National Highways & Infrastructure Development Corporation Ltd.

"Consultancy Services for Preparation of Feasibility Report cum Detailed Project Report (DPR) for Widening/ Up-gradation to 2 lanes of NH-301(Kargil – Zanskar Road) in the State of Jammu & Kashmir"

Volume-I Main Report

(Section from Km 0.000 to Km 30.040)

March - 2021

Feedback Infra Pvt. Ltd.
10th Floor, Building 10, Tower - C,
DLF Cyber City Phase - II,
Gurgaon – 122002
NCR – Haryana, INDIA
Tel.: +91 124 4169100
Website: www.feedbackinfra.com

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highways and Transportation Officials
ADB	Asian Development Bank
ADT	Average Daily Traffic
BBD	Benkelman Beam Deflection
BM	Bituminous Macadam
BOQ	Bill of Quantities
CBR	California Bearing Ratio
CD	Cross Drainage
DPR	Detailed Project Report
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMP	Environmental Management Plan
ESA	Environmental and Social Assessment
FMC	Field Management committees
GPS	Global Positioning System
GSB	Granular Sub-Base
ICB	International Competitive Bidding
IMD	Indian Meteorological Department
IRC	Indian Roads Congress
IS	Indian Standard
MoEF	Ministry of Environment and Forests
MoRTH	Ministry of Road Transport & Highways
NGOs	Non-Government Organizations
NPV	Net Present Value
NSEW	North-South East-West
OD Survey	Origin Destination Survey
ONGC	Oil & Natural Gas Corporation
PAP	Project Affected Person
PCU	Passenger Car Units
PIA	Project Influence Area
PWD	Public Works Department
QAP	Quality Assurance Plan
RAP	Resettlement Action Plan
R & R	Resettlement and Rehabilitation
RCC	Reinforcement Cement Concrete
ROW	Right of Way
RUCS	Road User Cost Study
SDBC	Semi Dense Bituminous Concrete
SPM	Suspended Particulate Matter
TBM	Temporary Bench Mark
TOR	Terms of Reference
VOC	Vehicle Operating Costs

0 EXECUTIVE SUMMARY

0.1 INTRODUCTION

Good transportation systems are lifeline to the area they serve. Roads bring about all-round development in the region. A good road network helps in the success of all development activities, be it in the sphere of movement of people and goods, agriculture, commerce, education, health, and social welfare, or even maintenance of law and order and security.

As a part of the study to establish the viability of the project, a DPR is to be prepared after carrying out detailed engineering surveys and appropriate assessment of a preliminary design considering the engineering conditions, the present traffic and its growth, the environmental impact assessment as well as the social aspects along with cost assessment.

0.2 THE PROJECT ROAD

The work for consultancy services for Feasibility Study cum Detailed Project Report for Widening/Up-gradation to 2 Lane with paved shoulder of NH-301 from km 0.000 (Design Chainage Ch. 0.000) to km 234.000 (Design Chainage Ch. 230+020) (Kargil – Zanskar Road) in the State of Jammu & Kashmir was awarded to M/s Feedback Infra Pvt. Ltd.

The existing alignment of Project Highway with total length 234 kms (Design Length is 230+020kms) is passing through Kargil district of Jammu and Kashmir state. The entire Project Highway passes through mountainous and steep terrain. At present there are many horizontal sharp curves at frequent intervals on Project Highway. Also, there are many vertical curves with very steep gradients.

The Project Highway starts at Kargil at km 0.000 (Design Chaiange is Ch. 0.000) and ends near Zanskar at km 234.000 (Design Chaiange Ch. 230+020). It passes through the district of Kargil, and passing through important villages/towns like Minjigum, Salaskot, Lankacherry, Sanku, Purtikche, Panikhar, Thangol, Parkachik, Zhuldo, Rangdum, Chibra, Skygam, Phe, Tungri, Sani, Padum, and Zanskar

0.3 CONSTRUCTION PACKAGING

The entre project road is divided into Eight construction packages and one separate package is prepared for Land Acquisiton, Trees, Utility Shifting and Structure/Builidng Compensations. Total 8 Packages are proposed, and the details are given in **Table 0.1.**

