramulla District	3353	1,008,039	Baramulla
	Kupwara District	2379	870,354	Kupwara
	Total for division	**18056.9**	**6,888,475**	**Kashmir**

6.4.3 Demographic Features

The major ethnic groups living in Jammu and Kashmir include Kashmiris, Gujjars/Bakarwals, Paharis, and Dogras . The Kashmiris live mostly in the main valley of Kashmir and Chenab valley of Jammu division with a minority living in the Pir Panjal region. The Pahari-speaking people mostly live in and around the Pir Panjal region with some in the northern Kashmir valley. The nomadic Gujjars and Bakarwals practice transhumance and mostly live in the Pirpanjal region. The Dogras are ethnically, linguistically and culturally related to the neighboring Punjabi people and mostly live in the Udhampur and Jammu districts of the state.

J&K along with Ladakh is one of India's two administrative divisions with a Muslim majority population. According to the 2011 census, Islam is practiced by about 68.3% of the state population, while 28.4% follow Hinduism and small minorities follow Sikhism (1.9%), Buddhism (0.9%) and Christianity (0.3%). About 96.4% of the population of the Kashmir valley are Muslim followed by Hindus (2.45%) and Sikhs (0.98%) and others (0.17%).

Religion in Jammu & Kashmir

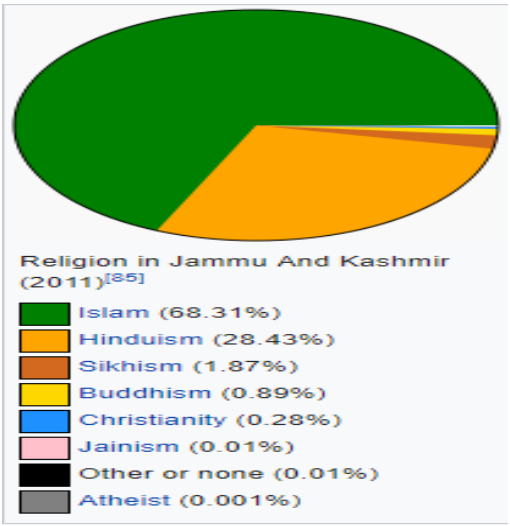


Fig 6.2: Religion Wise break up of Jammu and Kashmir

According to the 2011 census of India, the total population of Jammu and Kashmir is

42241 Km sq. The official language of the state is Urdu. Among other languages Kashmiri, Dogri, Hindi, Punjabi, Pahari, Balti, Gojri, Shina and Pashto are also spoken in other parts of Jammu and Kashmir. Jammu and Kashmir have a rich literary heritage with roots that lie deep in the sociological and historical movements of the region. Its literature reflects the regional consciousness and the evolution of an identity distinct from others in Northern India. The literacy is about 68.74%.

Table 2.1: Demographic Profile of Jammu and Kashmir

Division	% Muslim	% Hindu	% Sikh	% Buddhist & others
Kashmir	96.40%	2.45%	0.98%	0.17%
Jammu	33.45%	62.55%	3.30%	0.70%

6.5 Economical Profile of Project Influence Area (PIA):

The economy of Jammu and Kashmir has suffered from disturbed conditions. It would be therefore necessary to put the economy back to the rails to enable an average person get employment opportunities. In this direction, the following 8 sectors of economy have been identified for generation of gainful employment opportunities in the state on sustainable basis:

1. Agriculture (including Horticulture, Floriculture, Food Processing and Animal Husbandry)
2. Handlooms and Handicrafts
3. Industries (including Small Scale industries and Rural industries)
4. Tourism & travels
5. Education & health
6. Large infrastructure projects (Roads & Railways)
7. Information Technology & Telecommunication
8. Construction Sector

Jammu and Kashmir's economy is predominantly dependent on agriculture and allied activities. The Kashmir Valley is known for its sericulture and cold-water fisheries. Wood from Kashmir is used to make high-quality cricket bats, popularly known as Kashmir Willow. Kashmiri saffron is very famous and brings the state a handsome amount of foreign exchange. Agricultural exports from Jammu and Kashmir include apples, barley, cherries, corn, millet, oranges, rice, peaches, pears, saffron, sorghum, vegetables, and wheat, while manufactured exports include handicrafts, rugs, and

shawls.

Horticulture plays a vital role in the economic development of the state. With an annual turnover of over 3 billion (US$47 million), apart from foreign exchange of over 800 million (US$12 million), this sector is the next biggest source of income in the state's economy.

Economic centres:

Main industrial activity is concentrated in the Jammu and Kathua districts of Jammu division. This is mainly because Jammu is the only railhead, where loading and unloading of raw material becomes easy and less cumbersome as compared to Kashmir region where transportation cost is higher. The State has set up two industrial growth centers - one in Samba, Jammu and other in Lassipora, Pulwama with the assistance of Central Govt. under the centrally sponsored schemes.

The key industrial activity in J&K includes:

- Horticulture
- Floriculture
- Handloom & Handicraft
- Tourism.
- Mineral based Industries.
- Gem & Jewlery
- Sericulture
- Information Technology
- Pharmaceuticals
- Insecticides
- Pesticides
- Electronics
- Hardware

GDP and Profile of the Sectors Contributing to the Regional Economy:

This is a chart of trend of gross state domestic product of Jammu and Kashmir at market prices estimated by Ministry of Statistics and Programme Implementation with figures in millions of Indian Rupees.

Table 6.8: Gross State Domestic Product

Sr. No	Sector	2011-12 (Q)	2012-13 (Q)	2013-14 (A)
1	Agriculture including Livestock	743878	745110	756742
2	Forestry and Logging	130261	130059	131083
3	Fishing	18071	18160	18347
(A)	**Agriculture & Allied (1+2+3)**	**892209**	**893330**	**906171**
4	Mining and Quarrying	10446	44768	313638
(a)	**Sub-total Primary (A+4)**	**902655**	**938098**	**50300**
5	Manufacturing	290872	305100	956471
5.1	Manufacturing (Registered)	134062	138905	313638
5.2	Manufacturing (Un-registered)	163740	166195	142740
6	Construction	476989	489583	170898
7	Electricity, Gas, Water Supply	185792	188497	508922
(b)	**Sub-total Secondary (5-7)**	**690583**	**983180**	**194022**
(B)	**Industry (b+4)**	**971029**	**1027949**	**1016582**
8	Transport, Storage & Communication	326981	349799	233485
9	Trade, Hotels & Restaurants	290376	299924	379532
10	Banking & Insurance	232571	256991	286321
11	Real Estates, Ownership of Dwelling, Legal & Business Services	228437	238825	249603
12	Public Administration	684436	747025	823423
13	Other Services	519803	554075	594528
(C)	**Sub-total Tertiary (Services Sector) (8-13)**	**2200827**	**2366546**	**2566892**
	Total GSDP (a + b + c)	**4064065**	**4287825**	**4539945**
	Population in Lakhs	118.06	119.52	120.96
	Per Capita GSDP (Rs.)	**34424**	**35875**	**37533**
	Growth Rate	**6.19**	**5.51**	**5.88**

Workforce Characteristics

After collection and verification of the data from time to time, state income division prepares estimates at factor cost usually in the month of January-February every year. These estimates are discussed and verified by CSO during comparable discussion generally in the month of April-May every year. Advance estimates prepared in the current year is finalized in the forthcoming third year after discussion with CSO. For instance, an Advance GSDP estimate for the year 2013-14 has been prepared in the month of January 2014. In January 2015, a Quick estimate will be prepared for the same year. Similarly, In January 2016, a provisional estimate will be prepared for the year 2013-14 and finally In July 2016, GSDP estimates for the year 2013-14 would be finalized after discussion with CSO.

6.6 Socio-Economic Profile of the Project Road

Project Influence Area (PIA): The Khellani to Chattroo road section "Project Road" situated at south-west part of Jammu and Kashmir is having total length of about 96.473 Kilometre. Jammu and Kashmir is one of the States of India that is located at 33.7782° N and 76.5762° E. The project road has significant influence on Jammu and Kashmir State and on the Doda and Kishtwar districts. The Project Road starts from Existing Km 44.500 near Khellani and passes through Gangalwar, Bhuta, Suigwari, Nai Basti, Premnagar,Thatri, Darabshalla, Kandiri, Kishtwar, Marwah, Kodia, Dhadhpeth, Mughal Maidan, and Udil Gurjan and terminates at Existing Km 140.973 at Chhattroo. The road stretch goes towards east from Khellani side and turns towards north from New Thathri and finally ends near Chhatroo traversing through Kishtwar.

The project road has a significant role since it terminates near such point where the project of Vailoo Tunnel starts. The starting road of Vailoo Tunnel project coincides near the end point of Khellani-Chhatroo project. This project road is expected to meet with future traffic growth, once the Vailoo Tunnel starts operating. Hence, the project road of Khellani – Chhatroo along with Vailoo Tunnel project road will work as a single system and will carry the majority of traffic load from Kishtwar side directly towards the Vailoo side. This proposed section will bypass the very long and absurd stretch of Sinthan Pass.

The entire length of project road has a carriageway width varying from 5.0m – 12.0m but majority of portion traverses as carriageway of 7.0 m. Earthen shoulder of varying width from 1.0m - 2.0m exists along both sides of the road.

Table 6.9: Demographic Profile of Doda District

DESCRIPTION	
Population as per census 2011	409936
Population growth rate	27.89%
Literacy (As per 2011 Census)	64.68%
Density	160/sq. Km
Hindu	45.77%
Muslim	53.82%
Sikh	0.12%

Table 6.10: Demographic Profile of Kishtwar District

DESCRIPTION	
Population as per census 2011	230696
Population growth rate	21.06%
Literacy (As per 2011 Census)	56.2%
Density	30/sq. Km

DESCRIPTION	
Hindu	40.72%
Muslim	57.75%
Sikh	0.20%

6.6.1 Agriculture/ Irrigation in Project Influence Area

Impact on agricultural land

Jammu and Kashmir is essentially a mountainous region in which only about 30 per cent of the reporting area is under cultivation. Agriculture is the mainstay of the people as it provides employment, directly or indirectly to about 70 per cent of the workforce. It contributes about 65 per cent of the state revenue which explains the overdependence of the state on agriculture. Land is, however, limited and therefore, its judicious utilization is necessary to meet the growing need of the tremendously increasing population and for the sustainability of soils, ecosystems and environment. The total geographical area including region of Ladakh is 2.23 lakh sq. km including those parts which are under the occupation of Pakistan and China. About 92 per cent of the geographical area of the state consists of high mountains rugged topography and only 5 per cent is available for cultivation.

Being, hilly, mountainous and snow covered, it is only the gentle slopes (below 15°) which may be developed as orchards and pastures after heavy investment. The proportion of old fallow and current fallow is 0.29 and 4.0 per cent respectively. About 12 per cent of the total reporting area is put to non-agricultural uses, e.g., settlement, roads, cemetery, gulls (canals) and water bodies. In general, the Jammu plain has a high concentration of wheat, rice, maize, pulses, fodder and oilseeds, while the Valley of Kashmir is well known for its paddy, maize, orchards (apples, almond, walnut, peach, cherry, etc.) and saffron cultivation. In Ladakh, barley, wheat, maize, vegetables, berseem and fodder are the main crops. The Kashmir Valley has a large capacity of fruit production. Apples, walnuts, almonds, cherries and pears are imported by many foreign countries.

Over 70 percent of the Net Sown Area is under food crops and the area under fruits is a little over 13 percent. Viability of agriculture as a profession is presently affected capital inadequacy, lack of infrastructural support and controls on movement, storage and sale etc of agricultural produce. Dwindling water resources too is a major challenge as only 42 percent of the cultivated area is under irrigation.

Fig 6.3: Agriculture in Jammu and Kashmir

Rice, Maize and Wheat are the major crops in the state. While in Kashmir region Wheat, Oil Seeds and Fodder is being introduced as the secondary crop. In Jammu farmers are raising paddy as an additional crop. The production level of paddy adds about 40 quintals per hectare in Kashmir Valley and is highest in the country.

As per the figure for 2011-12 area not available for cultivation accounts for 574 thousand hectares. The category consists of 245 thousand hectares following under land put to non-agriculture use and 312 thousand hectares under barren and uncultivable land, 5 thousand hectares is under still water, marshy and water lodged category which is negligible proportion.

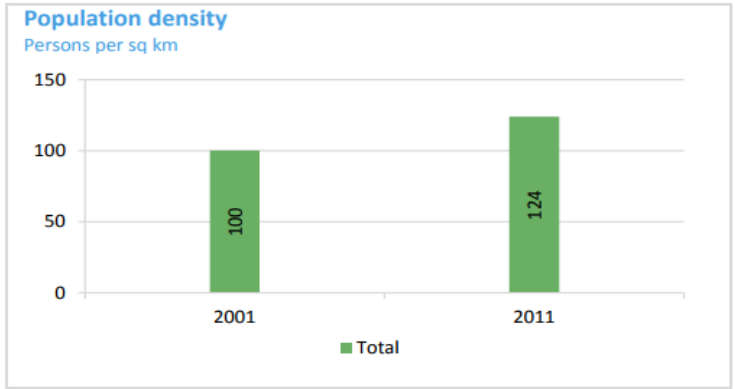
The crop yield for the year 2011-12 regarding principal agriculture crops was estimated to be 1.6 metric tonnes per annum for maize, 2.078 metric tonnes per annum for rice and 1.68 metric tonnes per annum for wheat, which are the major crops of the state.

S.No	District	Area Irrigated (Hectares)				
		Rice	Maize	Wheat	Barley	Other cereals Pulses & Millets
1)	Anantnag	25147	1335	-	-	538
2)	Kulgam	16812	530	-	-	68
3)	Pulwama	16567	849	-	-	110
4)	Shopian	556	162	-	-	48
5)	Srinagar	3709	-	-	-	17
6)	Ganderbal	7684	1290	-	-	104
7)	Budgam	24665	1428	6	-	536
8)	Baramulla	20236	5413	-	-	659
9)	Bandipora	9486	973	-	852	333
10)	Kupwara	15639	10122	-	-	-
11)	Leh	-	-	1092	4	3679
12)	Kargil	-	-	1324	-	5544
13)	Jammu	52338	118	49474	8	832
14)	Samba	7063	56	6350	29	171
15)	Udhampur	2926	4582	1654	169	96
16)	Reasi	1425	193	931	3	70
17)	Doda	1890	727	707	123	46
18)	Kishtwar	1202	836	253	227	801
19)	Ramban	1386	-	203	126	-
20)	Kathua	20000	297	15916	21	84
21)	Rajouri	453	118	3159	-	50
22)	Poonch	3621	98	2192	-	-
	Total	236888	29127	83261	1562	13786

Fig 6.4: Irrigated Land Distribution in Jammu and Kashmir

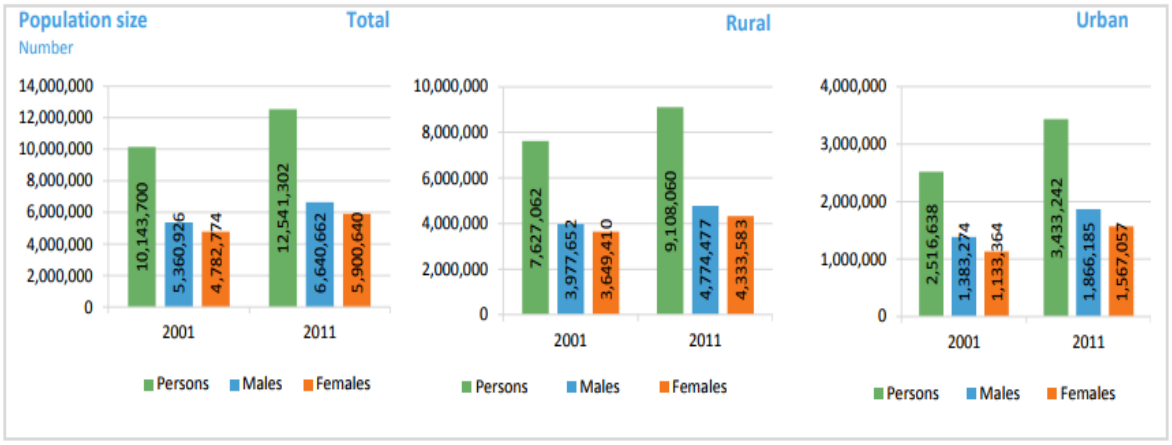
6.6.3 Population & Literacy

As per details from Census 2011, the following data is given by the Department of Ecology Environment and Remote Sensing. The **Population Density** of J&K is as below:



	2001	2011
Total	100	124

Population Size of Jammu and Kashmir



Total	2001	2011	Rural	2001	2011	Urban	2001	2011
Persons	10,143,700	12,541,302	Persons	7,627,062	9,108,060	Persons	2,516,638	3,433,242
Males	5,360,926	6,640,662	Males	3,977,652	4,774,477	Males	1,383,274	1,866,185
Females	4,782,774	5,900,640	Females	3,649,410	4,333,583	Females	1,133,364	1,567,057

Culture

The culture of Kashmir is a diverse blend and highly influenced by northern South Asian as well as Central Asian culture. Along with its scenic beauty, Kashmir is famous for its cultural heritage; it amalgamates Muslim, Hindu, Sikh and Buddhist philosophies and has involved composite culture based on the values of humanism and tolerance which is collectively known as Kashmiriyat.

The culture of Jammu and Kashmir is a comprehensive mingling of customs and practices of its two distinct regions, Kashmir Jammu Ladakh. Apart from its demographical variations, specific cultural diversions of its elements are what make the culture of Jammu and Kashmir remarkable. Music, dance, cuisine, lifestyle, festivals all these only highlight the diversities prevalent in these provinces. Unity is restored when a common thread of cultural tradition binds them together thus making it a part of Jammu and Kashmir as a whole. Culture of Jammu and Kashmir is therefore an interesting reflection of color, zest, harmony and concord which makes Jammu and Kashmir to stand apart with its distinct features of age-old tradition and deep ethnicity. The paradise on earth, Jammu and Kashmir is home to a rich cultural heritage, besides a panoramic landscape that leaves many a visitor spellbound. This culture and tradition is reflected in the several fairs and festivals in Jammu and Kashmir that are widely celebrated across the state with much zeal and gaiety. We at Indian Holiday take you on tours to Jammu and Kashmir that provide you with an exclusive opportunity to be a part of these memorable celebrations.

Almost all the major Hindu festivals in India are celebrated with equal enthusiasm in

the state of Jammu and Kashmir. Some of such prominent fairs and festivals in Jammu and Kashmir include Lohri, Holi, Navratri, Baisakhi or New Year Day, Guru Ravi Das's Birthday, Tihar and Samkrant. People from across Jammu and Kashmir gather in large numbers during the time of these festivals. Interestingly, all Hindu, Muslim or Sikh fairs and festivals are religiously observed in the entire state of Jammu and Kashmir.

6.6.4 Transportation Profile of the state

Roads

Jammu and Kashmir has a wide range of road network that connects all the cities. The major highways in Jammu and Kashmir are NH 1, NH 3, NH 44, NH 144, NH 244, NH 144-A, NH 301, NH 444, NH 501, NH 701, NH 701-A, Srinagar-Jammu National Highway, Udhampur -Jammu Highway and Skardu Kargil Road. A detail road network in the state is shown as below in the map.

National Highway 1

NH-1 is a national highway in the Indian state of Jammu & Kashmir. NH 1 comprises parts of old NH1A and NH1D. The number 1 indicates, under the new numbering system, that it is the northernmost East-West highway in India.

NH 1 passes from Uri to Baramulla, Srinagar, Sonamarg, Zoji La, Dras, Kargil and Leh. The route passes through high mountain passes and most of the road clings to mountainsides. The NH is the lifeline of the Ladakh region. An alternative route, the Leh-Manali Highway, exists but it climbs over even higher mountain passes. NH 1 passes near the India-Pakistan border.

National Highway 44

National Highway 44 is the longest-running major north–south National Highway in India. It begins from Srinagar and terminates in Kanyakumari; the highway passes through the states of Jammu and Kashmir, Punjab, Haryana, Delhi, Uttar-Pradesh, Madhya Pradesh, Maharashtra, Telangana, Andhra Pradesh, Karnataka, and Tamil Nadu.

National Highway 144

National Highway 144 is a national highway in state of Jammu and Kashmir in India. NH-144 is a branch of National Highway 44. It passes through Domel, Katra, Riasi, Pauni and Bamla.

National Highway 144-A

National Highway 144A is a national highway in State of Jammu and Kashmir in India. NH-144A is a spur road of National Highway 44 which passes through Jammu, Akhnur, Naoshera, Rajauri, Punch.

National Highway 244

National Highway 244 (NH 244) is a National Highway in India. It is located entirely within the state of Jammu and Kashmir. It was originally called National Highway 1B. NH 244 starts at NH44 near Khanabal, Achabal, Kokernag, Daksum, Sinthan pass (Elevation: 3748 m), Chatroo, Kishtwar, Doda and terminates at NH44 near Batote. Our project road lies in this stretch from Khellani to Chatroo having project length of 96.050 Km.

National Highway 301

NH 301 is a national highway in India. It is a spur road of National Highway 1.NH-301 traverses the state of Jammu and Kashmir in India. It provide route for Kargil to Padum.

National Highway 701

NH 701commonly referred to as NH 701 is a national highway in India.It is a spur road of National Highway 1.NH-701 traverses the state of Jammu and Kashmir in India. And it connects Baramulla - Rafiabad - Kupwara – Tangdhar.

National Highway 444

NH 444 is a national highway entirely in the state of Jammu and Kashmir in India. NH 444 is a branch of National Highway 44 which connects Srinagar - Badgam - Pulwama - Shupiyan - Kulgam – Quazigund.

National Highway 501

NH 501 is a national highway in India. It is a spur road of National Highway 1. And it traverses through Jammu and Kashmir connecting Panchtarni - Chandanwari - Pahalgam - Batakut - Martand – Khanabal.

Jammu-Srinagar National Highway

The Jammu-Srinagar National Highway is the northernmost segment of NH 44. It runs from Srinagar in the Kashmir Valley southward to the city of Jammu. It is one of the two road links that connects the Kashmir Valley with the rest of India. The traffic

on the highway is controlled by two control rooms, one in Srinagar and the other in Jammu

Udhampur Jammu highway

Udhampur Jammu highway is the national highway and the road in Jammu and Kashmir that connects municipal committee of Udhampur with Jammu City. The highway is 64 kilometres long passing through lofty mountain terrains. The highway also provides road link which connects Katra with rest of India. The highway is the small part of Srinagar Jammu National Highway.