Table 0.1.Summary of Proposed Construction Packages

Package No	Design Chainage (Km)		Design Length (Km)	Exisitng Chainage (Km)		Existing Length (Km)	Proposed Lane Configuration
	From	To		From	To		
1	0.000	30.040	30.040	0.000	30.000	30.000	2-Lane +PS
2	30.040	57.000	26.960	30.000	57.905	27.905	2-Lane +PS
3	57.000	87.000	30.000	57.905	88.249	30.344	2-Lane +PS
4	87.000	98.524	11.524	88.249	105.000	16.751	Intermediate lane + ES

Package No	Design Chainage (Km)		Design Length (Km)	Exisitng Chainage (Km)		Existing Length (Km)	Proposed Lane Configuration
	From	To		From	To		
5	98.524	117.180	18.656	105.000	115.000	10.000	Intermediate lane + ES
6	117.180	148.320	31.140	115.000	150.000	35.000	Intermediate lane + ES
7	148.320	196.250	47.930	150.000	194.790	44.790	Intermediate lane + ES
8	196.250	230.020	33.770	194.790	231.692	36.902	2-Lane +PS
			230.020			**231.692**	

As per MoRTH circular *No.NH·12014/1234/2017 I* J&K/Zone-11, the proposal for Project road from km 0.000 to 87.000 is 2 Lane with paved shoulder and from km 196.250 to 230.000 is 2 lane with paved shoulder.

0.4 SOCIO-ECONOMIC PROFILE OF THE PROJECT INFLUENCE AREA

Jammu and Kashmir is the state in northernIndia. It is located mostly in the Himalayan Mountains, and shares a border with the states of Himachal Pradesh and Punjab to the south. Jammu and Kashmir (J&K) has an international border with China in the north and east, and the Line of Control separates it from the Pakistani-occupied territories of Kashmir and Gilgit–Baltistan in the west and northwest respectively.

The state of J&K is drained by the mighty Indus and its tributaries like Kishan-Ganga, Jehlum, Chenab and Ravi and their tributaries. Out of these, the Indus and the river Chenab have their origins to the north of the greater Himalayas, and they pierce through the main ranges of Himalayas.

J&K consists of three distinct regions – Kashmir valley, Jammu, and Ladakh.

The regions of state Jammu, Kashmir and Ladakh have distinct agro climatic characteristics and cultural identity. Ladakh is situated in eastern mountain range of Kashmir. This is one of the highest ranges in the world. It is cold desert receiving very little precipitation. The temperature remains below the freezing point during winter due to its high altitude when people often remain indoors. Drass in Ladakh is the coldest place of the state. It has recorded the temperature of -50°C during winter. During the short period of summer season, the scorching heat of sun often causes sunburns.The area and population of the three regions is as given in**Table 0.2.**

Table 0.2. Population details of Three Regions

Region	Areas (Sq. Miles)	Population (2011 census) (Provisional)
Kashmir Valley	8,639	5,35,0811
Jammu Region	12,378	69,07,623
Ladakh Region	33,554	2,90,492
Total	**54,571**	**1,25,48,926**

Whereas, in 2011 Kargil district had population of 140,802 of which male and female were 77,785 and 63,017 respectively. In 2001 census, Kargil had a population of 119,307 of which males were 64,955 and remaining 54,352 were females. Kargil has a sex ratio of 775 females per every 1000 males, and a literacy rate of 74.49%.

There was change of 18.02 percent in the population compared to population as per 2001. In the previous census of India 2001, Kargil District recorded increase of 33.55 percent to its population compared to 1991.

The district has a population density of 10 inhabitants per square kilometer (26/sq mi). **Table 0.3** given below shows the growth of the economy of J&K State viz-a-viz National level at current and constant (2004-05) prices.