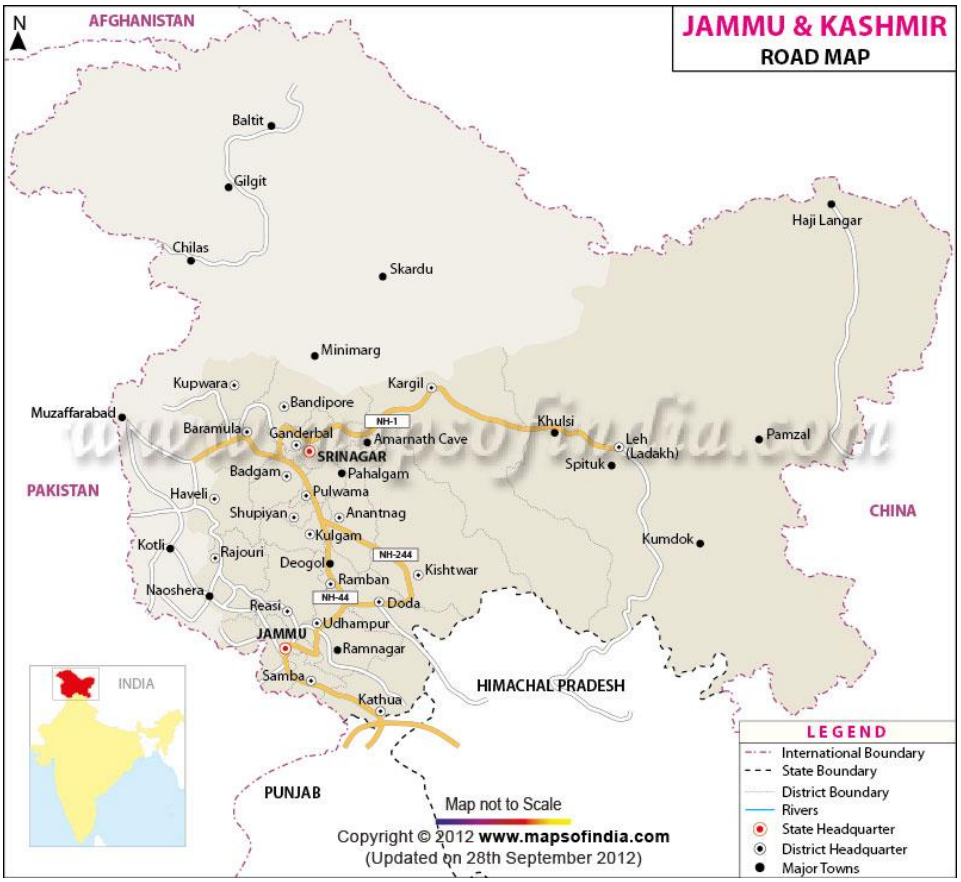


Fig 6.5: Jammu and Kashmir Road Map

Railways

Jammu & Kashmir have railway network of only 238.77 kms. The state government has recognised the crucial role of railways in the process of economic development and in response to that the government of India has also extended full cooperation in all respects by providing technical and financial support for developing railways links in the state at a very fast speed.

The Jammu–Srinagar–Baramulla railway line is a railway track being laid to connect

the Kashmir Valley in the Indian state of Jammu and Kashmir with Jammu railway station and hence to the rest of the country. This railway line will connect the state with mainstream of country and will lead to boost in trade, economy and tourism in the state

The list of railway stations in Jammu and Kashmir can be divided into 3 parts :-

- Railway stations in Jammu Region
- Railway stations in Kashmir Region
- Railway stations in Ladakh Region

A detail Railway network in the state is shown as below in the map.

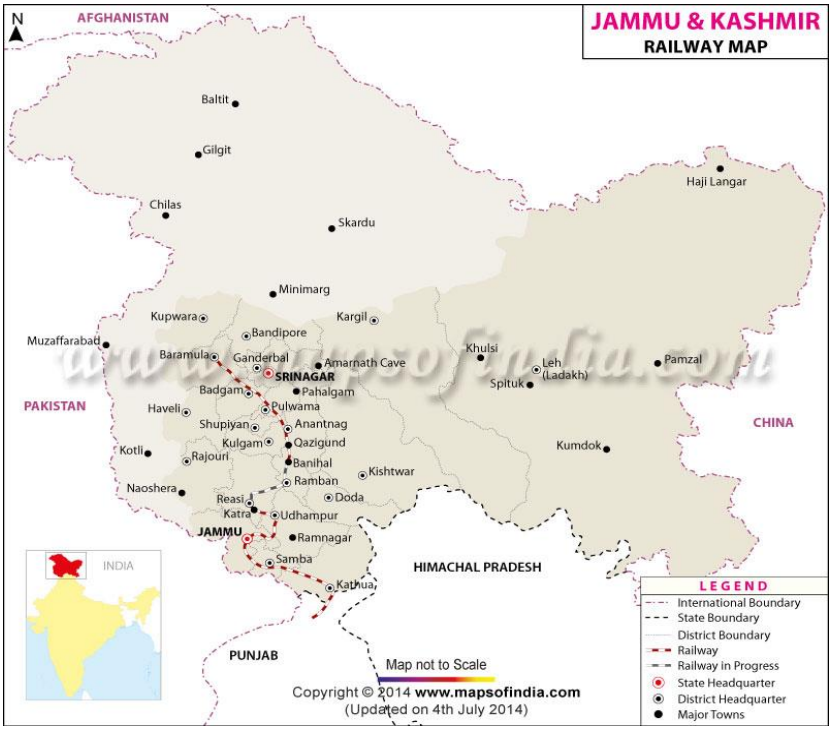


Fig 6.6: Jammu and Kashmir Railway Map

6.6.5 Trade and Tourism:

Jammu & Kashmir with its vast potential and growing economy has immense potential for the sustenance of the tourism industry. Tourism has historically remained an instrument of economic growth in the State of Jammu & Kashmir and has contributed a lot in developing the economy, particularly in Kashmir Valley and Ladakh. This sector has given jobs to many people and generated economic activities especially in the tertiary sectors. Its impact is visible in-service industry sectors of the State such as transport, hospitality, horticulture and small-scale industry. The

tourism activities at a particular place are directly related to the arrival of tourists at that place. The more the arrival, the more economic activities get generated and make impact on the related sectors accordingly. Tourist expenditure generates multiple effects on the service sector such as agriculture, horticulture, poultry and handicrafts.

Jammu & Kashmir is an important tourist destination and has been a place of attraction for tourists since centuries. The lush green forests, sweet springs, perennial rivers, picturesque alpine scenery and pleasant climate of Kashmir valley has remained an internationally acclaimed tourist destination, whereas Jammu region is attracting many pilgrim tourists and the important destination has been Shri Mata Vaishno Devi Shrine at Katra.

6.6.6 Industrialization in PIA:

Main industrial activity is concentrated in the Jammu and Kathua districts of Jammu division. This is mainly because Jammu is the only railhead, where loading and unloading of raw material becomes easy and less cumbersome as compared to Kashmir region where transportation cost is higher. The Industry sector has been declared as the main vehicle for accelerating economic activity besides providing employment opportunities to the unemployed educated youth in the State. To attract investment, the State government has come up with a new eco-friendly industrial policy in 2004, which is valid until 2015. The industrial policy is designated to promote rapid industrialization and has evoked a great deal of interest in the private investment. The policy has slew of incentives in the form of subsidies for all sorts of industries, especially for small-scale industries to make them capable of competing in the present market. The policy also lays emphasis on promoting industries based on local raw materials and skills. The State has set up two industrial growth centres - one in Samba, Jammu and other in Lassipora, Pulwama with the assistance of Central Govt. under the centrally sponsored schemes.

The key industrial activity in J&K includes:

- Horticulture
- Floriculture
- Handloom & Handicraft
- Tourism.
- Mineral based Industries.

- Gem & Jewellery
- Sericulture
- Information Technology
- Pharmaceuticals
- Insecticides
- Pesticides
- Electronics
- Hardware

The key industrial clusters are located at:

- Industrial Complex Bari Brahmana, Jammu
- Industrial Estate, Gangyal, Jammu
- Industrial Growth Centre, Samba, Jammu
- Industrial Infrastructure Development Project (IIDP), Udhampur
- Expert Promotion Industrial Park (EPIP) Kartholi, Jammu
- Industrial Complex Rangreth, Srinagar
- Industrial Complex Lassipora, Pulwama, Kashmir
- Industrial Complex Khunmoh, Srinagar
- Industrial Complex, Zainkot, Srinagar
- Industrial Estate, Zakura, Srinagar
- Industrial Growth Centre, Ompora, Budgam

Infrastructure

Housing

As per the census 2001 there were 155768 households in the state. The average household size is 6.5%. In urban areas, the average household size is little less i.e., 6.4%, the corresponding household size in rural areas is 6.6%.

Census 2001 has revealed that 55% of the households occupy permanent house whereas 32.16% resided in semi-permanent houses and 12.68% of household in temporary and unclassifiable houses.

Airports

Jammu and Kashmir have a very large area under mountainous topography, in difficult terrains like high mountainous areas of Leh and Kargil when road connectivity is disrupted during winter months due to heavy snowfall, the airways are the only source of access to such places. Airways connect all the three regions of the state with other parts of the country and abroad.

Out of the three airports of the state, Srinagar airport has been upgraded as international airport named as Sheikh-ul-Alam airport, where as the facilities at Jammu and Leh airports are also being upgraded. One more airport at Kargil headquarters has been connected by decota service. Although some areas have been covered by helipads, the difficult terrain and scattered area in the state need more airports and better connectivity. For promotion of tourism in the state starting of air taxi services between Katra-Bhaderwah is also under the consideration.

6.6.7 Sources of Employment:

J&K has agro-climatic conditions best suited for horticulture and floriculture. Horticulture is the mainstay of the rural economy, providing employment to large number of local inhabitants. The state's share in the overall apple production in India increased from 65.97 per cent in 2013-14 to 69.15 per cent in 2015-16, with the overall production of apple in the state reaching around 2.00 million metric tonnes (MT) in 2015-16. The state is also a major exporter of walnut & its international market share is about seven per cent.

At current prices, the gross state domestic product (GSDP) of Jammu & Kashmir was US$ 17.73 billion in 2015-16 and has expanded at a compound annual growth rate (CAGR) of 10.2 per cent from 2004-05 to 2015-16. As of November 2015, J&K had a total installed power generation capacity of 3,142.34 Megawatts (MW), comprising 1579.81 MW under central utilities, 1511.53 MW under state utilities and 51.00 MW under private utilities.

Key Sectors:

Food processing and agro-based industries (excluding conventional grinding and extraction units) thrive in the state due to an excellent climate for horticulture and floriculture. Handicrafts has been receiving priority attention from the Government in view of its large employment base and exports potential. J&K is famous for its small-scale and cottage industries such as carpet weaving, silks, shawls, basketry,

pottery, copper and silverware, papier-mâché and walnut wood. J&K SIDCO is the nodal agency for promotion and development of medium- and large-scale industries in the state. To boost infrastructure, J&K has approved funding of about US$ 1.8 billion. Additionally, US$ 120.07 million is earmarked under the Pradhan Mantri Gram Sadak Yojana during 2015-16.

6.7 Stakeholder Consultation

Definition of Stakeholder

Stakeholders are the individuals or groups that are likely to affect or be affected positively or negatively by a proposed project or activity. Stakeholders play a very important role in deciding the course of project implementation.

It is very much essential to address the interests of the stakeholders in implementation of the proposed project and to modify/accommodate their views in the project plan or programmed. It is crucial to develop the co-operation between stakeholders & the project team to ultimately achieve the successful completion of the project. Benefits of reaching out to stakeholders through surveys and one-on-one meetings consultations are:

- **Quality input leads to quality decision-making**. A broader perspective reduces "group think", helps to challenge traditional thinking, and sparks creativity in problem solving.
- **Greater stakeholder satisfaction with the final planning product** comes from their involvement in shaping it.
- **The chances of successful implementation increase** as more stakeholders feel committed to the plan or project's goals and take ownership of the plan's design.
- **Good governance, transparency and open communication** are served when we communicate and receive feedback from stakeholders, instead of being guided by personal agendas.

Types of Stakeholders Consulted for Feasibility / Screening Studies

In our present study, most important stake holders are the public living by or near the project road, Road development/construction department officials including project implementation unit, forest officials and NGOs working in the locality. These stakeholders hugely influence the process of project decision making.

Stakeholders were identified to ensure as wide coverage as possible of the project area as follows:

- Households in the project area including potential Project Affected Persons
- Local voluntary organizations / Non-government Organizations (NGOs)
- Government agencies / forest department
- Community leaders

Questionnaire survey/discussions were designed to obtain background information and details of general environmental issues that concern people in the project area. In addition, environmental issues were discussed with relevant government officials, beneficiaries and community leaders.

Details about the Consultations Carried Out

Rodic Consultants Private Limited has tried to consult for external input & tried to bring important new points of view to planning.

The people living in the impact zone of the project road were consulted regarding environmental issues in their area using structured questionnaire as well as unstructured questionnaire. In addition, issues such as any persisting problem people are facing due to existing road were also put in front before them. Realistically, some were not interested. We seek their input-on policy/plan development in respect to proposed project road.

Stake holder consultation process in the project ideally follows the following steps:

Survey: Surveys are mechanisms for dialog, creativity and consensus building for to identify the local stakeholders.

One-on-one/group meetings:

- Obtaining & documenting the stakeholders' views/needs.
- Assessing & analysing the need, feasibility and interest in implementing the documented stakeholders' views and also managing them.
- Take necessary corrective actions/modifications if needed. And review the status.

Stakeholder consultation would help us in identifying the interests of all stakeholders, who may affect or be affected by the project, potential issues that could intervene in the successful project implementation, and also possible ways to reduce

potential negative impacts & manage negative stakeholders.

Findings of the Stakeholder Consultation and Issues of Concern that need Attention

The issues which were put forward before us during the public consultation were:

- Disturbing Noise levels throughout the day due to vehicular traffic flow in the project road.
- Increased number and frequency of accidents on the project road.
- Poor provisions of both on road & roadside drainage.
- Poor & unsafe access to roads, absence of truck lay byes, footpaths, pedestrian crossing, signs & lightings were also put forward by the people during consultation.

6.8 Existing Key socio-economic issues and Risks of the Project

Poverty:

Since 1989, terrorist activity and violence have shattered peace and disrupted economic stability in Jammu and Kashmir. The constant threat to economic resources from rising militancy has led to its over-dependence on central government funding. Economic growth of the state measured in terms of per capita gross domestic product (GDP) from 2004-05 to 2013-14 was 12% per annum, at least 2 percentage points lower than the national average.

With this slow growth, the state could do very little to reduce the poverty rate during this period. As per the Tendulkar Committee's poverty estimates, poverty reduction in the seven-year period since 2004-05 has been merely three percentage points, from 13% in 2004-05 to 10% in 2011-12, compared with an average decline of 15 percentage points at the national level.

Though the extent of poverty (10%) in the state is not high relative to other states, a telescopic view shows chunks of poor population across the state. The eastern part of the state accounts for a large part of its poor population. The three districts, Jammu, Kupwara and Anantnag together account for one-third of the total poor in the state.

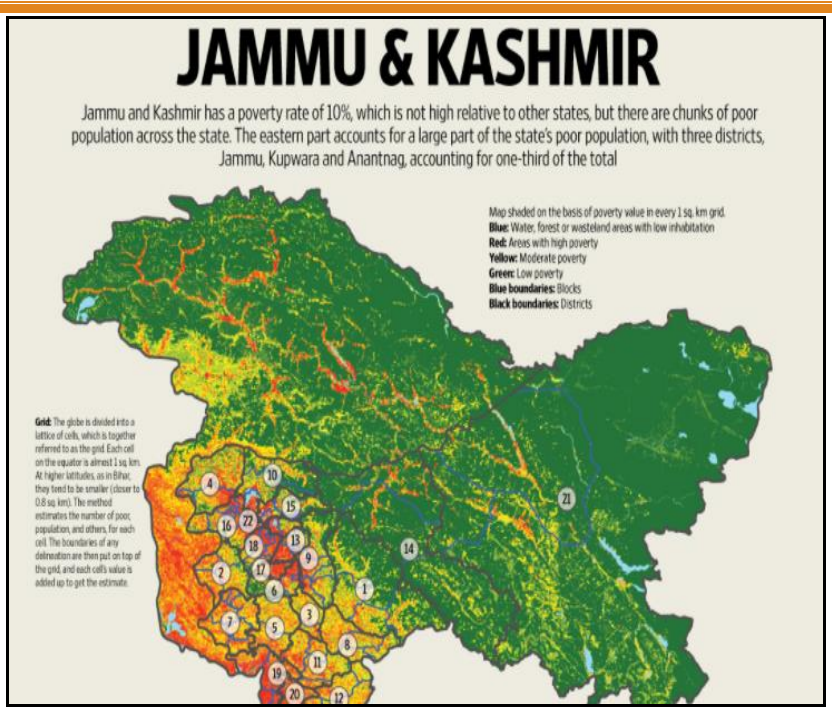
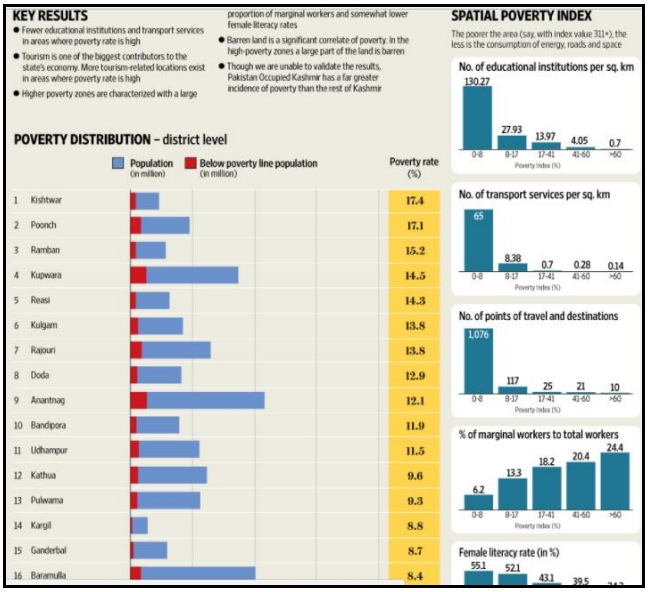


Fig 6.7: Poverty Index of Jammu and Kashmir



Access to government programs:

The government response:

The enforcement authorities at the district such as department of labour and police and Department Women and Children, Department of Education, Department of Civil supplies hardly have any clue or data about the movement of people. In the process of human mobility, the migrants are left out from grassroots governance process and stay away from Gram Sabha, General Elections, poverty survey and the ongoing Census operations and UID (Unique Identification) is going to bypass lakhs of

migrant unaccounted. In the past, thousands of hapless peoples include women, children and labourers were rescued in distress from various states are yet to be rehabilitated by the administration. Undoubtedly, the MGNREGA and the array of food entitlement have the necessary element of reducing distress migration and poverty. While, the MGNREGA can provide gainful employment and create livelihood assets, food security will be met from the food entitlements. However, it all depends whether the administration gears up the programme and target it to address the distress situations. Till today, most of the programmes are in state of despair and yet to fulfil its key objectives. The government of India under its National Disaster Management Authority clearly laid down guidelines for effective response and disaster management. All most every State today has a policy, plans and infrastructure towards mitigation and reduction of disasters and its effects. The disaster risk reduction (DRR) mandate of the government is a well-articulated step towards making the community disaster resilient. It is often observed that, due to lack of preparedness and adequate relief and rehabilitation, poor people tend to move out to safer places and become vulnerable to migrate to far-flung areas. Hence, timely response and rehabilitation help the people to overcome the shocks of disasters. The impact of climate change on farmer, fishing communities and the forest dwelling communities will further alienate from their traditional livelihood and make them vulnerable to migrate to sustain their livelihood. Migration sometime regarded as alternative livelihood for the people. Due to rapid industrialisation and infrastructure building, there is a huge demand and need for skilled person power requirement in various sectors. And finally, the migrant who are outside of the realm of social security, food security and various labour welfare measurers should be adequately addressed. Both the sending states and the receiving states need to have a proper coordination to create win-win situation for the migrants.

6.8.1 Other social issues and Risks to be managed under the project.

Women Empowerment:

Jammu and Kashmir is considered as one of the poorest states in India. Apart from high incidence of poverty, social and human development indicators reveal persistent gender, caste and class disparity. Women face worse than men with respect to most of the indicators. The gender disparity is too glaring for any further neglect in development strategy; Educational improvements in the overall sense have been modest, yet these are expectedly socially skewed with the backward sections being most deprived. This reality affects the nature of women's labour market participation

quite adversely. The vulnerability of women is also reflected by their lower participation rate in the labour market.

Poverty in Jammu and Kashmir is predominantly rural. A large proportion of the population is landless and near landless, and therefore most of the rural poor tend to depend on agricultural wages or casual non-farm jobs for income. Over the years seasonal migration of mainly male workers in search of alternative income opportunities has substantially increased. There have been some positive developments about the empowerment of women in the state. A very important development is the provision of 50 per cent reservation for women in all three tiers of the local bodies. This is a recent introduction and its impact on the lives of women has not been systematically examined so far.

6.10.2 Social Management Framework and budget estimates.

Institutional Arrangements

Effective implementation of the RP will require joint efforts of the Collector of Districts; district administration; Land Acquisition Officer, revenue department engaged NGOs and CBOs; and affected communities and PAPs. Committees will be formed, consisting of the LAO, Tehsildar (Revenue Officer), Block Development Officer (BDO), Sub-Divisional Magistrate (SDM), Panchayats Samiti representative (Pradhan), NGO partners and CBO/PAP representatives with the District Collector as Chairperson.

Village/hamlet level R&R committees will also be formed to implement the RP activities in the field, consisting of Patwari, Gram Panchayats representatives/Sarpanch, PAPs/CBOs, NGOs and other stakeholders. All officers and staff appointed by the appropriate Government under this policy shall be subordinate to the Administrator for Resettlement & Rehabilitation. The State Government shall appoint an officer of the rank of Commissioner / Secretary of that Government for resettlement and rehabilitation in respect of such projects to which this policy applies to be called the Commissioner for Resettlement & Rehabilitation. For this Policy, the Administrator for Resettlement & Rehabilitation and other officers and employees appointed for the purposes of resettlement and rehabilitation of PAPs shall be subordinate to the Commissioner for Resettlement and Rehabilitation.

The Commissioner shall be responsible for supervising the formulation of resettlement and rehabilitation plans / schemes, proper implementation of such

plans / schemes and redressal of grievances R &R Policy. Wherever tribal PAPs are involved, Commissioner, TW shall also be involved in above responsibilities and

Income Generating Scheme Grant: Each PAP comprising of rural artisan / small trader and self-employed person shall get one-time lump sum financial assistance as fixed by Government from time to time for construction of working shed / shop.

6.11 Environmental and Social Management & Capacity Building Consultant

Public Works Department, J&K appointed consultant at implementation stage for Environment Management & Capacity Building (EMCB). The consultant shall be responsible for

- Review institutional capacity of PWD, J&K and PIAs vis-à-vis environmental management in general and addressing environmental issues.
- Identify organizational needs in terms of structure, resources (facilities, and staff), roles and responsibilities in PWD / PIAs.
- Develop and plan training programmer including:
- Identification of different training modules covering various courses at different levels (initial and recurring)
- Identification of trainers
- Development of training programs for each module
- Development of training material for each module (slides, videos and information support material)
- Planning a training schedule
- Development of a mechanism for training feedback assessment
- Conduct or organise training program according to the above program and provide feedback on the effectiveness of the training.
- Helping to develop uniform codes of practice for construction management for all PIAs that integrate all relevant environmental concerns upstream in subprojects (based on a review of what currently exists within the PIA's)
- Assisting in supervision of studies to be undertaken under the project, for example study on noise levels along the project road to be undertaken to map the noise levels with respect to sensitive receptors with a view to recommending adequate mitigation measures.

6.12 Recommendation and Conclusion

6.12.1 Recommendations

Keeping in view the general scope for socio-economical parameters and most importantly sustainable environment and economic development, the following conclusions and recommendations have been drawn:

Recommendations

- Present road needs improvement as it needs to accommodate ever growing traffic.
- Road safety is a critical issue in the present scenario as there is a possibility of high rate of accidents. Also, critical sections identified are to be developed as "speed restriction zone".
- In addition, local slow moving traffic adds to the fast moving traffic on NH, thus causing reduction in traffic speed and increased travel time. If existing national highway can be developed without considering the proposal of bypasses, then major R& R issues and conflict between pedestrian, non-motorized traffic, local traffic and through traffic will be the issue of concern both at present and future stage. Also plenty of trees, sensitive receptors, religious properties and community properties are expected to have adverse effect.
- One of the major issues that surfaced during the public consultation was drainage of carriage way & drainage facility along the road side. This need to be developed to prevent houses/shops getting inundated during heavy rains.

Key issues / Concerns Identified

Through the above exercise, the following key issues were identified:

- There is no critical issue in the natural Social attribute.
- And in physical and socio-economic environmental attribute, almost all components are scoring except "cultural properties" & "market places" components as there are no archaeological monuments near the project road.

Summary of Key Benefits from the sub-project / Project Intervention

Availability of adequate and quality infrastructure is a pre-requisite for rapid development of any economy. Region of the project road being one of the emerging economic & densely populated areas of Jammu and Kashmir, it has quite high traffic

intensity on roads due to considerably increased growth. The existing road is not capable to cater to increasing traffic demand due to rapid development in project influence area.

Improvement in the project road will result in the following benefits:

- Providing better level of service in terms of **improved riding quality** and **smooth traffic flow.**
- Faster transportation will ultimately lead to massive savings in the form of reduced wear and tear of vehicles, reduced vehicle operating costs (VOCs) and total reduction in transportation costs etc. Mostly people of two the Doda and Kishtwar districts will get benefitted by this.
- Local people will get more benefit for all the point
- With the improvement of road surface, the traffic congestion due to obstructed movement of vehicles will be minimized and thus wastage of fuel emissions from the vehicles will be reduced.
- Introduction of additional safety measures like crash barrier, road illumination, retro-reflective boards, delineators etc. will result in lesser accidents.
- **Increased passenger comfort** due to good road condition shall be an added benefit.
- It will increase access of the villages and other small settlements to urban areas, thus **providing connectivity** of rural produce to urban markets, thereby enhancing the reach and export of perishable farm-goods, leading to better remuneration for the producer.
- The reach and export of perishable farm-goods will have quite a positive impact and this will prove to be a boon for the rural agricultural sector.
- Providing connectivity to the urban infrastructure.
- **Rural industrial produce**, whether from cottage industries, small-scale industries or medium-scale industries will have easy access to the urban markets. Especially silk industries in Bhagalpur are sure to get benefitted.
- **Strengthening of rural economies:** The rural sector / economy is sure to get strengthened, though at a gradual pace.
- **Higher education**: Education is one of the most dominant indicators towards

the development of a region. Though primary education facilities are present along the project road, access to high schools, higher secondary schools and colleges is not so easy at present. Provision of easy access to higher education can be directly linked to the improved educational scenario.

- **Access to medical facilities:** Villages in the project region are not yet well-equipped with all types of medical facilities and services like Public Health Centres (PHCs), dispensaries, hospitals. Due to inaccessibility, reaching even the nearest health centre sometimes becomes a colossal task. Even the doctor's reluctance will be converted into willingness to visit these areas after widening and improvement of the project road.
- By reducing the transportation costs, it will be more feasible to transfer construction materials which are important for many economic activities (house building, school building, small hydro-electric, projects etc) to hinterland. This will in turn, lead to direct as well as indirect strengthening of local economies.
- During the execution of the project, i.e. during the construction period, employment will be provided to workers from the local communities.

  The educated as well as uneducated people from villages will obtain access to new employment centres**.**
- The improvement of the road will reduce the number & frequency of collisions. This would be very beneficial from the safety point of view and will thus, reduce accident rate.
- Overall improved quality of life for the lesser developed areas in the neighbourhood.

Value Addition

- Aesthetic enhancement: Landscaping & road side plantation.
- Wayside facilities: Truck-lay byes, footpaths etc.
- Bypasses, under/over bridges, raised carriageway.
- Better road safety, signage and improved road surface.

Key Recommendations from Stakeholder Consultation Exercise

Based on the stakeholder consultation, the following recommendations are made:

- Drainage of carriage way & drainage facility along the roadside need to be developed to prevent houses/shops getting inundated during heavy rains.
- Road safety features need to be upgraded to reduce/bring down the frequency and number of accidents.

Summary Opportunities and Constraints at the sub-project Level

Opportunities:

With this project taking place, following opportunities are anticipated for the public:

- Improved road will indeed result in increased productivity, lesser transportation costs, lesser vehicle operating cost, increased access to urban markets for rural agricultural/non-agricultural products.
- Better connectivity to urban infrastructure for rural industrial products, there by strengthening rural economy.
- Better access to Health and educational facilities will lead to improved health and educational scenario in the project region. Also, this would be followed by many economic activities.

Constraints:

- There are many encroachments in the project road, so the process of widening the road at required sections may pose some opposition, as it will result in the loss of livelihood of some persons.
- Cost of land acquisition of non-forest land (Agri/non-agri) will be involved, to avoid huge R&R costs if the road is aligned in the existing densely populated settlements. This would further involve compensation amount given for displacement.

Thus, to keep away acquisition of land in densely populated areas, bypasses have been proposed at few settlements.

6.12.2 Conclusions

- The project road falls within two districts of Jammu and Kashmir i.e. Doda and Kishtwar and has a total length of 78.367 Km (Excluding link road length of 1.871 Km.)
- The project has been divided into five packages which are as follows:
  Package-I from km 31+449 to Km 51+700 =20.251 km

Package-II from km 51+700 to Km 66+535 =14.835 km

Package-III from km 67+805 to Km 80+675=12.870 km

Package-IV from km 80+675 to Km 95+550 (Kishtwar Bypass) =14.875 km

Package-V from km 95+550 to Km 111+086 =15.516 km

A Link Road connecting Kishtwar town of length 1.871 Km.

- During the initial social screening period, primary consultation was conducted at village Chalan town along the project road.
- The consultations were held to build awareness about the project amongst the people, district level administration, and NGOs and to enlist their support in preparation and implementation of the project. Also, it served the purpose of understanding the reaction of the likely affected persons.
- Issues raised by individuals during the consultations were mainly related to land acquisition, loss of livelihood and income restoration, loss of religious structures, community structures, trees, etc.
- A preliminary baseline socio-economic survey identified that structures are likely to be affected due to the project.

Chapter 7

Environmental Impact Assessment of the Project Influence Area

7.0 Environmental Impact Assessment of the Project Influence Area

7.1 Introduction

7.1.1 Project Description

National Highways & Infrastructure Development Corporation Limited (NHIDCL), Ministry of Road, Transport & Highways, Govt. of India has been assigned the work of preparation of feasibility study / DPR and providing pre-construction services of road stretches/ corridors for up-gradation to two/four laning with paved shoulder according to NH Configuration.

In pursuance of the above**, M/S Rodic Consultants Pvt. Ltd., New Delhi** in joint venture with **M/S Monarch Surveyors and Engineering consultant Pvt. Ltd**. have been appointed as Consultants to carry out the "Consultancy Services for Feasibility Study, Preparation of Detailed Project Report and providing Pre-Construction Services for upgradation to 2 lane with paved shoulder from (i) Km 44.500 to Km 142.000 of Chattroo Village & (ii) Km 235.000 (Vailoo Village) to Km 269.000 (Khanabal) of Khellani – Kishtwar – Chattroo - Khanabal Section of NH 244 in the state of Jammu and Kashmir. The agreement was signed on 4th June 2019.

This project deals with Khellani- Chattroo section from existing. Km. 44+500 to Km. 140+870 [Proposed Chainage km 31+449 (End of Khellani Tunnel) to km 111+066 (Chattroo). The total project length is 78.347 Km {Excluding Chainage 83 Tunnel project of Length 1.270 Km (From Design Ch. Km 66+535 to Km 67+805) and link road of length 1.871 Km}.

The project has been divided into five packages which are as follows:

Package-I from km 31+449 to Km 51+700 =20.251 km

Package-II from km 51+700 to Km 66+535 =14.835 km

Package-III from km 67+805 to Km 80+675=12.870 km

Package-IV from km 80+675 to Km 95+550 (Kishtwar Bypass) =14.875 km

Package-V from km 95+550 to Km 111+066 =15.516 km

A Link Road connecting Kishtwar town of length 1.871 Km.

7.1.2 Project Proponent

National Highways & Infrastructure Development Corporation Limited (NHIDCL), Ministry of Road, Transport & Highways, Govt. of India

7.1.3 Description of the Project

The entire proposed project road is in the newly formed Union Territory of Jammu and Kashmir. The Union Territory occupies a total area of 42241 square kilometres. Jammu and Kashmir shares borders with the states of Himachal Pradesh and Punjab

to the south. Jammu and Kashmir has an international border with Pakistan in the west Jammu & Kashmir consist of two divisions: Jammu & Kashmir and is further divided into 20 districts.

The Khellani – Chhatroo road section "Project Road" situated at west part of Jammu and Kashmir is having total existing length of about 96+473 Kilometres. The project road has significant influence on Jammu and Kashmir UT and on the Doda and Kishtwar districts. The Project Road starts from Existing Km 44+500 near Khellani and passes through Gangalwar, Bhuta, Suigwari, Nai Basti, Premnagar,Thatri, Darabshalla, Kandiri, Kishtwar, Marwah, Kodia, Dhadhpeth, Mughal Maidan, and Udil Gurjan and terminates at Existing Km 140+973 at Chhattroo. The road stretch goes towards east from Khellani and turns north from New Thathri and finally terminates near Chhatroo traversing through Kishtwar. The entire length of project road has a carriageway width varying from 5.0m – 12.0m but majority of portion traverses as carriageway of 7.0 m. Earthen shoulder of varying width from 1.0m - 2.0m exists along both sides of the road.

The project road has a significant role since it terminates near such point where the project of Vailoo Tunnel starts. The start road of Vailoo Tunnel project coincides near the end point of Khellani-Chhatroo project. This project road is expected to meet with future traffic growth, once the Vailoo Tunnel starts operating. Hence, the project road of Khellani – Chhatroo along with Vailoo Tunnel project road will work as a single system and will carry the majority of traffic load from Kishtwar side directly towards the Vailoo side. This proposed section will bypass the very long and absurd stretch of Sinthan Pass.

Table 7.1: Project Road Characteristics

Chainage		Terrain	Roadway Width	Carriage way width	Shoulder Type	Width of Shoulder on either Side
From	To					
44+500	80+500	Hilly	9	7	ER	1
80+500	82+600	Hilly	10	10	-	-
82+600	86+700	Hilly	12	10	ER	1
86+700	87+200	Hilly	7	7	-	-
87+200	90+500	Hilly	9	7	ER	1
90+500	90+800	Hilly	7.5	6.5	ER	1
90+800	91+400	Hilly	6.75	5.75	ER	1
91+400	93+600	Hilly	9	7	ER	1
93+600	97+000	Hilly	7.75	5.75	ER	1
97+000	99+700	Hilly	8.5	6.5	ER	1
99+700	107+700	Hilly	7.5	5.5	ER	1

Chainage		Terrain	Roadway Width	Carriage way width	Shoulder Type	Width of Shoulder on either Side
From	To					
107+700	109+900	Hilly	12	10	ER	1
109+900	110+500	Hilly	10	10	-	-
110+500	111+000	Hilly	10	8	ER	1
111+000	115+100	Hilly	9	7	ER	1
115+100	118+100	Hilly	7.75	5.75	ER	1
118+100	120+500	Hilly	4.5	3.5	ER	0.5
120+500	122+900	Hilly	7.5	5.5	ER	1
122+900	124+400	Hilly	7	5	ER	1
124+400	128+400	Hilly	7.5	5.5	ER	1
128+400	133+100	Hilly	7.75	5.75	ER	1
133+100	138+200	Hilly	7.5	5.5	ER	1
138+200	140+973	Hilly	9	7	ER	1

All major utilities follow the road alignment as the project road connects villages namely Pakka Kotha, Ramkot, Prangl, Dinga Amb, Sanyal, Galak, Chalan, Kilther, khoon, Battal, Mourian, Manval Gedda, Juganoo Morn etc.

7.1.4 Over – View of Major Key Project Activities

The following major activities are involved for the design and construction of proposed project road:

a) Widening

b) Geometric Improvement

c) Proposed Pavement & Overlay

d) Traffic Control and Safety Measures

e) Bridge and Cross Drainage Structures

7.1.5 Need for the Project Activities

Widening:

The whole section of the road is being reconstructed.

Requirement of realignment

The concept of alignment design is to upgrade the project highway within the existing right of way avoiding land acquisition, except for locations having inadequate width and where provision of short bypass, service roads, alignment corrections, improvement of intersection are considered necessary, practicable and cost effective. These are based on the findings from various engineering features carried out on the project roads such as Reconnaissance Survey, future traffic requirement, Inventory Data and Pavement Investigations.

Proposed Pavement

The Flexible pavement is adopted for proposed new carriageway and reconstruction.

Design period of 20 years considered for new carriageway.

➢**Traffic Control and Safety Measures**

Road Marking & Traffic Signs:

Pavement markings are proposed as per IRC: 35-2015, "Code of Practice for Road Marking" with centreline, edge line, continuity line, stop line, give way lines, diagonal/chevron markings and zebra crossings. The pavement marking shall be of hot applied thermoplastic paint with glass beads as per the MORT&H specification for Road and Bridge Works, April, 2013 (5th Revision, latest reprint).

Appropriate road safety measures are provided with stop signs, give-way signs, traffic merging and diverging signs, lane closure signs, compulsory keep left/right signs or any other signs as per IRC-67. Advance cautionary signs are proposed for sharp curves along with chevron signs at the outer edge of the curves.

Bridge and Cross Drainage Structures

There are 21 numbers of existing along the project road.

Culverts

There are 187 culvert and 2 causeways on project road. More nos of new Box culverts are proposed instead of pipe culverts due to silting problems.

Proposed design standards:

Table 7.2: Summary of Recommended Design Standard

Design Standards			
(i)	Design Speed (Km/hr) as per IRC SP:73-2018 Mountainous Terrain	:	60 (Ruling), 40(Minimum)
(ii)	Level of Service	:	B
(iii)	Roadway Widths (m) as per IRC SP:73-2018 (i) Mountainous Terrain	:	11 m for 2-lanes with paved shoulders and earthen shoulder with one side hill and one side valley.
(iv)	Roadway Elements as per IRC SP:73-2018 Mountainous Terrain with Retaining wall and parapet	:	Carriageway 2-lane- 2X3.5 m Paved Shoulder 1.5X2 m Earthen Shoulder 1.0 m (Valley Side)

Design Standards			
(v)	Camber as per IRC SP:73-2018		Carriageway Flexible- 2.50% Rigid - 2.00 % Paved Shoulder Flexible- 2.50% Rigid - 2.00 % Unpaved Shoulder Flexible- 3.50% Rigid - 3.00 %
(vi)	Right of Way		As per Plan and Profile
(vii)	Embankment/ Cutting Slope		
	Fill height, up to 3.0 m		In filling- 1V: 2 H
	Fill height from 3.0 m to 6.0 m		In filling- 1V: 1.5 H
			To be designed based on soil parameters, (IRC:75-1979)
	Fill height exceeding 6.0 m		In cutting- 1V:1H
(viii)	Stopping Sight Distance (As per IRC: SP:48-1998) Clause No-6.4.3		20 m for design speed of 20 km/hr 25 m for design speed of 25 km/hr 30 m for design speed of 30 km/hr 40 m for design speed of 35 Km /hr 45m for design speed of 40km/hr 60 m for design speed of 50km/hr
	Intermediate sight distance (As per IRC: SP:48-1998) Clause No-6.4.3		40 m for design speed of 20 km/hr 50 m for design speed of 25 km/hr 60 m for design speed of 30 km/hr 80 m for design speed of 35 Km /hr 90 m for design speed of 40km/hr 120 m for design speed of 50km/hr
(ix)	Super-elevation Mountainous Terrain (As per IRC: SP:48-1998) Clause No-6.8.2.2		With snow bound area Maximum 7% Without snow bound area Maximum 10% Adopted maximum 7%
(x)	Radii for Horizontal Curves as per IRC SP:73-2018 Mountainous Terrain		Ruling Minimum 150 m Absolute minimum 75 m
(xi)	Gradient (As per IRC: SP:73-2018) Clause 2.9.7.2		
	Mountainous Terrain		
	Ruling		5.00%
	Limiting		6.00%
	Steep Terrain		
	Ruling		6.00%
	Limiting		7.00%

Design Standards			
(xii)	Minimum k factor		
	(i) Summit Curve		
	Mountainous Terrain		Desirable: 15
			Minimum: 5
	(ii) Valley Curve		
	Mountainous Terrain		Desirable: 15
			Minimum: 7
(xiii)	Bridge Clearance		
	Vehicular underpass		5.5 m
	Light and Smaller Vehicular Underpass		4.0 m
(xiv)	Design Flood Frequency		
	Bridges		More than 50 years
	Sewers and Ditches		60 years

7.1.6 Expected benefits from the projects:

Following are the expected benefits due to the improvement in the project road:

- Better level of service in terms of **improved riding quality** and **smooth traffic flow.**
- Faster transportation will ultimately lead to massive savings in the form of reduced wear and tear of vehicles, reduced vehicle operating costs (VOCs) and total reduction in transportation costs etc.
- With the improvement of road surface, the traffic congestion due to obstructed movement of vehicles will be minimized and thus wastage of fuel emissions from the vehicles will be reduced.
- Increased road landscaping and safety features.
- Enhanced connectivity between rural & urban population which will benefit the all sections of the society like general population, small-medium-large scale industries, farmers, businessmen etc.
- Improved access to higher education facilities & modern health facilities.
- Strengthening of both rural & urban economies which in turn will improve economic scenario of the state and country.
- Improved road connectivity helps in better implementation and management of government schemes.
- With improvement in economy, more generation of employment opportunities.
- Overall improvement of the region.

7.1.7 EIA/IEE Objectives

The project is categorized as category 'B 'in accordance with Ministry of environment and forest EIA notification 2006, Government of India and ADB's Safeguard Policy Statement (SPS), 2009 warranting an Environmental Impact Assessment (EIA), initial environmental examination (IEE). EIA/IEE identifies the environmental issues to be considered at project planning and design stage. The EIA/IEE report covers the general environmental profile of the study area and includes an overview of the potential environmental impacts and their magnitude on physical, ecological, economic, and social and cultural resources within the project's influence area during design, construction, and operation stages. An Environmental Management Plan (EMP) forms part of this report which includes mitigation measures for significant environmental impacts during implementation of the project, environmental monitoring program, and the responsible entities for mitigation and monitoring. EIA/IEE has four basic objectives.

- Identify the environmental issues that should be considered due to project interventions,
- determine the magnitude of potential environmental concerns and to ensure that environmental considerations are given adequate weight at planning/design stage,
- identify need for further environmental studies or Environmental Impact Assessment (EIA),

7.1.8 Extent of EIA/IEE

EIA/IEE extent has been decided considering all likely Impacts and risks analysed in the context of the project's area of influence. It encompasses

- the primary project site(s) and related facilities
- associated facilities whose viability and existence depend exclusively on the project
- Areas and communities potentially affected by cumulative impacts from further planned development of any existing project or condition, and other project-related developments that are realistically defined at the time of assessment; and
- Areas and communities potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.

The core zone of impact is taken as proposed right of way and its immediate vicinity. The assessment also considers the areas and activities related to associate facilities viz. quarry operation, borrow areas, construction camp, transportation/haulage routes etc. The study area is considered up to 5 km on either side of road for larger analysis of land use and other features. Some road Stretch passed through Reserved forest. If acquisition required for diversion of forest land for non-forest purpose as per Forest conservation Act 1980, Rate as per 28th March 2008,28th April 2008 and 9th May 2008, the Apex court decide the rate of NPV per Ha. (the latest ISFR of FSI may be Followed for determination of density for the purpose of NPV rates.

7.1.9 Approach and Methodology

7.1.10 Preface

EIA/IEE report addressee all environmental impacts triggered by the entire project which EMPs have been prepare presenting the segregated technical details to define clear scope of activities under EMPs for the convenience of civil contractors.

7.1.11 Information Sources

The EIA/IEE report has been prepared based on project interventions as described in Design Report, field investigations and stakeholder consultations to meet the requirements for environmental assessment process and documentation as per ADB's Safeguard Policy Statement (SPS), 2009. Key information sources include executing agency, primary field survey, and consultations with govt. agencies, UT of J&K, IMD, Forest Department and other websites.

7.1.12 Steps Followed

EIA/IEE commenced with the review of legal requirements for the project. In next step, technical details were collected compiled by detailed design team. This was followed by a discussion with the implementing agency to reconfirm the technical details. Further steps followed for EIA/IEE has been concisely described in following paragraphs

7.1.13 Reconnaissance Survey and Initial Consultations

Reconnaissance survey and initial consultations facilitated in designing the nature of the environmental survey and extent of consultations to be carried out along the road alignment. It helped to identify data gaps, decide valued environment components, key stakeholders and key informants who can further substantiate the collected

information.

7.1.14 Primary Data Collection

Environmental resource inventory was prepared for all environmental features viz. terrain, land use, water bodies, roadside vegetation, forest Boundary, sensitive receptors, common property resources, utilities, drainage, flooding/water logging, accident prone areas etc. within the area of interest/core zone.

7.1.15 Secondary Data Collection:

Secondary sources included environmental assessment, published government reports, government websites, recognized institutions and relevant government departments (forests and wildlife, pollution control board, statistics, Indian Meteorological Department (IMD) etc. Recent Google images were captured to view environmental features at regional scale. References made to the secondary sources have been mentioned in the text and tables throughout the length of the report.