Table 0.3.Growth Details of the Economy of J&K State

Year	2004-05	2009-10	2010-11	2011-12	2012-13	2013-14
GSDP of J&K (Rs. in lakh)	2730462	4838451	5807257	6575852 (QE)	7557431 (QE)	8731872 (AE)
GDP of India (Rs. in lakh)	297146400	610890300	724886000^	839169100@	938887600*	----
% contribution of J&K to India	0.92	0.79	0.80	0.78	0.80	----
Per capita GSDP of J&K (Rs.)	25478	42052	49809	55699	63232	72188
Per capita GDP of India (Rs.)	27286	52213	61120	69814	77148	----
Growth rate J&K (%age)	----	14.34	20.02	13.24	14.93	15.54
Growth rate India (%age)	----	15.2	18.7	15.8	11.9	----

QE: Quick Estimates, AE: Advance Estimates,
** Ist Revised Estimates, @ IInd Revised Estimates, ^ IIIrd Revised Estimates*

0.5 TRAFFIC SURVEYS, ANALYSIS AND FORECASTS

Traffic at km 35.000 (Lankerchen) and km 215.000 (Padum) of Project Highway is the maximum. This traffic is mainly due to the presence of settlements in close vicinity of the two locations. We see a downslide in traffic in between the two points. Summary of Traffic details (ADT & AADT) are given in **Table 0.4.**

Table 0.4.Summary of Traffic details (ADT & AADT)

Location	ADT		AADT	
	Nos.	PCUs	Nos.	PCUs
km 35.000	630	833	570	755
km 45.000	235	289	213	261
km 60.000	95	201	90	196
km 120.000	81	169	76	164
km 185.000	65	110	59	100
km 208.000	135	239	122	218
km 215.000	911	1097	824	1004

Traffic forecasts made by determining the past trend of traffic flow along the Project Highway and by use of economic models developed to co-relate past vehicle registration data and economic indices such as per capital income (PCI), net state domestic product (NSDP) and gross domestic product (GDP). By using the elasticity values obtained from the economic models and the likely rate of growth of indicators, the mode wise growth rates are obtained. By applying these growth rates, future traffic volumes, in numbers as well in PCUs, are estimated as shown in **Table 0.5 and Table 0.6.**

Table 0.5.Projected Traffic in Numbers by Locations

Location	2015-16	2020-21	2025-26	2030-31	2035-36	2040-41
km 35.000 (Shankoo)	570	1012	1382	1792	2228	2776
km 45.000 (Sangra)	213	498	682	885	1100	1369
km 60.000 (Panikhar)	90	311	418	535	658	811
km 120.000 (Rangdum)	76	291	392	504	620	765
km 185.000 (Abran)	59	273	374	486	603	751
km 208.000 (Phe)	122	363	498	649	810	1013
km 215.000 (Padum)	824	1376	1876	2437	3038	3796

Table 0.6.Projected Traffic in PCUs by Locations

Location	2015-16	2020-21	2025-26	2030-31	2035-36	2040-41
km 35.000 (Shankoo)	755	1258	1690	2163	2657	3275
km 45.000 (Sangra)	261	566	769	991	1222	1511
km 60.000 (Panikhar)	196	437	566	707	875	1040
km 120.000 (Rangdum)	164	398	517	648	787	957
km 185.000 (Abran)	100	330	448	577	713	883
km 208.000 (Phe)	218	489	656	841	1035	1278
km 215.000 (Padum)	1004	1575	2094	2672	3287	4059

Projected sectional PCUs were compared with design service volume. The design service volume for Project Highway is considered at the end of LOS 'B' and capacity augmentation is suggested for road sections, which carry traffic volume more than design service volume.

As per the traffic requirements the Project Highway requires capacity augmentation from 2-Lane with paved shoulder in the year 2020-21. The capacity augmentation is proposed with respect to the traffic at km 215.000.

As per Ministry vide circular No. NH-15017/28/2018-P&M dated 15th December, 2020, For roads in hilly and mountainous terrain which act as feeder roads to the Indo-China border or are of strategic importance for national security, the carriageway width should be 7m with 1.5m paved shoulder on either side.

Further, as per meeting held at NHIDCL, HQ regarding Kargil – Zanskar road on 24/12/2020, It is recommended to upgrade the entire project road to 2 lane with paved shoulder facilities.