7.1.16 Public Consultations

Meaningful consultations were organized with the government agencies, local people/beneficiary population to know the level of project acceptability, understand their concerns, apprehensions, and overall opinion. These consultations enabled incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues. Efforts were made to make it gender inclusive and responsive. Information were gathered about existing baseline environmental condition viz. ambient levels and its effects on health, water resources, water logging/flooding, flora and fauna, wildlife movement, socio-economic standing of local people, impact due to loss of land other assets and common property resources, accident risk during construction and operation stage, perceived benefits and losses, etc. This will be continued throughout the project cycle.

7.1.17 Overview of Major Key Project Activities

The following major activities are involved for the design and construction of proposed project road:

f) Widening

g) Geometric Improvement

h) Proposed Pavement & Overlay

i) Traffic Control and Safety Measures

j) Bridge and Cross Drainage Structures

The various activities / components involved in the project include design process and construction activities. Some of the major activities likely to take place to implement the proposed up-gradation / improvement project are: Site clearing & grubbing, earthwork, pavement removal, granular sub-bound macadam sub-base / base, bituminous pavement layers, pavement widening, drainage, safety measures, bridge & culvert improvement, waste material management, equipment staging & materials, aggregate and sand quarries etc. These major activities have been considered while finalizing the methodology for the impact assessment of the project.

Table 7.3: Details of Env. Features

Project Component for Design	Details of Env. Features
Alignment	
Geometric Design & Cut / Fill Balance	Final alignment should be determined to minimize land take, air pollution, and the impact on people and animals and to avoid unfavourable geological condition and cultural relics. Unusable debris shall be disposed at nearest disposal sites as approved by engineer.
	The design should attempt to equalize cut and fill. The centreline should be aligned so that on all slopes below 60 degrees, half cut and half fill can be achieved.
	The improvements to the road section may involve the cutting of some hill slopes. At few locations, amount of cut and fill work expected to be significant mainly at curves and bridge locations.
Ecology	
Roadside Plantation	Trees to be cut within the alignment shall be identified / marked with the help of forest/Horticulture department.
	Trees shall be removed as identified and with prior approval of the State Forest Department

Project Component for Design	Details of Env. Features
	Tree Plantation as per State Forest Guideline and Green highway policy.
Wildlife	No wildlife sanctuary fall within 5 km radius of proposed project. Hence, NOC/ Clearance not required from NBWL/SBWL.
Forest	Forest Clearance Required (Area identification with the forest department under scrutiny) Some road Stretch passed through Protected/Reserved forest. If acquisition required for diversion of forest land for non-forest purpose as per Forest conservation Act 1980, Rate as per 28th March 2008,28th April 2008 and 9th May 2008, the Apex court decide the rate of NPV per Ha. (The latest ISFR of FSI may be Followed for determination of density for the purpose of NPV rates.
Water	
Water Sources	Water resources shall be protected and enhanced by redesigning as per Enhancement measures plan
Road Drainage	Provision of adequate size and number of cross-drainage structures (culverts) as well as drains along the road
Quarries and borrow area	
Illegal and / or improper mining	Only approved and licensed Quarries and Borrow pits shall be permitted. Non-Productive, barren lands, raised lands, riverbeds are to be recommended for borrow material
Location of Camps	
Site selection/ Location of Labour Camp/ Construction Camps	▯ Labour Camp/ Construction camps should be located at least 500 m away from existing habitations
	▯ All sites used for camps should be adequately

Project Component for Design	Details of Env. Features
	drained and they should not be subjected to periodic flooding
	Camps should be located such that drainage from and through the camps will not endanger any domestic or public water supply.
	Living accommodation and ancillary facilities should be erected and maintained to standards and scales approved by the Engineer
	Toilets and urinals should be provided in accessible places away from the asphalt plant and mixing yard
Utilities	
Relocation of utility lines / community utilities.	Affected utilities like electric poles, water pipelines, hand pumps, etc. shall be relocated with prior approval of the concerned agencies.
	All the cultural properties that have been identified as affected shall be relocated.
Road Safety	
Traffic control system	Temporary traffic arrangement during construction shall be planned in DPR.
	The concessionaire shall take all necessary measures for the traffic during demolition and site clearing activities.
Pedestrian safety	Special considerations shall be given in the local traffic management to the pedestrian safety Especially at congested locations
Environmental Quality	
Permission for establishment and Operate of Hot mix plants/ Batching plants etc.	CTO, CTE from State Pollution Control Board UT of Jammu and Kashmir.
	NOC for quarry sites. If New Quarry SEIAA EC required.

Project Component for Design	Details of Env. Features
Noise Level -For Hot mix plant and construction machinery &At sensitive receptors.	▯ Improved traffic speeds and riding conditions shall reduce noise levels. As per CPCB/SPCB Guideline and Condition must be followed
	▯ Noise screening by trees plantation scheme proposed as noise barriers
	▯ Provide noise attenuation at critical locations like Hospital, school etc.
Generation of Debris from Dismantling Structures and Road Surface	Vegetation will be removed from the RoW before the commencement of construction. All works will be carried out such that the damage or disruption to flora other than those identified for cutting is minimized. Details shall be Incorporated in EMP
	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 Authority Engineer (AE). The concessionaire, under any circumstances will not damage trees (in addition to those already identified to be cut). Compensatory plantation will be provided for cutting of trees.

7.1.18 CONCLUSION AND RECOMMENDATION

The scope of works under involves Feasibility Stage, Preparation of Detailed Project Report and providing Pre-Construction Services for upgradation to 2 lane with paved shoulder from (i) Km 44.500 to Km 142.000 of Chattroo Village & (ii) Km 235.000 (Vailoo Village) to Km 269.000 (Khanabal) of Khellani – Kishtwar – Chattroo - Khanabal Section of NH 244 in the state of Jammu and Kashmir.

National Highway Infrastructure Development Corporation limited aggregating 96.370 km since, the project of Vailoo tunnel and its approach road meets this project of Khellani – Chhatroo at existing chainage 140+870. Hence, the project of Khellani-Chattroo starts from Ex Km. 44+500 and ends at Ex Km 140+870 and has a total project length of 96.370 Km stress on existing natural resource viz, land, water, soil and aggregates are not significant.

Further, the project is outside any legally protected, eco-sensitive, or critical habitat areas. Most of the adverse impacts are co-terminus with the construction stage, site specific, limited within the RoW, and are easily mitigated through good engineering and environmentally acceptable practices.

Hence, classified as environment Category B in accordance with the MOEF EIA notification 2006 and its amendment/ ADB's Safeguards Policy Statement 2009. As per EIA notification 2006 and its amendment Environmental Clearance exempted from the purview of the Environmental Impact Assessment. **Approximately Rs. 10131147** Estimates cost for Different Environment Management Plans for Khellani-Chattroo starts from Ex Km. 44+500 and ends at Ex Km 140+870 and has a total project length of 96.370 Km. [Proposed Chainage km 31+449 (End of Khellani Tunnel) to km 111+066 (Chattroo). The total project length is 78.347 Km {Excluding Chainage 83 Tunnel project of Length 1.270 Km (From Design Ch. Km 66+535 to Km 67+805)}].

Chapter 8

Improvement Proposals and Design

8.0 Improvement Proposals and Design

8.1 General

This chapter describes the various improvement proposals and their necessities to upgrade the existing carriageway facility of project road into two lane with paved shoulder in accordance to the IRC and design standards proposed for the project road. These improvement proposals are based on the findings of various engineering features carried out on the project roads such as Traffic Survey and Analysis (Chapter-3), Inventory Data and Pavement Investigations (Chapter-4).

The project road of Khellani – Chhatroo section is a part of NH-244 (Old NH-1B). NH-244 runs from Batote to Khanabal via Khellani, Thatri, Kishtwar, Vailoo, Achabal and Anantnag. The Project Road section is situated in Doda and Kishtwar districts and located at south-west part of Jammu and Kashmir union territory. The project road stretch goes towards east from Khellani and turns north from New Thathri and finally ends near Chhatroo after traversing through Kishtwar.

As per contract, the Project Road starts from existing Km 44.500 near Khellani and passes through Gangalwar, Bhuta, Suigwari, Nai Basti, Premnagar, Thatri, Darabshalla, Kandiri, Kishtwar, Marwah, Kodia, Dhadhpeth, Mughal Maidan, and Udil Gurjan and terminates at existing Km 142.000 near Chhattroo in the UT of Jammu & Kashmir.

The project road of Khellani – Chhatroo coincides with the other two DPR projects. One is at its starting and another at the end point. The starting point of project coincides with the end point of Goha – Khellani tunnel project i.e. Ex Ch. 44+500 and the end point of project section coincides with the starting point of approach of Vailoo tunnel project i.e. at Ex Ch. 140+870. So, we have considered these two locations as our starting and End Chainages respectively for the Khellani – Chhatroo project section.

In future these three projects will work as a single stretch, and will facilitate the traffic going towards Vailoo/Anantnag side, instead of opting Sinthan Pass route which is closed for almost 3-4 months during winter season, so the traffic will divert from Chattroo and reach Vailoo/Anantnag via Vailoo Tunnel.

DPRs of Goha - Khellani Tunnel project and Vailoo Tunnel project are under preparation and the project stretch of Khellani - Chhatroo will cater as link between these two tunnel projects.

Hence, the project of Khellani-Chhatroo starts from Ex Km. 44+500 near Khellani and ends at Ex Km 140+870 near Chhatroo and has a total existing length of 96.370 Km.

The proposed stretch of Khellani – Chhatroo starts near Khellani from design Ch. 31+449 (At ex. Km. 44+500) and ends near Chhatroo at design. Ch. 111+066 (At ex. Km. 140+870).

The project has been divided into five packages which are as follows:

- **Package-I from Design CH. Km 31+449 to Km 51+700 =20.251 km**
- **Package-II from Design CH. Km 51+700 to Km 66+535 =14.835 km**
- **Package-III from Design CH. Km 67+805 to Km 80+675=12.870 km**
- **Package-IV from Design CH. Km 80+675 to Km 95+550 (Kishtwar Bypass) =14.875 km**
- **A Link Road (To connect the Kishtwar town) of length 1.871 Km.**
- **Package-V from Design CH. Km 95+550 to Km 111+066 =15.516 km, and**

However, this Chapter deals with the details of Package 1 of the project road.

This chapter of Improvement proposals include.

a) Upgradation of existing road into new 2 lane road including paved shoulder into its entire stretch.

b) Proposed Pavement Design

c) Bridge and Cross Drainage Structures

d) Traffic Control and Safety Measures

The existing road passes through congested Premnagar, New Thatri, Kishtwar city and Chhatroo with existing ROW is approximately to be 6 m to 18 m where bypasses and realignments have been proposed. This is as per direction of NHIDCL official during meeting held on 23rd December 2019.

8.2 Alignment and Geometry

The Location of the Project Road lies in the Doda and Kishtwar districts of J&K.

The project road under the scope of study runs through mountainous terrain and there is an appreciable amount of deficiency in the horizontal geometry and vertical profile with respect to the design standards. Thus, proper geometric design would play a pivotal role to ensure the proper functioning of the proposed facility for the proposed road.

Geometric design of a highway is the process whereby the layout of the road in specific terrain is designed to meet the needs of the road users keeping in view of the road function, type and volume of traffic, potential traffic hazards and safety as well as convenience of the road users. The principal areas of control for fulfilment of this objective are the horizontal alignment, vertical alignment and the road cross-section.

The Consultants have referred to the latest IRC publications and MORT&H circulars regarding design standards for National Highways in India. After careful review of all available data and requirements of the project road the proposed Design Standards for adoption on the project road have been recommended.

Design Standards			
(i)	Design Speed (Km/hr) as per IRC SP:48-1998 Mountainous Terrain	:	50 (Ruling), 40(Minimum)
(ii)	Level of Service	:	B
(iii)	Roadway Widths (m) as per IRC SP:73-2018 Mountainous Terrain	:	11 m for 2-lanes with paved shoulders and earthen shoulder with one side hill and one side valley.
(iv)		:	<u>Carriageway</u> 2-lane- 2X3.5m (Both Hill and Valley side)
(v)	Camber as per IRC SP:73-2018	:	<u>Carriageway</u> Flexible- 2.50% Rigid - 2.00 % <u>Paved Shoulder</u> Flexible- 2.50% Rigid - 2.00 % <u>Unpaved Shoulder</u> Flexible- 3.50% Rigid - 3.00 %
(vi)	Right of Way	:	As per Plan and Profile
(vii)	Embankment/ Cutting Slope		
	Fill height, up to 3.0 m	:	In filling- 1V: 2 H
	Fill height from 3.0 m to 6.0 m	:	In filling- 1V: 1.5 H
	To be designed based on soil parameters, (IRC:75-1979)		
	Fill height exceeding 6.0 m		In cutting- 1V:1H
(viii)	Stopping Sight Distance	:	20 m for design speed of 20 km/hr 25 m for design speed of 25 km/hr 30 m for design speed of 30 km/hr 40 m for design speed of 35 Km /hr 45 m for design speed of 40km/hr 60 m for design speed of 50km/hr

	Intermediate sight distance	:	40 m for design speed of 20 km/hr 50 m for design speed of 25 km/hr 60 m for design speed of 30 km/hr 80 m for design speed of 35 Km /hr 90 m for design speed of 40km/hr 120 m for design speed of 50km/hr
(ix)	**Super-elevation** Mountainous Terrain (As per IRC: SP:48-1998) Clause No-6.8.2.2		With snow bound area Maximum 7% Without snow bound area Maximum 10% **Adopted maximum 7%**
(x)	Radii for Horizontal Curves as per IRC SP:48-1998 Mountainous Terrain	:	(Areas not affected by Snow) Ruling Minimum 80 m Absolute minimum 50 m (Snow Bound Area) Ruling Minimum 90 m Absolute minimum 60 m
(xi)	**Gradient** (As per IRC: SP:48-1998) Table 6.11		
	Mountainous Terrain		
	Ruling	:	5.00%
	Limiting	:	6.00%
	Steep Terrain		
	Ruling	:	6.00%
	Limiting	:	7.00%
(xii)	**Minimum k factor**		
	Summit Curve		
	Mountainous Terrain	:	Ruling: 15
		:	Minimum: 8.4
	Valley Curve		
	Mountainous Terrain	:	Ruling: 15
		:	Minimum: 6.6

(xiii)	**Vertical Clearance** as per IRC: SP:48-1998. (Clause no-6.7.2.1)	:	5.0 m
	Minimum Vertical Clearance of 5 mts. should be given over the entire roadway at all underpasses and similarly at overhanging cliffs and semi tunnel sections.		
(xiv)	Design Flood Frequency		
	Bridges	:	100 years
	Sewers and Ditches	:	60 years

8.3 Improvement Scheme

To meet future traffic requirement, the existing carriageway is proposed for upgradation to 2 – lane with paved shoulder in its entire stretch.

The proposed stretch includes many curve improvements realignments and bypasses. There is one major realignment from design Ch. 0+000 to design Ch. 3+400.

Kishtwar city bypass is proposed to reduce the travel time and also deviate the freight traffic from main city in order to reduce the congestion in city.

8.3.1 Typical Cross-sections

The typical cross-sections along with development proposal to be followed in the project road are shown in **Table 8.1** below and **Annexure 8.5.**

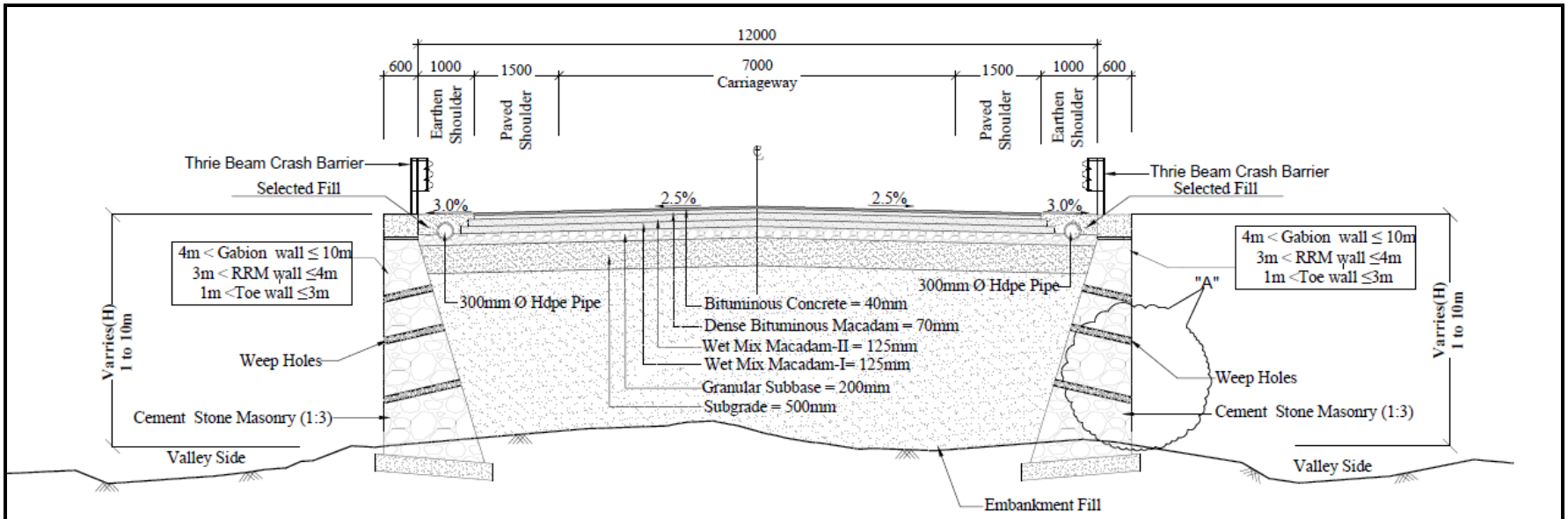
Table 8.1: Widening Scheme

SL No	Chainage		Length	TCS Type	TCS DETAILS
	From	To			
1	31+449	31+493	43.5	TCS-3	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (Reconstruction)
2	31+493	31+508	15	Minor Bridge	
3	31+508	31+560	52.5	TCS-1A	Two Lane C/W With PS With Both Side Fill & Protection As Applicable (Reconstruction)
4	31+560	31+650	90	TCS-3	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (Reconstruction)
5	31+650	31+810	160	TCS-1A	Two Lane C/W With PS With Both Side Fill & Protection As Applicable (Reconstruction)
6	31+810	31+900	90	TCS-3	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (Reconstruction)

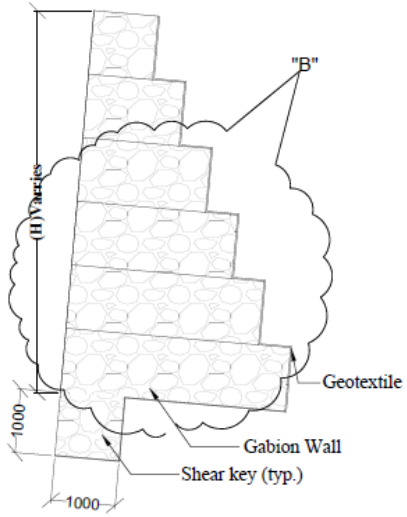
SL No	Chainage		Length	TCS Type	TCS DETAILS
	From	To			
7	31+900	31+970	70	TCS-2	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (New Construction)
8	31+970	32+070	100	TCS-1	Two Lane C/W With PS With Both Side Fill & Protection As Applicable (New Construction)
9	32+070	32+180	110	TCS-2	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (New Construction)
10	32+180	32+230	50	TCS-1	Two Lane C/W With PS With Both Side Fill & Protection As Applicable (New Construction)
11	32+230	32+350	120	TCS-4	Two Lane C/W With PS With Both Side Cut & Protection As Applicable (New Construction)
12	32+350	32+390	40	TCS-2	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (New Construction)
13	32+390	32+420	30	TCS-1	Two Lane C/W With PS With Both Side Fill & Protection As Applicable (New Construction)
14	32+420	32+470	50	Minor Bridge	
15	32+470	32+560	90	TCS-2	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (New Construction)
16	32+560	32+718	157.5	TCS-4	Two Lane C/W With PS With Both Side Cut & Protection As Applicable (New Construction)
17	32+718	32+733	15	Minor Bridge	
18	32+733	32+780	47.5	TCS-1	Two Lane C/W With PS With Both Side Fill & Protection As Applicable (New Construction)
19	32+780	33+440	660	TCS-2	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (New Construction)
20	33+440	33+700	260	TCS-4	Two Lane C/W With PS With Both Side Cut & Protection As Applicable (New Construction)
21	33+700	33+850	150	TCS-2	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (New Construction)
22	33+850	34+100	250	TCS-4	Two Lane C/W With PS With Both Side Cut & Protection As Applicable (New Construction)
23	34+100	34+160	60	TCS-1	Two Lane C/W With PS With Both Side Fill & Protection As Applicable (New Construction)
24	34+160	34+198	37.5	TCS-2	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (New Construction)
25	34+198	34+273	75	Viaduct	
26	34+273	34+340	67.5	TCS-2	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (New Construction)

SL No	Chainage		Length	TCS Type	TCS DETAILS
	From	To			
27	34+340	34+900	560	TCS-4	Two Lane C/W With PS With Both Side Cut & Protection As Applicable (New Construction)
28	34+900	35+215	315	Viaduct	
29	35+215	35+288	72.5	TCS-2	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (New Construction)
30	35+288	35+303	15	Minor Bridge	
31	35+303	35+340	37.5	TCS-2	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (New Construction)
32	35+340	35+460	120	TCS-3	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (Reconstruction)
33	35+460	35+510	50	TCS-1A	Two Lane C/W With PS With Both Side Fill & Protection As Applicable (Reconstruction)
34	35+510	35+550	40	TCS-3	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (Reconstruction)
35	35+550	35+610	60	TCS-1A	Two Lane C/W With PS With Both Side Fill & Protection As Applicable (Reconstruction)
36	35+610	36+180	570	TCS-3	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (Reconstruction)
37	36+180	36+220	40	TCS-1A	Two Lane C/W With PS With Both Side Fill & Protection As Applicable (Reconstruction)
38	36+220	36+240	20	Minor Bridge	
39	36+240	37+092	852	TCS-3	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (Reconstruction)
40	37+092	37+182	90	Major Bridge	
41	37+182	41+260	4078	TCS-3	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (Reconstruction)
42	41+260	41+300	40	TCS-1A	Two Lane C/W With PS With Both Side Fill & Protection As Applicable (Reconstruction)
43	41+300	43+010	1710	TCS-3	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (Reconstruction)
44	43+010	43+048	37.5	TCS-1A	Two Lane C/W With PS With Both Side Fill & Protection As Applicable (Reconstruction)
45	43+048	43+063	15	Minor Bridge	
46	43+063	43+705	642	TCS-3	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (Reconstruction)
47	43+705	43+730	25	Minor Bridge	

SL No	Chainage		Length	TCS Type	TCS DETAILS
	From	To			
48	43+730	44+750	1020.5	TCS-3	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (Reconstruction)
49	44+750	44+880	130	TCS-1A	Two Lane C/W With PS With Both Side Fill & Protection As Applicable (Reconstruction)
50	44+880	45+130	250	TCS-3	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (Reconstruction)
51	45+130	45+190	60	TCS-1A	Two Lane C/W With PS With Both Side Fill & Protection As Applicable (Reconstruction)
52	45+190	46+103	912.5	TCS-3	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (Reconstruction)
53	46+103	46+118	15	Minor Bridge	
54	46+118	47+570	1452.5	TCS-3	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (Reconstruction)
55	47+570	47+644	74	TCS-1A	Two Lane C/W With PS With Both Side Fill & Protection As Applicable (Reconstruction)
56	47+644	47+694	50	Minor Bridge	
57	47+694	47+740	46	TCS-3	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (Reconstruction)
58	47+740	47+800	60	TCS-1A	Two Lane C/W With PS With Both Side Fill & Protection As Applicable (Reconstruction)
59	47+800	50+950	3150	TCS-3	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (Reconstruction)
60	50+950	51+051	101	TCS-1A	Two Lane C/W With PS With Both Side Fill & Protection As Applicable (Reconstruction)
61	51+051	51+081	30	Minor Bridge	
62	51+081	51+150	69	TCS-1A	Two Lane C/W With PS With Both Side Fill & Protection As Applicable (Reconstruction)
63	51+150	51+180	30	TCS-3	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (Reconstruction)
64	51+180	51+290	110	TCS-1A	Two Lane C/W With PS With Both Side Fill & Protection As Applicable (Reconstruction)
65	51+290	51+700	410	TCS-3	Two Lane C/W With PS With one side cut & one Side Fill & Protection As Applicable (Reconstruction)



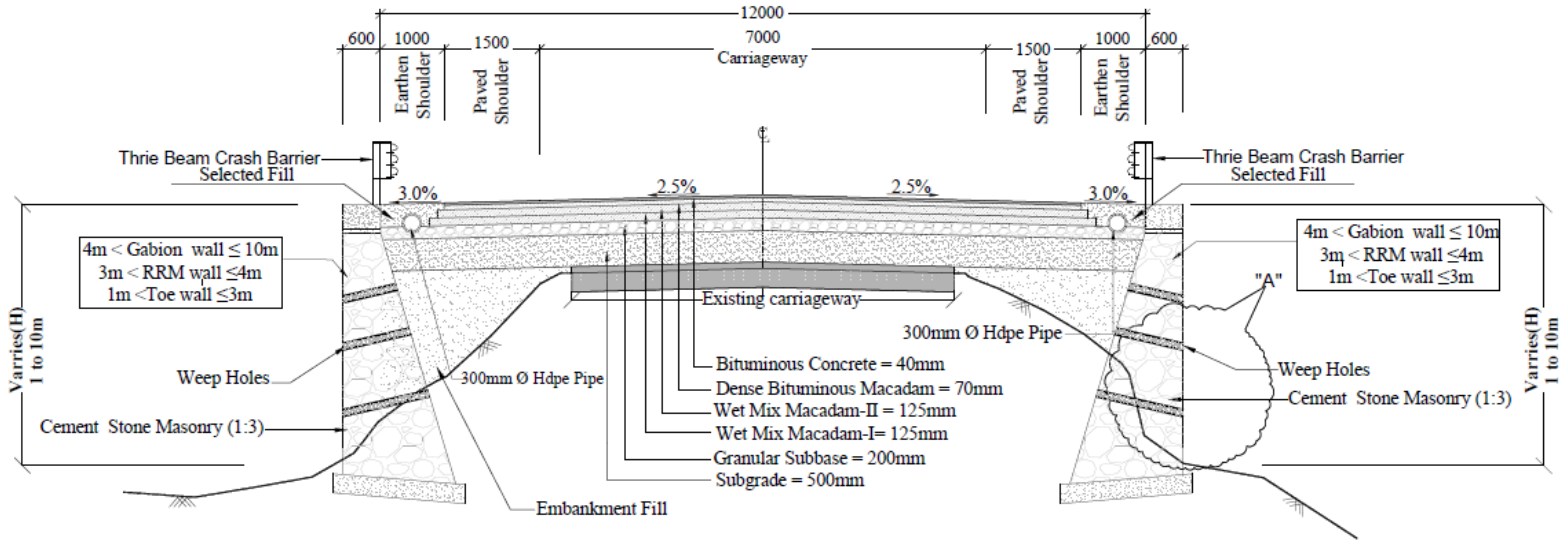
Type - 1 - Typical Cross-Section For Two Lane Carriageway With Paved Shoulder In Mountainous Terrain With Both Side Fill & Protection As Applicable .
(New Construction)



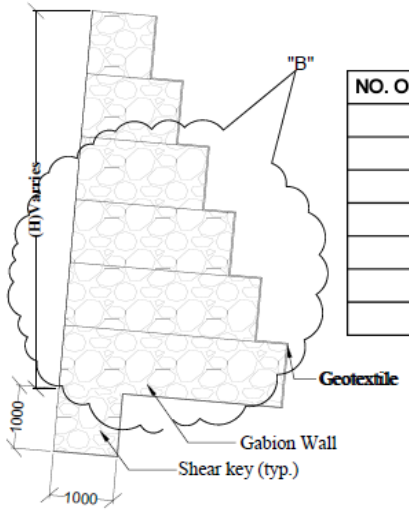
NO. OF COURSES	H (M)	B (M)
5	4	3
6	5	3.5
7	6	4
8	7	4.5
9	8	5
10	9	5.5
11	10	6

NOTE:-

1. All Dimension are in millimeters except otherwise specified
2. Extra widening will be provided where radius of horizontal curve is less th
3. Toe wall Shall be provided where height of embankment is less than3m.& g
4. Retaining wall Shall be provided where height of embankment is greater th
5. Gabion wall shall be provided where height of embankment is greater than
6. Breast wall Shall be provided where height of cut is greater than 3m.
7. No protection is required when height of fill is less than 1 m and height of c



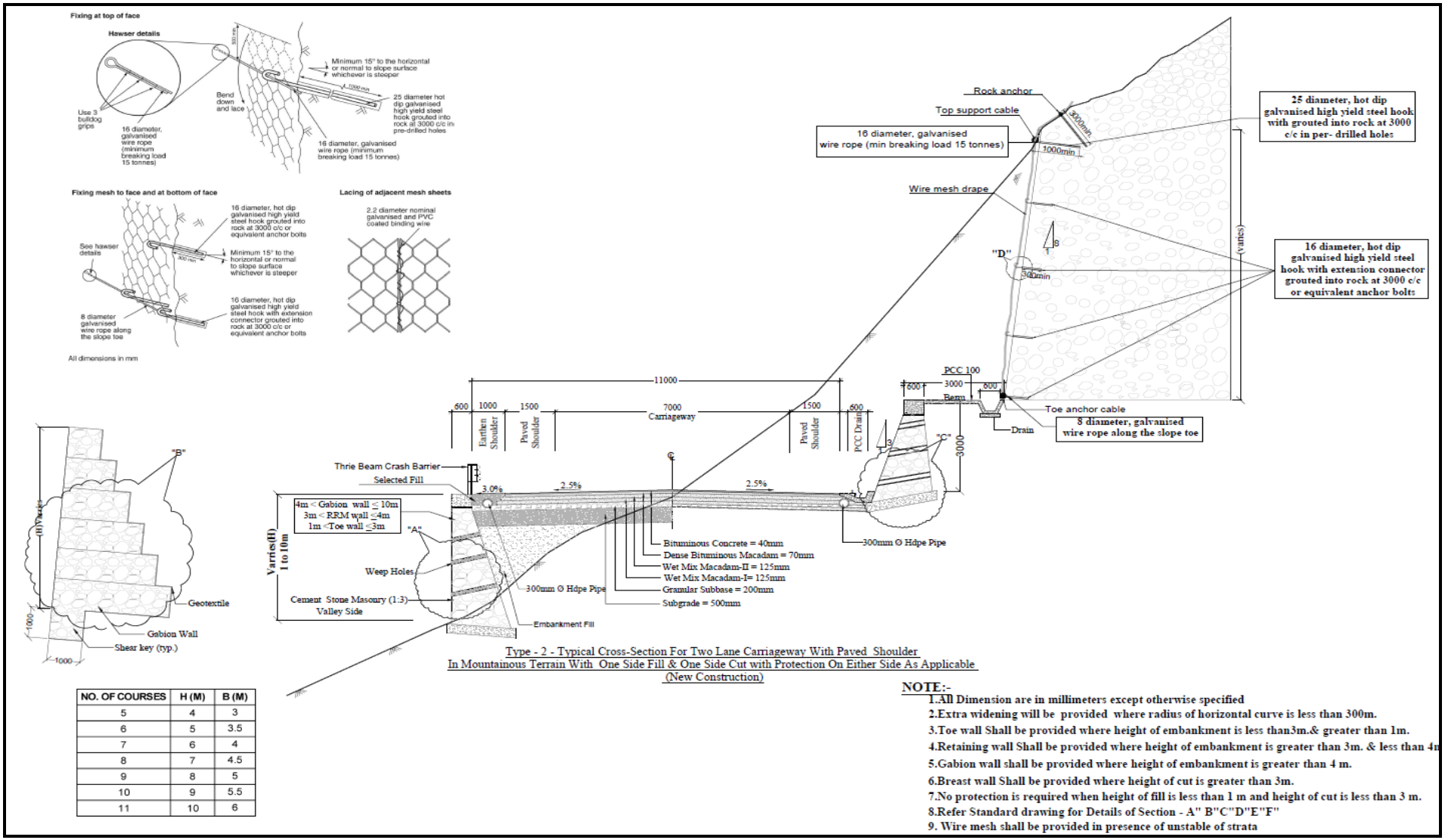
Type - 1A - Typical Cross-Sectionfor Two Lane Carriageway With Paved Shoulder
In Mountainous Terrain With Both Side Fill & Protection As Applicable
(Reconstruction)



NO. OF COURSES	H (M)	B (M)
5	4	3
6	5	3.5
7	6	4
8	7	4.5
9	8	5
10	9	5.5
11	10	6

NOTE:-

1. All Dimension are in millimeters except otherwise specified
2. Extra widening will be provided where radius of horizontal curve is l
3. Toe wall Shall be provided where height of embankment is less than3m
4. Retaining wall Shall be provided where height of embankment is great
5. Gabion wall shall be provided where height of embankment is greater
6. Breast wall Shall be provided where height of cut is greater than 3m.
7. No protection is required when height of fill is less than 1 m and heigh
8. Refer Standard drawing for Details of Section - A" B"C"D"E"F"
9. Wire mesh shall be provided in presence of unstable of strata

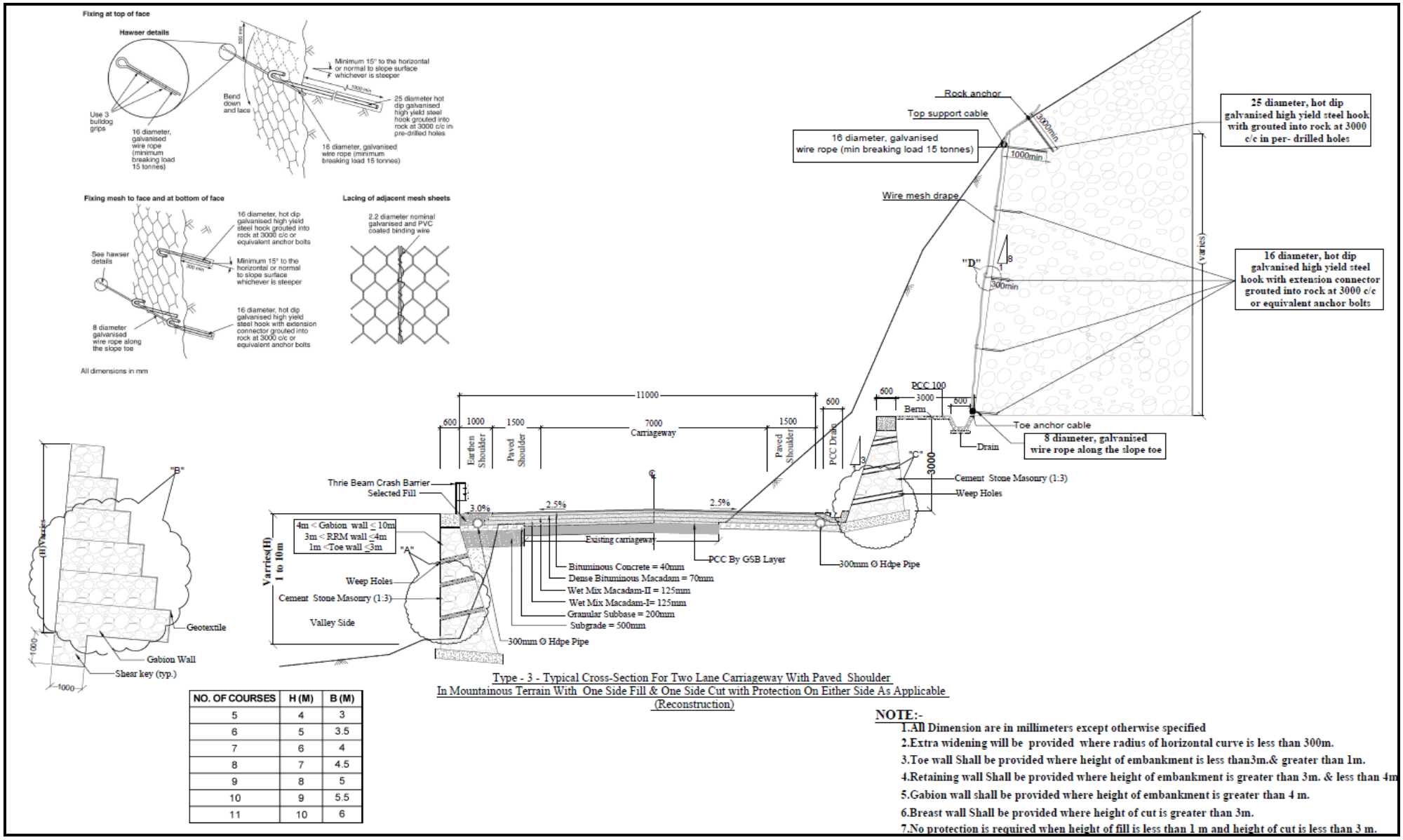


Type - 2 - Typical Cross-Section For Two Lane Carriageway With Paved Shoulder
In Mountainous Terrain With One Side Fill & One Side Cut with Protection On Either Side As Applicable
(New Construction)

NO. OF COURSES	H (M)	B (M)
5	4	3
6	5	3.5
7	6	4
8	7	4.5
9	8	5
10	9	5.5
11	10	6

NOTE:-

1. All Dimension are in millimeters except otherwise specified
2. Extra widening will be provided where radius of horizontal curve is less than 300m.
3. Toe wall Shall be provided where height of embankment is less than3m.& greater than 1m.
4. Retaining wall Shall be provided where height of embankment is greater than 3m. & less than 4m
5. Gabion wall shall be provided where height of embankment is greater than 4 m.
6. Breast wall Shall be provided where height of cut is greater than 3m.
7. No protection is required when height of fill is less than 1 m and height of cut is less than 3 m.
8. Refer Standard drawing for Details of Section - A" B"C"D"E"F"
9. Wire mesh shall be provided in presence of unstable of strata

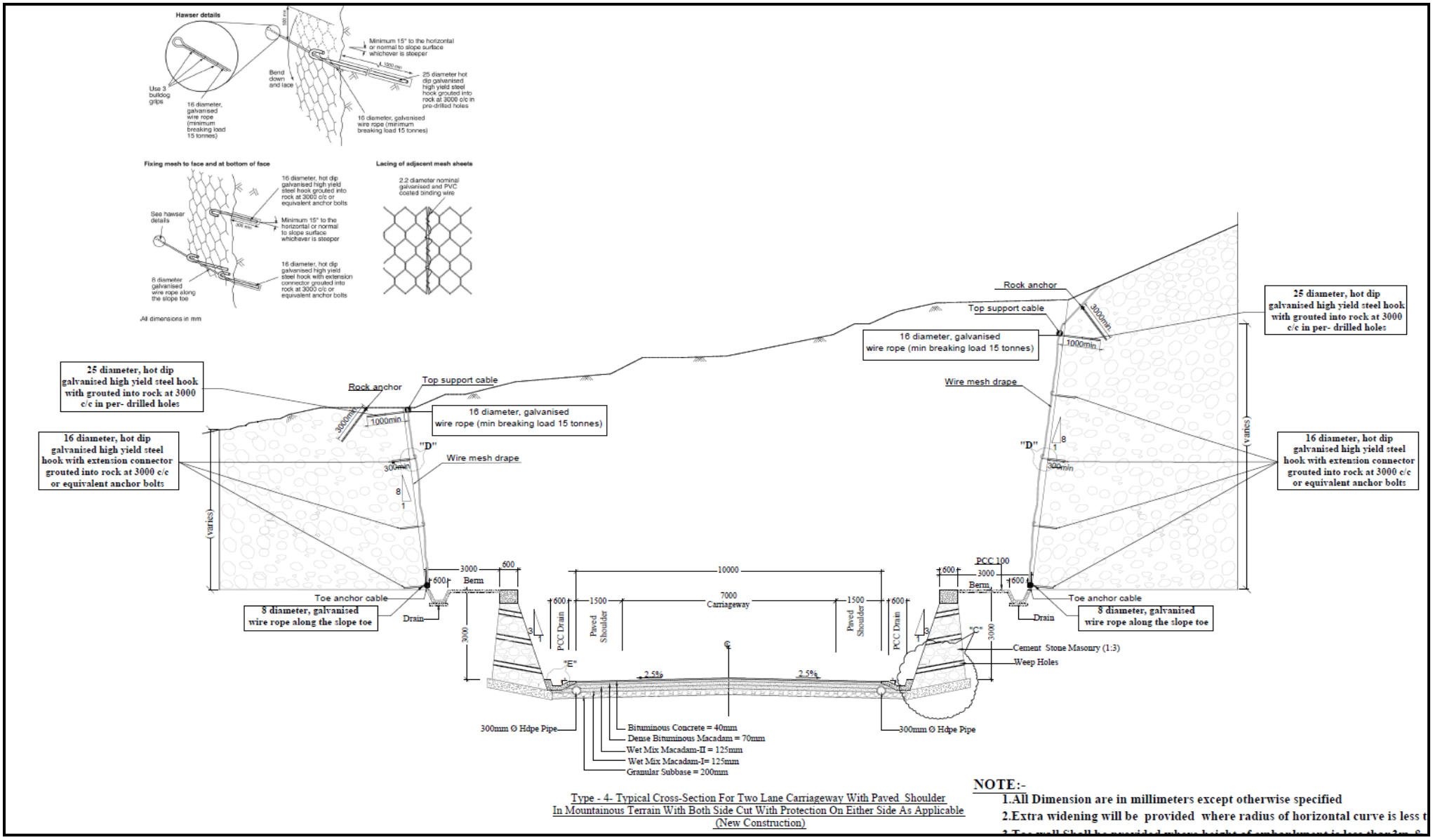


Type - 3 - Typical Cross-Section For Two Lane Carriageway With Paved Shoulder
In Mountainous Terrain With One Side Fill & One Side Cut with Protection On Either Side As Applicable
(Reconstruction)

NO. OF COURSES	H (M)	B (M)
5	4	3
6	5	3.5
7	6	4
8	7	4.5
9	8	5
10	9	5.5
11	10	6

NOTE:-

1. All Dimension are in millimeters except otherwise specified
2. Extra widening will be provided where radius of horizontal curve is less than 300m.
3. Toe wall Shall be provided where height of embankment is less than3m.& greater than 1m.
4. Retaining wall Shall be provided where height of embankment is greater than 3m. & less than 4m
5. Gabion wall shall be provided where height of embankment is greater than 4 m.
6. Breast wall Shall be provided where height of cut is greater than 3m.
7. No protection is required when height of fill is less than 1 m and height of cut is less than 3 m.



Type - 4- Typical Cross-Section For Two Lane Carriageway With Paved Shoulder In Mountainous Terrain With Both Side Cut With Protection On Either Side As Applicable (New Construction)

NOTE:-

1. **All Dimension are in millimeters except otherwise specified**
2. **Extra widening will be provided where radius of horizontal curve is less t**

8.4 Proposal for Bypasses and Realignments.

8.4.1 Bypasses

The project road stretch starts near Khelani and passes through Gangalwar, Bhuta, Suigwari, Nai Basti, and Ends at Premnagar.

The proposed stretch includes curve improvements and realignments.

Realignment at Starting location

At starting location of project stretch from Design Km 31+900 to Design Km 35+360, a realignment is proposed which bypasses some sparse built ups and directly meet with the project road near Pul Doda. This is shorter in length for about 4.3 Km as compared to existing road and it's geometrically very much improved. This alignment option was discussed in various presentations and meetings and was principally agreed to. The alignment is schematically presented in ***Figure 8.3***.

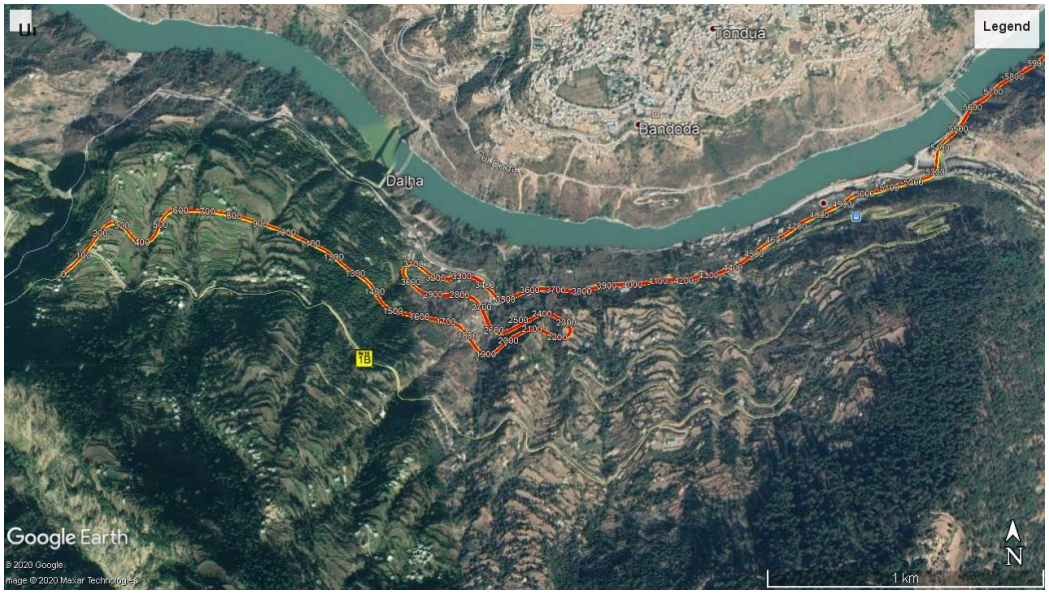


Figure 8.3 – Realignment at starting location

8.5 Improvement Proposal of CD Structures

There are existing 4 bridges (1 major and 3 Minor), 32 existing slab/pipe culverts The Brief detail of existing structures have been given separately, improvement proposals are shown as below in table:

Table 8.2: Summary of Proposed Structures

SL.NO.	DESCRIPTION	No. of Structures
1	Major Bridges	1
2	Viaducts	2

SL.NO.	DESCRIPTION	No. of Structures
3	Viaducts cum Bridge	1
4	Minor Bridges	9
5	Culverts	77

8.5.1 Detail of proposed Bridges

Based on inventory of the existing structures, Hydraulics study, and widening requirement etc., improvement of existing bridges are presented below in table 8.3 and the proposal of new major bridges, viaducts and minor bridges are presented below in table 8.4, table 8.5 and table 8.6 respectively

Table 8.3 Improvement proposal for Bridges and Via Ducts.