0.6 ENGINEERING SURVEYS AND INVESTIGATIONS

0.6.1 Inventory and Condition Surveys

The existing carriageway of the Project Highway from km 0.000 (Desing Chaiange Ch. 0.000) to km 234.000 (Design Chaiange is Ch. 230+020) has intermediate lane and single lane carriageway with earthen shoulder configuration except in initial 1.60 kms in Kargil town where it is 2-Lane with paved shoulder carriageway configuration with existing Right of Way (ROW) varying from minimum 4.50m to maximum 10.00m. Propsoed bypass for Kargil City from existing km 0.000 to km 3.368.

Land use along the road is mainly agricultural with some stretches of built up areas near the towns/ villages along the Project Highway. The existing pavement is flexible type. The riding quality of the pavement is poor to very poor.

The complete all packages of existing Project Highway has total 28 numbers minor bridges, 935 culverts and 30 causeways. As none of those meets design standards and specifications therefore proposed to be dismantled and reconstructed.

There are 45 minor junctions along the existing Project Highway, all need to be properly developed.

0.6.2 Pavement Condition Surveys

Out of total 234 kms length only 79.20 kms carriageway is having bituminous layers with Good to Very Poor pavement conditions. And out of 79.20 kms length 84.09% is in very good condition, 0.38% in good condition, 1.70% in fair condition, 3.60% in poor condition and 10.29% in very poor condition. The summary of pavement condition is given **Table 0.7.**

Table 0.7.Summary of Existing Paement Condition of the Project Road

Summary	Length (km)	% of Total Length
Excellent to Very Good	66.60	84.03
Good	0.30	0.38
Fair	1.35	1.70
Poor	2.85	3.60
Very Poor	8.15	10.29
Total	**79.2**	**100.00**

The condition of gravel/ non-bituminous stretches of Project Highways that is of 154.8 kms is also in very poor conditions.

0.6.3 Pavement Investigations

The characteristic deflections of total 79.20 kms length of the Project Highway vary between 1.287 mm to1.949 mm while the BI values vary between 719 mm/km to 2701mm/km and corresponding IRI values vary between 1 and 4.

0.6.4 Sub-grade Investigations

The pavement composition of the existing pavement is bituminous and base course only. The wearing coat (Bituminous) varies from 20 mm to 150 mm, base course varies from 78 mm to 230 mm and sub-base varies from 90 mm to 250mm .

0.6.5 Soil and Materials Investigations

Number of sources of natural soil deposits, moorum, gravel, sand, and potential quarries for production of crushed rock aggregate to be used in the construction of highway pavement layers and structures were located and surveyed. The quality of earth, aggregates stone and sand are satisfactory as per laid down specifications. Identified potential soil borrow sources have confirmed the availability of suitable soil at number of locations along the Project Highway. The identification of borrow areas were done mainly through local inquiries and contacting the villagers and local panchayat bodies. For each identified borrow area, an assessment of the available quantity of suitable soil is made taking due consideration of over burden and weathered rock segments. All relevant information such as ownership of the land, present condition, and average lead of the area from project road, possible rehabilitation and utilization of the land after excavation are being assessed and documented.

Investigations to identify potential gravel and crushed granular sources have confirmed the availability of suitable granular material at number of crushers and hilly portion along the Project Highway. For each identified area an assessment of the available quantity of sub base is made taking due consideration of over burden and weathered rock segments. All relevant information such as ownership of the land, present condition, and average lead ofthe area from project road, possible rehabilitation and utilization of the land after excavation are being assessed and documented. The availability and quality of material as coarse aggregate was explored and crushed stone.

0.6.6 Hydrological Investigations and Studies

Although stream is lying in the hilly terrain but due to non channalized flow through the stream hydrological calculations are carried out to fix the discharge and the soffit level of superstructure as per hydrological studies, the new structure are proposed to take care of the water overflowing the road.

0.7 DESIGNS STANDARDS AND ENGINEERING DESIGNS

0.7.1 Design Standards

Standards and specifications as provided in" IRC: SP: 73 – 2015 (First Revision) – "Manual of Specifications & Standards for Two Laning of Highways with Paved Shoulder" and IRC: SP: 48 – "Hill Road Manual" have been adopted.