Package I : From Km 31+449 TO Km 51+700							
Sr. No.	**Proposed centre Chainage**	**Structure Type**	**Span arrangement**	**Total length**	**Overall Width**	**Type of Superstructure**	**Recommendation /Observation**
1	31+500	Viaduct	1 x 15	15	1 x 12.5	RCC Girder	New 2 Lane Bridge
2	32+445	Minor Bridge	2x25	50	1 x 12.5	PSC I -Girder	New 2 Lane Bridge
3	32+725	Minor Bridge	1x15	15	1 x 12.5	RCC Girder	New 2 Lane Bridge
4	34+235	Bridge Cum Viaduct	3x25	75	1 x 12.5	RCC VOIDED SLAB	New 2 Lane Bridge
5	35+058	Viaduct	3x25+4x40+ 4x20	315	1 x 12.5	RCC VOIDED SLAB & STEEL COMPOSITE GIRDER	New 2 Lane Bridge
6	35+295	Minor Bridge	1x15	15	1 x 12.5	RCC Girder	New 2 Lane Bridge
7	36+230	Minor Bridge	1x20	20	1 x 12.5	RCC Girder	New 2 Lane Bridge
8	37+137	Major Bridge	4x22.5	90	1 x 12.5	RCC Girder	New 2 Lane Bridge
9	43+055	Minor Bridge	1x15	15	1 x 12.5	RCC Girder	New 2 Lane Bridge
10	43+717	Minor Bridge	1x25	25	1 x 12.5	RCC Voided Slab	New 2 Lane Bridge
11	46+110	Minor Bridge	1x15	15	1 x 12.5	RCC Girder	New 2 Lane Bridge
12	47+669	Minor Bridge	2x25	50	1 x 12.5	PSC Girder	New 2 Lane Bridge
13	51+066	Minor Bridge	1x30	30	1 x 12.5	PSC I Girder	New 2 Lane Bridge

8.5.2 Widening / Improvement of Culverts

Based on the detail survey and hydrological analysis over the project alignment we have identified

77 location where culverts are to be proposed. The identified locations will be provided with box culverts and their detailed span arrangements is provided below.

Table 8.4: Culvert List

Sr. No.	Proposed centre Chainage	Span arrangement (Clear Span x Clear Height)	Structure Type	Recommendation
1	31+455	3x3	RCC BOX	New Construction
2	31+590	2x2	RCC BOX	Reconstruction
3	31+775	2x2	RCC BOX	New Construction
4	32+000	4x4	RCC BOX	New Construction
5	32+205	2x2	RCC BOX	New Construction
6	32+910	3x3	RCC BOX	New Construction
7	33+225	3x3	RCC BOX	New Construction
8	33+715	3x3	RCC BOX	New Construction
9	33+825	3x3	RCC BOX	New Construction
10	34+475	3x3	RCC BOX	New Construction
11	35+480	3x3	RCC BOX	New Construction
12	35+620	3x3	RCC BOX	New Construction
13	35+835	3x3	RCC BOX	New Construction
14	36+010	3x3	RCC BOX	New Construction
15	36+480	3x3	RCC BOX	Reconstruction
16	36+750	3x3	RCC BOX	New Construction
17	37+420	2x2	RCC BOX	Reconstruction
18	37+705	3x3	RCC BOX	New Construction
19	37+805	2x2	RCC BOX	New Construction
20	38+030	2x2	RCC BOX	New Construction
21	38+380	2x2	RCC BOX	New Construction
22	38+665	3x3	RCC BOX	New Construction
23	38+815	2x2	RCC BOX	New Construction
24	39+055	2x2	RCC BOX	New Construction
25	39+180	2x2	RCC BOX	New Construction
26	39+530	3x3	RCC BOX	New Construction
27	39+905	3x3	RCC BOX	New Construction
28	40+035	3x3	RCC BOX	Reconstruction

Sr. No.	Proposed centre Chainage	Span arrangement (Clear Span x Clear Height)	Structure Type	Recommendation
29	40+220	3x3	RCC BOX	New Construction
30	40+392	3x3	RCC BOX	Reconstruction
31	40+730	3x3	RCC BOX	Reconstruction
32	40+880	3x3	RCC BOX	Reconstruction
33	41+005	3x3	RCC BOX	New Construction
34	41+155	2x2	RCC BOX	New Construction
35	41+280	3x3	RCC BOX	New Construction
36	41+390	2x2	RCC BOX	Reconstruction
37	41+525	2x2	RCC BOX	Reconstruction
38	41+655	2x2	RCC BOX	Reconstruction
39	41+745	2x2	RCC BOX	New Construction
40	41+855	2x2	RCC BOX	New Construction
41	41+965	2x2	RCC BOX	Reconstruction
42	42+193	2x2	RCC BOX	Reconstruction
43	42+365	3x3	RCC BOX	Reconstruction
44	42+680	2x2	RCC BOX	Reconstruction
45	42+920	3x3	RCC BOX	New Construction
46	43+170	2x2	RCC BOX	Reconstruction
47	43+440	2x2	RCC BOX	Reconstruction
48	43+620	3x3	RCC BOX	Reconstruction
49	43+970	2x2	RCC BOX	New Construction
50	44+080	2x2	RCC BOX	New Construction
51	44+195	2x2	RCC BOX	Reconstruction
52	44+355	2x2	RCC BOX	New Construction
53	44+525	3x3	RCC BOX	Reconstruction
54	44+655	3x3	RCC BOX	New Construction
55	44+785	3x3	RCC BOX	New Construction
56	45+170	3x3	RCC BOX	Reconstruction
57	45+505	2x2	RCC BOX	Reconstruction
58	45+730	3x3	RCC BOX	Reconstruction
59	46+245	2x2	RCC BOX	Reconstruction

Sr. No.	Proposed centre Chainage	Span arrangement (Clear Span x Clear Height)	Structure Type	Recommendation
60	46+573	2x2	RCC BOX	Reconstruction
61	46+645	4x4	RCC BOX	Reconstruction
62	46+740	4x4	RCC BOX	Reconstruction
63	46+915	2x2	RCC BOX	Reconstruction
64	47+255	2x2	RCC BOX	New Construction
65	48+005	3x3	RCC BOX	New Construction
66	48+230	3x3	RCC BOX	New Construction
67	48+390	2x2	RCC BOX	Reconstruction
68	48+473	2x2	RCC BOX	Reconstruction
69	48+745	5x5	RCC BOX	Reconstruction
70	49+025	3X3	RCC BOX	Reconstruction
71	49+130	2x2	RCC BOX	New Construction
72	49+310	3X3	RCC BOX	New Construction
73	49+665	3X3	RCC BOX	Reconstruction
74	49+915	2x2	RCC BOX	New Construction
75	50+195	2x2	RCC BOX	New Construction
76	50+540	3x3	RCC BOX	New Construction
77	50+745	3x3	RCC BOX	New Construction

8.6 Project Facility

8.6.1 Toll Plaza

There is no toll plaza section proposed in this section.

8.6.2 Road Side Furniture

Traffic signs, kilometre stone (5th km, km and hectometer), Road marking, Road Delineator, Crash barrier, Road studs etc. has been proposed along the project road as per manual.

8.6.3 Lighting

The provisions have been considered while proposing the locations as per IRC and MORTH guidelines. The street lighting have been proposed at the location interchange i.e. Major junction, Major Bridge, Toll Plaza as per manual.

8.6.4 Rain Water harvesting System

In order to replenish the ground water table and conservation of fresh water resource. Rain water harvesting systems have been proposed at approx. 500 m length on both side of the project road. A total of 82 harvesting pits have been proposed.

8.6.5 Bus Stops

In order to promote and facilitate the use of public transport bus stops have been proposed along the length of the project. A total of 10 nos. of bus stops have been proposed. The location may be decided during the execution with concern of Authority Engineer. The tentative locations are presented in table below:

Table 8.5: Bus stop location

BUS STOP Khellani-Chatroo-NH-244		
S.NO	**LHS**	**RHS**
Package 1		
1	031+850	031+850
2	036+400	
3	036+980	
4		037+220
5	040+160	
6	044+700	
7		045+280
8	046+560	
9	048+060	

8.7 Junction List

The total of 9 nos. of junctions are proposed on the project road and their package wise list is presented as follows.

Table 8.6: Package wise Junction list

SL No	Chainage	Type	Junction	Cross Road Direction To Village
1	31+920	T	Major	NH-1B
2	35+280	Y	Minor	To Khellani
3	36+280	Y	Minor	NH-1B
4	37+080	T	Major	To Baderwah
5	37+220	Y	Minor	To Village
6	37+360	T	Minor	To Doda
7	40+190	Y	Minor	To Duga/Bhala
8	44+740	Y	Minor	To Kandous
9	48+010	Y	Minor	To Himote

8.8 Drainage Details

Suitable drainage details have been provided as suitable locations. PCC drainage, catch

water drainage and RCC cover drainage system have been used accordingly. Further details are given below:

Table 8.7: Package wise Drain List

	Design Chainage		Design Length (m)	TCS Type	Side	Roadside Drain Length (m)
	From	To				
	31449	31492.5	43.5	TCS-3	RHS	43.5
	31560	31650	90	TCS-3	RHS	90
	31810	31900	90	TCS-3	RHS	90
	31900	31970	70	TCS-2	RHS	70
	32070	32180	110	TCS-2	RHS	110
	32230	32350	120	TCS-4	LHS+RHS	240
	32350	32390	40	TCS-2	RHS	40
	32470	32560	90	TCS-2	RHS	90
	32560	32717.5	157.5	TCS-4	LHS+RHS	315
	32780	33440	660	TCS-2	RHS	660
	33440	33700	260	TCS-4	LHS+RHS	520
	33700	33850	150	TCS-2	RHS	150
	33850	34100	250	TCS-4	LHS+RHS	500
	34160	34197.5	37.5	TCS-2	RHS	37.5
	34272.5	34340	67.5	TCS-2	RHS	67.5
	34340	34900	560	TCS-4	LHS+RHS	1120
	35215	35287.5	72.5	TCS-2	RHS	72.5
	35302.5	35340	37.5	TCS-2	RHS	37.5
	35340	35460	120	TCS-3	RHS	120
	35510	35550	40	TCS-3	RHS	40
	35610	36180	570	TCS-3	RHS	570
	36240	37092	852	TCS-3	RHS	852
	37182	41260	4078	TCS-3	RHS	4078
	41300	43010	1710.00	TCS-3	RHS	1710
	43062.5	43704.5	642	TCS-3	RHS	642
	43729.5	44750	1020.5	TCS-3	RHS	1020.5
	44880	45130	250	TCS-3	RHS	250
	45190	46102.5	912.5	TCS-3	RHS	912.5
	46117.5	47570	1452.5	TCS-3	RHS	1452.5
	47694	47740	46	TCS-3	RHS	46
	47800	50950	3150	TCS-3	RHS	3150
	51150	51180	30	TCS-3	RHS	30
	51290	51700	410	TCS-3	RHS	410
	Total Roadside PCC Drainage Length					**19537**

	Catch Water Drainage List					
	Design Chainage		Design Length (m)	TCS Type	Side	Roadside Drain Length (m)
	From	To				
	31449	31492.5	43.5	TCS-3	RHS	43.5
	31560	31650	90	TCS-3	RHS	90
	31810	31900	90	TCS-3	RHS	90
	31900	31970	70	TCS-2	RHS	70
	32070	32180	110	TCS-2	RHS	110
	32230	32350	120	TCS-4	LHS+RHS	240

	Catch Water Drainage List					
	Design Chainage		Design Length (m)	TCS Type	Side	Roadside Drain Length (m)
	From	To				
	32350	32390	40	TCS-2	RHS	40
	32470	32560	90	TCS-2	RHS	90
	32560	32717.5	157.5	TCS-4	LHS+RHS	315
	32780	33440	660	TCS-2	RHS	660
	33440	33700	260	TCS-4	LHS+RHS	520
	33700	33850	150	TCS-2	RHS	150
	33850	34100	250	TCS-4	LHS+RHS	500
	34160	34197.5	37.5	TCS-2	RHS	37.5
	34272.5	34340	67.5	TCS-2	RHS	67.5
	34340	34900	560	TCS-4	LHS+RHS	1120
	35215	35287.5	72.5	TCS-2	RHS	72.5
	35302.5	35340	37.5	TCS-2	RHS	37.5
	35340	35460	120	TCS-3	RHS	120
	35510	35550	40	TCS-3	RHS	40
	35610	36180	570	TCS-3	RHS	570
	36240	37092	852	TCS-3	RHS	852
	37182	41260	4078	TCS-3	RHS	4078
	41300	43010	1710.00	TCS-3	RHS	1710
	43062.5	43704.5	642	TCS-3	RHS	642
	43729.5	44750	1020.5	TCS-3	RHS	1020.5
	44880	45130	250	TCS-3	RHS	250
	45190	46102.5	912.5	TCS-3	RHS	912.5
	46117.5	47570	1452.5	TCS-3	RHS	1452.5
	47694	47740	46	TCS-3	RHS	46
	47800	50950	3150	TCS-3	RHS	3150
	51150	51180	30	TCS-3	RHS	30
	51290	51700	410	TCS-3	RHS	410
	Total Roadside PCC Drainage Length					**19537**

8.9 Traffic Management and Safety Considerations

During construction work it becomes quite necessary to provide passengers a safe passage throughout the construction zone. The Contractor shall take all the required measures and make arrangements for the safety of Users during the Construction and Maintenance of the Project Highway or a Section thereof in accordance with the provisions of MORTH Specifications. It shall provide, erect and maintain all such barricades, signs, markings, flags, and lights as may be required by Good Industry Practice for the safety of the traffic passing through the Section under construction or maintenance. Some of the necessary temporary structures and measures are as follows:

- Portable Type Barricade in Construction Zone.
- Traffic Signs for Diversion/construction zone.
- Filling of Pot- holes and Patch Repairs on existing road.

- Providing, laying and rolling of built-up-spray grout layer over prepared base on existing road.
- Maintenance of Earthen Shoulders.
- Diversion at the structure's location etc.

8.10 Protection Works

8.10.1 Breast Wall

Breast Wall Left Hand Side				
Sr. No.	**From**	**To**	**Length**	**Height**
1	**33540**	**33630**	90	3.00
2	33860	34080	220	3.00
3	34180	34190	10	3.00
4	34300	34880	580	3.00
	Total Length		**900**	

Breast Wall Right Hand Side				
Sr. No.	**From**	**To**	**Length**	**Height**
1	31810	31890	80	3.00
2	32230	32320	90	3.00
3	32610	32680	70	3.00
4	32800	33280	480	3.00
5	33340	33690	350	3.00
6	33740	34080	340	3.00
7	34380	34450	70	3.00
8	34490	34600	110	3.00
9	34760	34850	90	3.00
10	35230	35280	50	3.00
11	35320	35460	140	3.00
12	35500	35520	20	3.00
13	35630	35730	100	3.00
14	35770	35790	20	3.00
15	35860	35880	20	3.00
16	35910	36000	90	3.00
17	36020	36170	150	3.00
18	36320	36740	420	3.00
19	36760	36820	60	3.00
20	36840	36960	120	3.00
21	37000	37050	50	3.00
22	37230	37280	50	3.00
23	37310	37420	110	3.00
24	37450	37620	170	3.00
25	37640	37800	160	3.00
26	37820	38000	180	3.00
27	38020	38030	10	3.00

Breast Wall Right Hand Side				
Sr. No.	**From**	**To**	**Length**	**Height**
28	38050	38380	330	3.00
29	38400	38440	40	3.00
30	38490	38500	10	3.00
31	38520	38560	40	3.00
32	38580	38650	70	3.00
33	38690	38920	230	3.00
34	38950	39020	70	3.00
35	39050	39360	310	3.00
36	39380	39460	80	3.00
37	39510	39580	70	3.00
38	39600	39730	130	3.00
39	39780	39870	90	3.00
40	39970	40000	30	3.00
41	40070	40140	70	3.00
42	40280	40310	30	3.00
43	40430	40540	110	3.00
44	40580	40820	240	3.00
45	40840	40880	40	3.00
46	40910	41170	260	3.00
47	41190	41230	40	3.00
48	41300	41380	80	3.00
49	41400	41500	100	3.00
50	41550	41730	180	3.00
51	41770	41950	180	3.00
52	41990	42080	90	3.00
53	42100	42210	110	3.00
54	42300	42340	40	3.00
55	42460	42500	40	3.00
56	42520	42650	130	3.00
57	42790	42880	90	3.00
58	42950	43000	50	3.00
59	43100	43140	40	3.00
60	43210	43240	30	3.00
61	43300	43430	130	3.00
62	43450	43470	20	3.00
63	43490	43570	80	3.00
64	43620	43680	60	3.00
65	43760	43930	170	3.00
66	44000	44060	60	3.00
67	44100	44160	60	3.00
68	44210	44250	40	3.00
69	44290	44390	100	3.00
70	44410	44420	10	3.00
71	44460	44500	40	3.00
72	44570	44620	50	3.00

Breast Wall Right Hand Side				
Sr. No.	**From**	**To**	**Length**	**Height**
73	44680	44730	50	3.00
74	45090	45110	20	3.00
75	45200	45220	20	3.00
76	45460	45490	30	3.00
77	45650	45680	30	3.00
78	45780	45820	40	3.00
79	45960	45970	10	3.00
80	45990	46060	70	3.00
81	46140	46620	480	3.00
82	46670	47470	800	3.00
83	47490	47540	50	3.00
84	47860	48000	140	3.00
85	48030	48140	110	3.00
86	48160	48190	30	3.00
87	48210	48300	90	3.00
88	48340	48410	70	3.00
89	48440	48450	10	3.00
90	48470	48590	120	3.00
91	48610	48700	90	3.00
92	48850	49140	290	3.00
93	49220	49270	50	3.00
94	49320	49430	110	3.00
95	49500	49510	10	3.00
96	49590	49640	50	3.00
97	49680	49890	210	3.00
98	49940	50110	170	3.00
99	50130	50240	110	3.00
100	50280	50370	90	3.00
101	50390	50420	30	3.00
102	50460	50510	50	3.00
103	50610	50730	120	3.00
104	50760	50820	60	3.00
105	50890	50930	40	3.00
106	51290	51300	10	3.00
107	51360	51460	100	3.00
108	51510	51680	170	3.00
Total Length			**11800**	

8.10.2 Retaining Wall

Left Hand Side				
Sr. No.	**Chainage**		**Length**	**Height Adopted**
	From	**To**		
1	31570	31630	60	4.00
2	32160	32170	10	2.50

Left Hand Side				
Sr. No.	Chainage		Length	Height Adopted
	From	To		
3	32200	32210	10	2.50
4	32480	32490	10	5.00
5	32760	32780	20	3.50
6	32850	32860	10	2.50
7	32890	32930	40	3.00
8	33050	33070	20	5.00
9	33160	33200	40	3.50
10	33230	33420	190	4.00
11	33740	33750	10	3.50
12	35310	35340	30	3.00
13	35470	35480	10	2.50
14	35570	35590	20	3.00
15	35740	35750	10	4.00
16	35790	35880	90	3.00
17	36140	36150	10	2.50
18	36190	36200	10	4.00
19	37000	37050	50	3.00
20	37070	37080	10	3.00
21	38380	38410	30	2.50
22	38510	38550	40	2.50
23	38570	38590	20	3.00
24	38610	38660	50	3.50
25	38680	38770	90	3.50
26	38800	38890	90	2.50
27	38920	38930	10	2.50
28	39250	39260	10	3.00
29	39320	39420	100	3.50
30	39440	39500	60	4.00
31	39520	39540	20	3.50
32	39560	39570	10	3.00
33	39590	39620	30	3.50
34	39640	39650	10	2.50
35	39860	39920	60	2.50
36	40010	40040	30	3.00
37	40190	40210	20	3.00
38	40250	40270	20	2.50
39	40330	40340	10	2.50
40	40440	40450	10	2.50
41	40490	40510	20	2.50
42	40560	40580	20	3.00
43	40630	40640	10	2.50
44	40850	40870	20	2.50

Left Hand Side				
Sr. No.	Chainage		Length	Height Adopted
	From	To		
45	41140	41200	60	3.00
46	41240	41300	60	3.50
47	42440	42460	20	2.50
48	42510	42530	20	3.00
49	42900	42940	40	3.50
50	43020	43030	10	4.00
51	43180	43190	10	4.00
52	43270	43290	20	3.00
53	43590	43640	50	3.50
54	43830	43840	10	2.50
55	43860	43870	10	3.00
56	44070	44090	20	3.50
57	44180	44190	10	3.00
58	44250	44280	30	3.50
59	44440	44450	10	3.50
60	44520	44530	10	3.50
61	44640	44670	30	3.50
62	44750	44760	10	3.50
63	44840	44870	30	3.50
64	44970	44990	20	5.00
65	45060	45140	80	3.50
66	45720	45730	10	3.50
67	48210	48220	10	3.00
68	48310	48340	30	3.00
69	48710	48720	10	4.00
70	48740	48750	10	3.00
71	49160	49170	10	2.50
72	50570	50600	30	2.50
73	50630	50640	10	3.00
74	50750	50780	30	3.50
75	50820	50860	40	2.50
76	50960	51050	90	3.50
77	51110	51150	40	4.00
78	51190	51270	80	2.50
79	51330	51350	20	2.50
	Total Length		**2430**	

Right Hand Side				
Sr. No.	Chainage		Length	Height Adopted
	From	To		
1	31520	31550	30	3.50
2	32000	32010	10	2.50

Right Hand Side				
Sr. No.	Chainage		Length	Height Adopted
	From	To		
3	32730	32740	10	3.50
4	34140	34190	50	4.00
5	34880	34890	10	4.00
6	36210	36220	10	3.50
7	47620	47640	20	2.50
8	51040	51050	10	2.50
9	51080	51110	30	3.00
	Total Length		180	

8.10.3 Gabion Wall

Left Hand Side				
Sr. No.	Chainage		Length	Height
	From	To		
1	31450	31490	40	9.00
2	31510	31560	50	9.50
3	31640	31660	20	7.50
4	31680	31710	30	9.50
5	31730	31800	70	9.50
6	31970	32040	70	7.00
7	32400	32420	20	7.50
8	32730	32750	20	7.00
9	33020	33040	20	7.00
10	33210	33220	10	5.50
11	33710	33730	20	7.00
12	33790	33840	50	9.50
13	35230	35250	20	7.50
14	36210	36220	10	7.00
15	36240	36250	10	5.50
16	43040	43050	10	7.00
17	43070	43080	10	7.00
18	43160	43170	10	5.50
19	43950	43980	30	7.00
20	44770	44830	60	7.00
21	44920	44960	40	8.50
22	45000	45050	50	6.00
23	45150	45170	20	7.00
24	47600	47640	40	7.50
25	51080	51100	20	5.50
Total Length			750	

Right Hand Side				
Sr. No.	Chainage		Length	Height
	From	To		
1	32410	32420	10	5.50
2	34120	34130	10	5.50
3	34270	34300	30	7.50
Total Length			50	

8.10.4 Wire Mesh

Sr. No.	Chainage		Side	Stretch Length (m)
	From	To		
1	33540	33620	LHS	80
2	33860	34080	LHS	220
3	34180	34190	LHS	10
4	34300	34880	LHS	580
5	31810	31890	RHS	80
6	32230	32310	RHS	80
7	32620	32670	RHS	50
8	32800	33280	RHS	480
9	33340	33690	RHS	350
10	33740	34080	RHS	340
11	34380	34450	RHS	70
12	34500	34600	RHS	100
13	34760	34850	RHS	90
14	35230	35280	RHS	50
15	35320	35460	RHS	140
16	35500	35520	RHS	20
17	35630	35730	RHS	100
18	35770	35790	RHS	20
19	35860	35880	RHS	20
20	35910	36000	RHS	90
21	36020	36170	RHS	150
22	36320	36740	RHS	420
23	36760	36820	RHS	60
24	36840	36960	RHS	120
25	37000	37050	RHS	50
26	37230	37280	RHS	50
27	37310	37420	RHS	110
28	37450	37620	RHS	170
29	37640	37800	RHS	160
30	37820	38000	RHS	180
31	38020	38030	RHS	10
32	38050	38380	RHS	330
33	38400	38440	RHS	40

Sr. No.	Chainage		Side	Stretch Length (m)
	From	To		
34	38490	38500	RHS	10
35	38520	38560	RHS	40
36	38580	38650	RHS	70
37	38690	38920	RHS	230
38	38950	39020	RHS	70
39	39050	39360	RHS	310
40	39380	39460	RHS	80
41	39510	39580	RHS	70
42	39600	39730	RHS	130
43	39780	39870	RHS	90
44	39970	40000	RHS	30
45	40070	40140	RHS	70
46	40280	40310	RHS	30
47	40430	40540	RHS	110
48	40580	40820	RHS	240
49	40840	40880	RHS	40
50	40910	41170	RHS	260
51	41190	41230	RHS	40
52	41300	41380	RHS	80
53	41400	41500	RHS	100
54	41550	41730	RHS	180
55	41770	41950	RHS	180
56	41990	42080	RHS	90
57	42100	42210	RHS	110
58	42300	42340	RHS	40
59	42460	42500	RHS	40
60	42520	42650	RHS	130
61	42790	42880	RHS	90
62	42950	43000	RHS	50
63	43100	43140	RHS	40
64	43210	43240	RHS	30
65	43300	43430	RHS	130
66	43450	43470	RHS	20
67	43490	43570	RHS	80
68	43620	43680	RHS	60
69	43760	43930	RHS	170
70	44000	44060	RHS	60
71	44100	44160	RHS	60
72	44210	44250	RHS	40
73	44290	44390	RHS	100
74	44410	44420	RHS	10
75	44460	44500	RHS	40
76	44570	44620	RHS	50

Sr. No.	Chainage		Side	Stretch Length (m)
	From	To		
77	44680	44730	RHS	50
78	45090	45110	RHS	20
79	45200	45220	RHS	20
80	45460	45490	RHS	30
81	45650	45680	RHS	30
82	45780	45820	RHS	40
83	45960	45970	RHS	10
84	45990	46060	RHS	70
85	46140	46620	RHS	480
86	46670	47470	RHS	800
87	47490	47540	RHS	50
88	47860	47990	RHS	130
89	48030	48140	RHS	110
90	48160	48190	RHS	30
91	48210	48300	RHS	90
92	48340	48410	RHS	70
93	48440	48450	RHS	10
94	48470	48590	RHS	120
95	48610	48700	RHS	90
96	48850	49140	RHS	290
97	49220	49270	RHS	50
98	49320	49430	RHS	110
99	49500	49510	RHS	10
100	49590	49640	RHS	50
101	49680	49890	RHS	210
102	49940	50110	RHS	170
103	50130	50240	RHS	110
104	50280	50370	RHS	90
105	50390	50420	RHS	30
106	50460	50510	RHS	50
107	50610	50730	RHS	120
108	50760	50820	RHS	60
109	50890	50930	RHS	40
110	51290	51300	RHS	10
111	51360	51460	RHS	100
112	51510	51680	RHS	170
Total				**12640**

8.10.5 Rock fall Protection during Construction

Right Hand Side			
Sr. No.	Chainage		Length
	From	To	

Right Hand Side			
Sr. No.	Chainage		Length
	From	To	
1	35320	35460	140
2	35500	35520	20
3	35630	35730	100
4	35770	35790	20
5	35860	35880	20
6	35910	36000	90
7	36020	36170	150
8	36320	36740	420
9	36760	36820	60
10	36840	36960	120
11	37000	37050	50
12	37230	37280	50
13	37310	37420	110
14	37450	37620	170
15	37640	37800	160
16	37820	38000	180
17	38020	38030	10
18	38050	38380	330
19	38400	38440	40
20	38490	38500	10
21	38520	38560	40
22	38580	38650	70
23	38690	38920	230
24	38950	39020	70
25	39050	39360	310
26	39380	39460	80
27	39510	39580	70
28	39600	39730	130
29	39780	39870	90
30	39970	40000	30
31	40070	40140	70
32	40280	40310	30
33	40430	40540	110
34	40580	40820	240
35	40840	40880	40
36	40910	41170	260
37	41190	41230	40
38	41300	41380	80
39	41400	41500	100
40	41550	41730	180
41	41770	41950	180
42	41990	42080	90

Right Hand Side			
Sr. No.	Chainage		Length
	From	To	
43	42100	42210	110
44	42300	42340	40
45	42460	42500	40
46	42520	42650	130
47	42790	42880	90
48	42950	43000	50
49	43100	43140	40
50	43210	43240	30
51	43300	43430	130
52	43450	43470	20
53	43490	43570	80
54	43620	43680	60
55	43760	43930	170
56	44000	44060	60
57	44100	44160	60
58	44210	44250	40
59	44290	44390	100
60	44410	44420	10
61	44460	44500	40
62	44570	44620	50
63	44680	44730	50
64	45090	45110	20
65	45200	45220	20
66	45460	45490	30
67	45650	45680	30
68	45780	45820	40
69	45960	45970	10
70	45990	46060	70
71	46140	46620	480
72	46670	47470	800
73	47490	47540	50
74	47860	48000	140
75	48030	48140	110
76	48160	48190	30
77	48210	48300	90
78	48340	48410	70
79	48440	48450	10
80	48470	48590	120
81	48610	48700	90
82	48850	49140	290
83	49220	49270	50
84	49320	49430	110

Right Hand Side			
Sr. No.	**Chainage**		**Length**
	From	**To**	
85	49500	49510	10
86	49590	49640	50
87	49680	49890	210
88	49940	50110	170
89	50130	50240	110
90	50280	50370	90
91	50390	50420	30
92	50460	50510	50
93	50610	50730	120
94	50760	50820	60
95	50890	50930	40
96	51290	51300	10
97	51360	51460	100
98	51510	51680	170
Total Length			**10070**

Chapter 9

Cost Estimate

9.0 Cost Estimate

9.1 Introduction and Assumptions

Preliminary cost estimate for **Khellani to Chattroo** road section has been finalised based on the improvements proposed under Chapter – 8. The estimate is worked out based on the quantities calculated for the items of work to be executed in the project and rates derived after detail analysis and as contained in the government Basic schedule of Rates.

Following assumptions have been made for calculating quantities, rate analysis and cost estimate.

a) It is assumed that suitable water would be available for construction purpose within reasonable lead and hence no separate haulage / rate has been considered for this purpose.

b) Establishment of good hygienic labour camp is deemed to be included in adopted rates and hence no separate provision has been made.

c) Establishment of field laboratory for conducting basic tests on soils, construction material and for quality control is also deemed to be included in adopted rates.

d) For road work including bituminous works, bridge work and CD work, basic lead is considered package wise from HMP and Batching Plant to site.

e) All sundries, contractor profit, and other overhead charges are deemed to be included in the derived rates. Items required for adhering to safety standards during construction and maintenance phases mentioned in O&M standards are also deemed to be considered.

f) Mechanised construction using hot mix plant, pavers, concrete batching plant etc has been assumed while working out the rates.

9.2 Adoption of Unit Rates

The cost estimate of the project road as presented in the Draft Detailed Project Report is based on the final development proposals and priced at latest schedule of rates of Jammu and Kashmir.

The cost estimate has been done with the consideration that the full proposed length of the road will be constructed in one section under one construction package.

For arriving at unit rates at DPR stage, it has been assumed that the specifications generally conform to the provisions made in "**Specifications for Road and Bridge Works (Vth Edition)**" of **MORT&H**.

To develop a thorough understanding of the prevailing construction rates, the Consultant have reviewed prevailing **J&K Schedule of Rates-2020, for Civil works of all Engineering Departments, sanctioned vide Govt. Order no. 192-PW(R&B) of 2020 dated 07.07.2020.**

9.2.1 Based on Rate Analysis

The item rate for road works and bridge works have been worked out based on prevailing J&K Schedule of Rates-2020, for Civil works of all Engineering Departments, sanctioned vide Govt. Order no. **192-PW(R&B) of 2020 dated 07.07.2020** and MORT&H Standard Data Book for Analysis of Rates.

9.2.2 Based on Market Rates

The consultant has thoroughly reviewed the market rate and adopted the market for the items of works such as Bitumen, steel, cement etc.

9.3 Bill of Quantities for Civil Works

The quantities of major items of works have been worked out based on the preliminary highway design, inventory, condition surveys, and other pavement investigations data. The pavement quantities have been worked out based the geometrics and cross sections, pavement design done based on traffic and laboratory investigations.

Site Clearance:

The area considered for Site Clearance is the area within the proposed Right of Way minus the existing carriageway area.

Earth Works:

This item provides for roadway excavation, earthwork in embankment, subgrade and shoulders including disposal of surplus earth and unsuitable material. The earth work quantities like roadway in embankment have been computed based on the data collected during inventory survey. The quantity for cutting in deep section is computed and further classified as cutting in ordinary rock or cutting by open/ controlled blasting in hard rock. The earthwork quantities has been computed using MX Road Software.

Sub-base, Base, Surface Courses:

The quantities for road pavement, base, sub-base etc. for main carriageway have been calculated through applicable cross-sectional template developed in excel format as per TCS Schedule.

Bituminous Works:

The quantities for bituminous work for main carriageway have been calculated

through applicable cross-sectional template developed in excel format as per TCS Schedule. Quantities for the pavement component are based on the pavement designs proposed in **Chapter 8**.

Cement Concrete Pavement Concrete:

CC pavement have been proposed at Toll Plaza Locations i.e. Package-II and Quantity have been calculated as per Design & Drawing.

Culverts:

The estimation of quantities for culverts was based on site inventory condition survey and study of require hydraulics. The detailed recommendations are given in **Chapter 8**. The quantities have been calculated based on detailed General Arrangement Drawings (GAD).

Bridges and structures:

The cost estimation for Structures was based on site inventory condition survey and study of require hydraulics. The detailed recommendation is given in **Chapter 8**. The structure rate has been calculated based on Deck Area basis.

Junctions Improvement:

The cost estimate of the junction have been calculated based on the standard drawing given in MORTH.

Traffic Signs and Markings:

Proper traffic signs were planned at required locations along the project corridor. The number of traffic signs shall be adequate and modified if required. Centre line and edge markings required from safety point of view were considered in the quantity estimate. RCC Guard posts, W metal beam crash barrier, delineators, studs and overhead gantry signs have been considered at appropriate locations.

Drainage and Protection works:

Provision under this sub head has been made for surface drain, road side drains(catch drains), construction of breast wall, retaining wall/toe wall, gabion wall and soil/rock nailing on hill and valley side .

Miscellaneous Items:

The amount has been provided for project maintenance, way side amenities and electrifications. In addition to these, traffic control and diversion, bus-stops and cross utility ducts have also been provided.

Table 9.1: Description of Bills for Cost Estimate

Major Heading	Item of Works
Site Clearance	• Clearing and Grubbing

Major Heading	Item of Works
	• Dismantling of existing structures/km stones/ pavement/ road signs • Cutting of Trees and Removal of stumps • Scarifying existing bituminous surface • Dismantling
Earth work	• Earthwork in excavation for Ordinary soil / soft rock / hard rock • Embankment construction with material from borrow area • Embankment construction with material from road cutting • Subgrade and Shoulder construction • Turfing
Non-Bituminous Courses	• Granular sub-base • Wet mix macadam
Bituminous Course	• Prime coat • Tack coat • Bituminous Macadam as Profile Corrective Course • Dense Bituminous Macadam • Semi dense bitumen macadam • Bituminous Concrete
Cement Concrete Pavement	• Dry Lean Concrete • Pavement Quality Concrete
Bridge and Cross Drainage Structures	• Earthwork in excavation for Ordinary soil / soft rock / hard rock • Concrete work in foundation, substructure and superstructure • CR masonry work in foundation and substructure • Slab culvert (widening / new construction / repair / on cross road) • Pipe culvert (widening / new construction / repair / on cross road/ duct for utility crossing) • Major/Minor Bridge (widening / new construction / repair) • RCC bore pile and pile cap • Load test of Pile • Reinforcement in foundation, substructure and superstructure • HT Steel

Major Heading	Item of Works
	• Steel liner • Bearing - PTFE, Tar paper, elastomeric • Expansion joint - Strip seal, Pre-moulded filler • Asphaltic Wearing coat • Cement paint to exposed concrete • PMC mortar & epoxy bonding coat to concrete • Stone pitching in slope and apron • NP-4 Pipe for culvert
Drainage and Protection works	• Unlined drain • Covered lined drain • Retaining /Toe Wall • Gabion Wall • Rock Bolt and shot creting • Catch water drains
Roadside Furniture	• Km. stone / Boundary stone • Road signs • Pavement markings • Road signage • Crash Barrier • Road stud • Railing • Fencing • Delineators
Maintenance	• Diversion • Routine Maintenance
Electrical Works	• Streetlight in Urban area • Lighting at toll plaza • Lighting at Truck Lay byes • Lighting at Intersections
Miscellaneous Items	• Roadside Barriers
Bus Bays/Bus Shelter	• Bus Stops • Bus shelter

Major Heading	Item of Works
	• Tree plantation
Toll Plaza	• Toll Booth • Barrier Gate • Canopy • Administrative Building
HTMS	• Highway Traffic Management System

9.4 Costing for Safety Devices

The safety devices have been proposed based on criteria given in Chapter 8 – Improvement Proposal. Cost for safety devices like crash barrier, road signs and markings, delineators, kerbs, etc. have been derived in Bill of Roadside Furniture.

9.5 Land Acquisition and R&R Cost

Rs. 79.76 Cr Cost for Land Acquisition and R&R has been considered

9.6 Cost of Environmental Mitigation Plan

Rs. 6.47 Cr. Cost for Environment Mitigation plan and muck disposal management have been considered at this stage.

9.7 Total Cost Estimate

The Package wise Summary of Estimate and Abstract of Cost has been provided below and their detailed description can be found in **Volume VII- Cost Estimate**.

Table 9.2: Package wise Summary of Estimate and Abstract of Cost

SUMMARY OF ESTIMATE (As Per MoRT&H Norms)				
Sr. No.	**Item No.**	**Description**	**Length (20.251 Km)**	**Total Amount (Rs. in Crores)**
1	BILL NO. 1	SITE CLEARANCE		1.01
2	BILL NO. 2	EARTH WORKS		28.03
3	BILL NO. 3	SUB-BASES AND BASES COURSES		12.64
4	BILL NO. 4	BITUMINOUS COURSES		19.83
5	BILL NO. 5	CROSS DRAINAGE WORKS(CULVERTS)		10.65
6	BILL NO. 6	BRIDGES		53.99
7	BILL NO. 7(A)	TRAFFIC SIGNS, MARKINGS		6.37
8	BILL NO. 7(B)	**DRAIN & PROTECTION WORK**		
9	i)	PCC DRAIN	19537 m	2.66
10	ii)	RRM CATCH WATER DRAIN	19537 m	3.54
11	iii)	RRM RETAINING WALL	2610 m	10.25
12	iv)	GABION WALL	800 m	6.36
13	v)	BREAST WALL	12700 m	28.73
14	vi)	Wire Mesh	12640 m	44.31
15	BILL NO. 8	JUNCTIONS		0.82
16	BILL NO. 9	PROJECT FACILITIES		
17	A)	BUS STOP		0.13
18	B)	RAIN WATER HARVESTING		0.37
19	BILL NO. 10	SAFETY AND TRAFFIC MANAGEMENT DURING CONSTRUCTION		7.32
20	BILL NO. 11	TEMPORARY DIVERSION AT STRUCTURE LOCATION		0.48
21	BILL NO. 12	ENVIORNMENT MANAGEMENT & MUCK DISPOSAL MANAGEMENT		3.87
22	BILL NO. 13	ENVIORMENT MANAGEMENT PLAN COST		2.60
23	BILL NO. 14	MISCELLANEOUS ITEMS		1.42
A	**Civil Cost**			**245.39**
B	**GST @ 12% @ Payable ON Civil Cost only (on A)**			**29.45**
C	**SUB TOTAL (A+B)**			**274.84**
D	Contingencies at 2.8% of (A)			6.87
E	Construction Supervision Charges @ 3% of (A)			7.36
F	Agency Charges @ 3% of (A)			7.36
G	Escalation @ 5%per annum for 2nd year during Construction payable to Contractor of (C)			6.13
H	**TOTAL COST INCLUDING CENTAGES (C+D+E+F+G)**			**302.56**
I	Maintenance Charges @ 0.5% for 2nd, 3rd, 4th years & 1% for 5th year of (C)			6.13
J	**TOTAL PROJECT COST (H+I)**			**308.70**
K	Cost of Land Acquisition and R & R Cost (Approx.)			79.76
L	Cost towards Utility Shifting (Approx.)			6.10
TOTAL CAPITAL COST (J+K+L)				**394.57**

General Abstract of Cost						
Sr. No.	**Detail**	**Unit**	**No**	**Length**	**Rate**	**Cost**
1	**Road Work**					
(a)	**Site Clearance**					1,00,59,183.509
(b)	Typical Cross Section Type- 1	Km	1	0.288	1,76,07,127.950	50,62,049.286
(c)	Typical Cross Section Type- 1A	Km	1	1.044	1,76,07,127.950	1,83,81,841.580
(d)	Typical Cross Section Type- 2	Km	1	1.335	1,72,21,067.225	2,29,90,124.745
(e)	Typical Cross Section Type- 3	Km	1	15.507	1,57,42,881.255	24,41,24,859.624
(f)	Typical Cross Section Type- 4	Km	1	1.348	1,68,35,006.500	2,26,85,171.259
(g)	Extra widening					1,81,93,655.008
(h)	Cutting & Filling					27,36,11,508.491
	Total Road Works					**61,51,08,393.502**
2	**Culvert**					
(i)	Construction of Culvert					10,65,03,292.003
	Total Culvert Works					**10,65,03,292.003**
3	**Minor Bridges**					
(i)	Reconstruction & New construction					21,70,37,045.923
4	**Major Bridges**					
(i)	Reconstruction					5,35,41,281.084
5	**Viaduct**					
(i)	New construction					26,93,26,690.477
	Total Bridge Works					**53,99,05,017.484**
6	**Other Works**					
(i)	Drainage Work					6,20,09,304.854
(ii)	RRM Retaining Wall					10,25,37,409.860
(iii)	Gabion Wall					6,36,19,403.080
(iv)	RRM Breast Wall					28,72,88,893.124
(v)	Wire Mesh					44,30,90,700.000
(vi)	Traffic Signs road markings & safety devices					6,37,46,875.253
(vii)	**Junction**					
a)	Major Junction					23,27,756.540
b)	Minor Junction					59,11,290.120
(viii)	**Project Facilities**					
a)	Bus Stop					12,50,000.000
b)	Rainwater Harvesting					36,90,000.000
(ix)	Temporary Diversion For Structure Location					48,27,375.775
(ix)	Safety and Traffic Management During Construction					7,31,63,193.500
(xi)	Environment Management & Muck Disposal Management					3,86,73,729.602
(xii)	Environment Plan					2,60,03,760.080
(xiii)	Miscellaneous					1,42,32,954.000
	Total Other Works					**1,19,23,72,645.787**
	Grand Total					**2,45,38,89,348.775**

The summary of package wise cost estimate has been computed and presented in **Table 9.3** below.

Table 9.3: Section wise Cost of Civil Works Summary

Section	PROPOSED LENGTH (KM)	BASE COST IN CRORE (Including GST)	BASE COST IN CRORE (Including CENTAGES)	TOTAL CAPITAL COST
Package-I Design CH. km 31+449 to Km 51+700	20.251	274.83	308.70	394.57

Chapter 10

Economic Analysis

10.0 ECONOMIC ANALYSIS

An infrastructure project is subjected to economic appraisal to ensure that the investment proposed would yield appropriate return to the national economy. It is therefore important that decisions about investments in roads are made on objective judgments and therefore, Economic appraisal has been carried out for each traffic homogenous section of entire Project road.

The basic purpose of the economic analysis is to enable the decision-makers in the Government to decide whether the project is worthy of investment keeping in view the benefits to the society. The Proposal for project road is "**Consultancy Services for Feasibility Study, Preparation of Detailed Project Report and providing Pre-Construction Services for upgradation to 2 lane with paved shoulder from Km 44.500 (Khellani) to Km 142.000 (Chhatroo) of Khellani – Kishtwar – Chattroo - Khanabal Section of NH 244 in the newly formed Union Territory of Jammu and Kashmir**. For this purpose, the entire Project Road has been considered along with its proposed maintenance and improvement proposals.

10.1 Economic Analysis Approach

The economic evaluation has been carried out within the broad framework of social - benefit analysis assuming the project life for a period 25 years. The economic feasibility of the project has been sought to maximize the economic returns on investment. There will be reduction in road user costs of motorized traffic (MT) on the existing parallel roads, which are likely to be affected in consequence of construction of this road. The economic savings at significant level in the following areas are expected to occur due to introduction of this road.

- Vehicle traffic congestion
- Journey time of passengers and goods

The economic analysis has been based on comparison of costs and benefits under two scenarios 'without the improvement of road project' and 'with the improvement of road project'. All costs and benefits are valued in monetary terms and expressed in economic prices to have the analysis on resource-based framework. The analysis is made corridor-wise as well as project-wise. The results are expressed in terms of

Economic Internal Rate of Return (EIRR) and Economic Net Present Value (ENPV).

Table10.1: Total Transport Costs

Road Supplier Costs	Road User Costs
Construction Costs	Vehicle Operating Costs (VOC) both MT & NMT
Maintenance Costs	Travel Time Costs
Replacement Costs: Costs of Environmental Impact Mitigation Measures, Costs of Rehabilitation and Resettlement (R&R) measures	

These costs are generated using HDM – IV for every year of the analysis period (cost-benefit stream) from which economic indicator parameters that essential for viability of project namely Net Present Value (NPV), Economic Rate of Return (EIRR) and Benefit Cost Ratio (B/C) are the final economic outputs.

NPV is the present value of Net Benefits (NB) during the project period. EIRR is the discount rate at which the NPV of the Net Benefit (NB) is zero. Net Benefit is the cumulative sum of the difference between yearly benefit and yearly costs incurred after discounting.

$$NB = \sum_{n=1}^{M} (Benefit(n) - Cost(n))$$

Savings from vehicle emission reduction and less energy consumption due to improved facility are also important economic savings which are possible to calculate but these quantities are not converted to economic cost inside the software. So these benefits are not included.

The appraisal period (including the construction period) has been taken as 25 years after which a residual value of investment is assumed as 10%.

10.2 Project Economic Evaluation using HDM - 4

Economic evaluation for road section is carried out by consideration of two alternatives In HDM – 4.

10.2.1 Alternative 1: Existing

For without project consideration, project road will carry existing traffic on it without any improvement and maintenance in present condition that means No treatment is

given to existing road for improving its capacity augmentation, functional and structural pavement quality and geometry standards.

10.2.2 Alternative 2: Proposed

For with project consideration, Project road is rehabilitated and upgraded as 2 lanes with paved shoulders. In this alternative, project road improvements are made by improving its geometry through realignments, providing bypasses and rehabilitation to existing pavement though reconstruction and strengthening.

10.3 Project Cost and Scheduling

The project road is 20.251 km(Package – 1). Project road is proposed to be a new 2-lane bypass to facilitate the proposed road section area. Accordingly, economic analysis of the project road is being carried out in 2 sections as follows:

Table 10.2: Section Details

Homogeneous Section	Design Chainage		Improvement
	From	To	
Khellani - Chhatroo	31/449	51/700	2 lane Paved Shoulder

The Economic analysis was carried out for 30-year benefit period (2022-2052). For performing economic evaluation, a 'project' is formulated in which comparison is made between two scenarios namely (1) Existing and (2) Proposed.

10.3.1 Capital Cost

Total Project cost is Rs. 394.57 Crore for project road. For economic evaluation base costs have been taken as factor cost of civil works and other cost related to land acquisition social environmental and utility relocations that mean Capital cost is the total construction cost of civil works for the project improvement.

The construction cost for homogeneous section is tabulated in **Table 10.3** for the year 2020 at which Project will start to implement. Therefore, the project cost of present year is increased with 5 % inflation rate for two successive years. The construction cost of project will be utilised in three phases i.e. 20 % in the first year and 50 % in second year and 20% in last 6 months as construction period of 30months.

The cost estimate for each section has been calculated separately based on the

quantities worked out for major items of work to be executed in the project on the basis of preliminary engineering design of roads, structures and the adopted rates. A conversion factor of 0.85 has been used to convert financial cost into economic costs.

The economic cost for each package is as under:

Table 10.3: Total Project Cost

Homogeneous Section	Financial Cost (Cr)	Economical Cost
Khellani - Chhatroo	394.57	335.39

10.3.2 Maintenance Cost

5 years Maintenance Period including structures:

No maintenance charges shall be paid for the first year; 0.50 % of the Contract Price each for the second, third and fourth year; and 1% of the Contract Price for the fifth year.

10.4 Project Benefits

Project Benefits mainly occurs due to Reduction in Vehicle operating cost and travel time savings.

The vehicle operating cost (VOC) components are

- Fuel
- Lubricants
- Tyres
- Spare Parts
- Maintenance Labour
- Wages of Crew
- Fixed costs including overheads, administration, interest on borrowed capital
- Depreciations
- Travel time cost
- Social Development around the project length

10.4.1 Vehicle Fleet

10.4.1.1 Fleet Utilization

Fleet utilization data adopted for the analysis is based on the findings of Road User

Cost study in 2001, IRC SP: 30-2009. The adopted values are summarized as shown in table below.

Table 10.4: Life Norms for Vehicles

Particulars	Km Driven	Life, Year	Working Hour	Passenger
2 Axle Truck	90000	12	1950	-
Multi Axle Truck	75000	12	2100	-
3 Axle Truck	75000	12	2100	-
LCV	45500	10	1050	-
Bus/Mini-Bus	125000	10	2400	45
Car / Jeep / Van	87500	10	1750	5
Two-Wheeler	28800	10	636	1.5

10.4.2 Vehicle Resources

10.4.2.1 Vehicle and Tyre Cost

Economic costs of vehicle and tyre are derived from the market survey. Ex-Show Room Price for each category of vehicle have been collected and elements of taxes, duties, freight, dealer's margin and incentives as applicable have been removed to arrive at the economic costs. The adopted economic costs are summarized as presented in table below.

Table 10.5: Prices of Vehicles

Category	Vehicle (Rs.)	Tyre (Rs.)
2 Axle Truck	2000000	15000
3 Axle Truck	2500000	20000
Multi Axle Truck	3500000	25000
LCV	1000000	10000
Bus	2500000	13500
Car / Jeep / Van	750000	7500
Two-Wheeler	55000	2000

10.4.2.2 Fuel & Lubricant

Economic Prices fuel and lubricant are arrived based on ratio of WPI for all commodities of June 2020 with respected to March 2009 and applying that ratio to search out actual value.

Table 10.6: Economic Cost of Fuel & Lubricants

Item	Price/ litre as per SP 30:2009 without taxes	WPI Ratio	Present Cost/ litre
Petrol	18.55	4.28	79.39
Diesel	18.20	3.81	69.34
Lubricants	56.70	4.05	229.6

10.4.2.3 Maintenance Labour and Crew Wages

Adopted values for Maintenance Labour and Crew Wages are based on the enquiries made by the Consultant with transport operators and workshops in and around the project Road. The adopted values are summarized vide in table below.

Table 10.7: Labour and Crew Wages

(Cost in Rs. per hour)

Category	Maint. Labour	Crew Wage
Truck	250	250
3 Axle and Multi Axle Truck	250	450
LCV	250	200
Bus	250	400
Car / Jeep / Van	250	200
Two-Wheeler	250	-

10.4.2.4 Annual Overhead

Recommendations of the "Study for Updating Road User Cost Data: 2001"and IRC SP: 30-2009 are considered to arrive at annual overhead cost per vehicle and are summarised in table below:

Table 10.8: Annual Overheads

Category	Annual Overhead Cost (Rs.)
2 Axle Truck	192500
3 Axle and Multi Axle Truck	258000
LCV	128000
Bus	155000
Car / Jeep / Van	80000
Two-Wheeler	6624

10.4.2.5 Annual Interest

An Economic Interest Rate of 12% has been adopted for the analysis.

10.4.2.6 Time Value of Passengers

Time Value of Passenger (Work Trips and Non-Work Trips) is arrived based on "Manual of Economic evaluation of Highway Projects in India (" IRC SP:30 -2009)". The values of 2009 are upgraded by considering Wholesale Price Index Ratio for the year 2009 and 2015. Non work time value of passenger is considered 15% and work time value of passenger is considered 85 % of time value of passengers as suggested in IRC SP:30 -2009". The adopted values are summarized as given in table below.

Table 10.9: Time Value of Passengers

Mode of Travel	Unit	2-Wheeler	Car/ Taxi	Bus
Travel time Value RUCS-March 2009	Rs/Hour	62.5	32.0	39.5
WPI Ratio 2010/ 2009	-	1.156	1.156	1.156
Travel time Value RUCS-august2010	Rs/Hour	31.0	61.0	39.0
Eq. Non-work Time Value in 2010	Rs. /Hour	5.5	10.8	6.8

10.4.2.7 Time Value of Cargo

Average value of commodity is based on "Manual of Economic evaluation of Highway Projects in India (" IRC SP: 30 - 2009)". Equivalent cost of commodity in 2010-2011 is determined using the WPI ratio (1.156 over 2009). Average payload for each category of freight vehicles is based on axle load survey. Time-delay cost is estimated with an economic interest rate of 12% and economic conversion factor of 0.90 and provided in table below:

Table 10.10: Time Value of Cargo

Vehicle Category	Average Payload (Tonnes)	Average Running Time (hour/Year)	Time-delay Cost (Rs./Hr)
2Axle Truck	15	1950	32.00
3 Axle and Multi Axle Truck	17	2100	55.00
LCV	8.25	1050	19.0

10.4.3 HDM Traffic

Following category of fast moving and slow-moving vehicles are considered for carrying out HDM 4 Analysis.

- 2 Axle Truck
- 3 Axle Truck

- Multi Axle Truck
- LCV
- Bus
- Minibus
- Car / Jeep / Van
- Two-Wheeler

As HDM-4 does not include 3-Wheeler and Agricultural Tractor Categories of Vehicle therefore these categories are not considered in the analysis. Percentage compositions of assigned traffic in AADT on the project road as on year 2019 and adopted for the analysis for the Project road are summarized as given in table below.

Table 10.11: Composition of Motorized Traffic assigned on Project road (%)

Section ID	2-Wheeler (PCU)	Passenger Car + Jeep	3-Wheeler	Bus	LCV	2-Axle	3-Axle	Cycles	AADT (PCU)
PT	428	1445	40	53	114	170	14	43	2307

Adopted traffic growth rates as per traffic analysis is Presented in **Table10.12.**

Table 10.12: Traffic growth Rate of Motorized Traffic assigned on Project road (MT) (%)

Sr. No.	Period	Two Wheelers	Cars/jeeps	Buses	Trucks			LCV and Mini LCV
					2 Axle	3 Axle	M Axle	
1	Up to 2020	10.0	10.0	5.0	5.0	5.0	5.0	10.0
2	2021 -2025	9.0	9.0	5.0	5.0	5.0	5.0	9.0
3	2026 – 2030	8.0	8.0	5.0	5.0	5.0	5.0	8.0
4	2031 – 2035	7.0	7.0	5.0	5.0	5.0	5.0	7.0
5	Beyond 2035	6.0	6.0	5.0	5.0	5.0	5.0	6.0

10.5 Economics Internal Rate of Return

Economic Analysis has been carried out for construction option discussed above. Variables considered in for economic analysis of the project are volatile and depend on various factors. In general, in case of economic analysis is also recommended that analysis period should not be long as it may lead to erroneous results.

However, in order to be able to draw the conclusions on common platform Economic Analysis have also been carried out for 30 years of analysis period. The summary of Economic internal rate of return (EIRR) worked out, for construction option based on life cycle cost analysis is presented below.

The Economic Analysis Summary with time savings (By Alternative) is presented vide **Annexure 10.**

The EIRR and NPV at 12% discount rate for each construction package as worked out with and without benefits due to travel time savings are summarized as under:

Table 10.13: Results of Economic Analysis

Homogeneous Sections	Option	Net Economic Benefit (NPV @ 12%)	Economic Internal Rate of Return (12 %)
Khellani - Chhatroo	With time saving	-47.97	8.8

10.6 Sensitivity Analysis

The Sensitivity analysis has been carried out in order to study the viability of the project against the uncertainties in traffic forecasting and the possible variations of project cost due to unforeseen reasons. The sensitivity analysis has been performed with following situations.

S1: Base cost plus 15% and Base Benefits
S2: Base cost and Base Benefits minus 15%
S3: Base cost plus 15% and Base Benefits minus 15%
The analysis has been done by changing the cost and benefit streams independently as well as in combination. The end results of this study have been summarised below:

Table 10.14: Results of Sensitivity Analysis

Option	Economic Internal Rate of Return (%)		
	S1	S2	S3
With time saving	7.91	7.45	6.48

10.7 Conclusion

Since the IRR is 8.8 % that is less than the market interest rate and present NPV @ 12% is also negative (-47.97). The project is not recommended for BOT mode and hence EPC mode can be adopted.

Chapter 11

Financial Analysis

11.0 FINANCIAL ANALYSIS

Financial Study is carried out for **Khellani - Chhatroo** project road from design km 31+449 to km. 51+700 (Package-1).

This section has **20.251 Km** proposed length. The commercial viability is assessed for **20 years** concession period by making financial analysis (BOT / Annuity analysis) as given below.

Alternative I - Construction Cost – 245.39 Crores.

For above alternatives viability has been assessed for all possible modes i.e. EPC, BOT & PPP.

11.1 Approach

The viability of any EPC/ BOT / Annuity package depends on working cash flows available to service the debt and equity. This working cash flow is basically dependent upon the following:

a) Capital Cost

b) Traffic Forecast

c) User fee Structure

d) Operation and Maintenance expenses

e) Interest on Debt

f) Tax

Infrastructure projects are typically capital intensive and are characterised by long payback periods. To look at such projects on a commercial format, it becomes necessary to adopt measures, which significantly improve the financial viability of the project. Such steps include optimising capital costs and drawing up a user fee structure based on benefit analysis and revenue optimisation principles.

In this ultimate analysis, the extent to which such projects raise non-budgetary resources depend on the ability of the project to service investments at commercial terms. Presently, average returns on equity are structured to range from 12% to 13% per annum on an IRR basis. Likewise, debt instruments placed with financial institutions provide an average return of around 9% to 12% per annum. To raise the resources for such project, it is necessary that the project is expected to give the lucrative returns at healthy debt-equity ratio.

The main objective of Financial Analysis is to examine the viability of implementing the project on a BOT / PPP basis. The analysis attempts to ascertain the extent to which the investment can be recovered through toll revenue and the gap, if any, be funded through Grant / Subsidy. This covers aspects like financing through debt and equity, loan repayment, debt servicing, taxation, depreciation, Annuity etc. The viability of the project is evaluated on the basis of Project FIRR (Financial Internal Rate of Return on total investment). The FIRR is estimated on the basis of cash flow analysis, where both costs and revenue have been indexed to take account of inflation. Financial analysis has been carried out for debt equity ratio of 70:30.

11.2 Capital Cost

The construction is expected to be executed completely in 30 months; year-wise progress will be 20 % in first year, 50% in second year and 20 % in last 6 months. The civil construction cost for the project road is considered as base cost. The construction is expected to be executed completely in 30 months; year-wise progress will 20 % in first year, 50% in second year and 20 % in last 6 months. Total Project cost showing these additional provisions are tabulated below:

Table 11.1: Phasing of Cost

Section	Proposed Length (km)	Base Cost (Rs.)	Phasing of Cost
Khellani - Chhatroo	20.251	302.56	20% in first year, 50% in second year and 20% in 6 months.

11.2.1 Cost Escalation

The price escalation has been considered as 5 %.

11.2.2 Project Cost

In base construction cost, provision for physical contingency (2.8% of the base construction cost) has been made to arrive at the Engineering procurement cost (EPC). In addition to the above, a provision of 3% Agency Charges, 0.25% Quality Control Charges, 0.25% Road Safety Charge, 3% Supervision Charges and 5% Escalation charges per annum on total cost have been made to get the project cost.

This financial implication increases the Total Project Cost by approximately 25% of Civil Construction Cost.

Sr. No.	Item of Works	Cost (cr.)
A	Civil Works Cost with 12% GST	**274.83**
B	Total Project Cost	**394.57**

11.3 Operation and Maintenance Costs

No maintenance charges shall be paid for the first year; 0.50 % of the Contract Price each for the second, third and fourth year; and 1% of the Contract Price for the fifth year.

11.4 Project Revenue

Infrastructure project like Highways are generally having two types of revenue generation.

- Toll Revenue
- Advertisement Revenue

11.4.1 Toll Revenue

11.4.1.1 Basic Toll Rates

In assessing the financial viability of a user fee model road project, the willingness of people to pay user fees is a key issue. The standard approach to this issue is to estimate the generalised or perceived cost of trip making. To standardise the toll structure MORT&H has recommended that basic rate per km for National Highways are adopted for analysis purpose.

Table 11.3: Official Toll Rates

Vehicle Type	Base rate of fee per km for the base year 2007-08 (in Rupees)
Car	0.65
MINI-BUS/LCV	1.05
Bus/ 2 axle	2.20
3 - Axle	2.40
MAV (four to six axles)	3.45
Oversize Vehicle (seven or more axles)	4.20

The base rates given in **Table 11.3** shall be increased without compounding by three percent each year and such increased rate shall be deemed to be the base rate for next year. Such applicable base rate shall be revised annually to reflect the increase in wholesale price index; but restricted to forty percent of the increase in wholesale price index.

The toll rates are allowed with 10% inflation at every two years interval and shall be rounded off to nearest 5 rupees. User fees are revised once in every two years.

11.4.1.2 Location of Toll Plazas

There is no toll plaza proposed in this stretch.

11.4.1.3 Traffic Assumptions and Forecast

Light vehicles especially Two/Three wheelers and slow-moving vehicles are exempted from user fee as per guidelines for toll roads. Toll able traffic has been assessed leaving slow moving and light vehicles except light commercial vehicles, car, minibuses, trucks and Tractor with trailers.

11.4.1.4 Concession Period

The guiding principle for determining project specific concession period is the carrying capacity of the respective highway at the end of the proposed concession period. As such, the concession period is proposed based on volume of present and projected traffic. In other ways concession period ends in the year when capacity of respective highway exhaust to cater project traffic volume.

Table provided below shows existing traffic and the year when traffic exceeds the capacity of the highway, calculated for "**Level of Service B** (LOS B) and warrants capacity augmentation.

Lane Capacity and Augmentation Required for the Project Corridor

Homogenous Section	LOS B	LOS C
	2-Lane with Paved Shoulder	2-Lane with Paved Shoulder
Khellani - Chhatroo (Ch. Km 31+449 to Km 51+700)	2020	2021

It is revealed from the capacity analysis results; the project road requires **2 lanes with paved shoulder** for capacity augmentation and efficient movement of traffic up to project common concession period of 20 years i.e. horizon year 2042.

11.4.2 Advertisement Revenue

The advertisement has been not recommended on the project road due to safety concern to the road users. So, revenue generation from the advisement is not taken into consideration for this project.

11.5 Financial Model Input and Analysis

11.5.1 Grant and Its Treatment

It shall be equal to the sum specified in the bid and as accepted by the authority but in no case greater than the equity and shall be further restricted to a sum not exceeding 40% of TPC i.e. maximum 40% of TPC (Total Project Cost). It shall be due and payable to the Concessionaire as per PPP guidelines. Further it shall be disbursed proportionately along with the loan funds. For analysis, VGF of 25% have been adopted to ensure minimum 12% IRR.

11.5.2 Proposed Sources of Finance

In general, the developer shall crystallize the sources of finance by optimizing his equity returns keeping in view the project cash flows, terms, and conditions of various financing options available. Further the market standing, and financial strength of the Developer would largely determine the terms and conditions of finance offered to the Developer by various lending agencies. For the study, following sources of finance have been taken:

- Equity: To be provided by the Developer
- Subsidy / Grant for viability of funding, to be provided by the client.
- Debt: To be arranged by the Developer / Concessionaire

11.5.3 Expenses

Expenses can broadly be classified based on the phases in which they are incurred, viz. construction period expenses and operation & maintenance period expenses.

11.5.4 Construction Period Expenses

- Preliminary and pre-operative expenses
- Contingency allowance
- Interest during construction period

- Finance Charges

11.5.5 Operation and Maintenance Period Expenses

- Toll collection expenses
- Administrative expenses for day-to-day operation including insurances
- Maintenance expenses, which include routine and periodic maintenance
- Interest expenses incurred for servicing term loans
- Tax

11.5.6 Financial Viability

To assess whether the project is a profitable proposition, the returns to investors are measured by the post-tax project FIRR and the equity FIRR, which is estimated from the cash-flow statements, based on discounted cash-flow technique. The returns expected by the investors are a function of the value of equity issues on the Indian stock Markets, Interest rates on commercial loans, the risk profile of the investment and alternative investment opportunities. To qualify the project in terms of attractive financial returns, the following criteria are adopted:

- Post tax IRR on Project Investment : minimum 12%
- Post tax IRR on Equity : minimum 12%
- DSCR : >1.0
- BCR : >1.3
- NPV @ 12% : must be positive

11.5.7 Findings of Financial Analysis

With the assumptions already stated above the financial analysis for the project corridor has been undertaken. The results of financial analysis have been presented in Annexure 10 for BOT and EPC option

11.6 Recommendation & Conclusion on Type of Financing

- ❑ Project road section is financially not viable based on the forecasted traffic and MORT&H user fee with 25% government subsidy and maximum concession period of 20 years
- ❑ Therefore, the project road is being proposed under EPC mode of construction.

Chapter 12

Conclusion and Recommendations

12 Conclusion and Recommendations

12.1 General

Given the needs of the project to adequately address the concerns of the local population and latest IRC guidelines, the project has been conceived with the provision of viaducts at Premanagar & Chattroo village and project facility like bus stops etc. completely integrated into the project wherever required. Looking at the peculiarity of soaring prices around the highways for which the widening works are in progress, the aspect of acquisition of wider land strip or formation of bypasses/realignment has been examined wherever feasible.

12.2 Project Clearances

Following clearances are required before the commencement of construction work. Out of these, few are critical and need to be obtained immediately to avoid the time lag at later date.

Table 10.1: Project Clearances

Sr. No.	Item	Agency
1	Forest Clearance	Jammu and Kashmir Forest Department
2	Pollution Clearance -No Objection Certificate (NOC) (Exempted)	Jammu and Kashmir State Pollution Control Board
3	Shifting of services and utilities including underground water pipeline sewerage line and optical fibre cables	BSNL, BSEB, Public Health Engineering department, Optical fibber cable operator
4	Clearance for cutting trees and transporting	Forest Department, Department of Horticulture
5	Dismantling of structure falling within right of way	Competent Land Acquisition Authority

12.3 Recommendations

Based on the lane capacity analysis results, the project road requires 2 lanes with paved shoulder for capacity augmentation and efficient movement of traffic up to project common concession period of 20 years i.e. horizon year 2049.

The project road can be improved without causing significant adverse environmental impacts to the natural, social, economic, or cultural environments.

The process of land acquisition is under progress i.e. ground verification works are under progress based on widening schedule.

The construction time for Package I, III & V is 24 months period and for Package II & IV is 30 months with strategic planning and through five construction packages. The construction work may begin from January 2021. The estimated basic cost is given below table

The estimated basic cost is given below table

Section	Proposed Length (km)	Base Cost in Crore (Including GST)	Base Cost in Crore (Including Centages)
Package-I Design CH. km 31+449 to Km 51+700	20.251	274.83	302.56