0.7.2 Geometric Design Standards

The indicative design standards for geometric design of main carriageway are illustrated in **Table 0.8.**

Table 0.8.Summary of Geomteric Design Standars Considered for the Project road

S. No.	Parameter	Value		
		For 2-Lane	For Intermediate Lane	Standard / Code Reference
1	**Design Speed**			IRC : SP-48-1998
	(i) on Mountainous – ruling	50 kmph	50 kmph	
	(ii) on Mountainous – minimum	40 kmph	40 kmph	
	(iii) on steep terrain – ruling	40 kmph	40 kmph	
	(iv) on Steep – minimum	30 kmph	30 kmph	
2	**Cross Section**			IRC : SP-48-1998/ IRC: SP: 73 – 2015
	(i) Carriageway	2x3.5 = 7.00m	5.500 m	
	(ii) Paved shoulder	Not provided	Not provided	
	(iii) Cross slope:			
	Main carriageway and Paved shoulders	2.50%	2.50%	
	Unpaved/ Earthen Shoulders	3.00%	3.00%	
3	**Horizontal Alignment**			
3.1	Superelevation			IRC : SP-48-1998
	In snow bound areas	Max. 7%	Max. 7%	
	Hilly areas not bound by snow	Max. 10%,	Max. 10%,	
3.2	Minimum Curve Radius			IRC : SP-48-1998
	(i) In snow bound areas (hills) (ruling)	60 m	60 m	
	(ii) In snow bound areas (hills) (minimum)	33 m	33 m	

S. No.	Parameter	Value		
		For 2-Lane	For Intermediate Lane	Standard / Code Reference
	(iii) Hilly areas not bound by snow(ruling)	50 m	50 m	
	(iv) Hilly areas not bound by snow (minimum)	30 m	30 m	
3.3	Radius of curve beyond which transition is not required			IRC : SP-48-1998
	On mountainous ruling	450m	450m	
	On mountainous minimum	280m	280m	
	On steep terrain-ruling	280m	280m	
	On steep terrain-minimum	160m	160m	
4	**Vertical Alignment**			
4.1	Longitudinal Gradient			IRC : SP-48-1998
	(i) Ruling	5% (1 in 20.0)	5% (1 in 20.0)	
	(ii) Limiting	6% (1in 16.7)	6% (1in 16.7)	
	(iii) Exceptional	7% (1 in 14.3)	7% (1 in 14.3)	
4.2	Minimum Vertical Curve Length			IRC : SP-48-1998
	(i) up to 35kmph	15 m	15 m	
	(ii) up to 40kmph	20 m	20 m	
	(iii) up to 50kmph	30 m	30 m	
4.3	Maximum Grade Change not Required Vertical Curves			IRC : SP-48-1998
	(i) up to 35kmph	1.50%	1.50%	
	(ii) up to 40kmph	1.20%	1.20%	

S. No.	Parameter	Value		
		For 2-Lane	For Intermediate Lane	Standard / Code Reference
	(iii) up to 50kmph	1.00%	1.00%	
4.4	Stopping Sight Distance for Vertical Curve			IRC : SP-48-1998
	(i) up to 35kmph	40 m	40 m	
	(ii) up to 40kmph	45 m	45 m	
	(iii) up to 50kmph	60 m	60 m	
4.5	Design Standards for Hair pin bend curves			
	(i) Minimum Design Speed	19 kmph	20 kmph	IRC : SP-48-1998
	(ii) Minimum roadway width at apex	11.5 m for two lane	11.5 m for two lane	
	(iii) Minimum radius of the inner curve	14.0 m	14.0 m	
	(iv) Minimum length of transition curves	15.0 m	15.0 m	
	(v) Gradient			
	Maximum	0 in 40 (2.5%)	1 in 40 (2.5%)	
	Minimum	0 in 200 (0.5%)	1 in 200 (0.5%)	
	(vi) Super elevation	0 in 10 (10%)	1 in 10 (10%)	
Note:	• Due to the existing terrain where we could not provide the Transition curves, Superelevation will be applied as per IRC: 73 1980 section 9.3.3.			
	• Hair-pin bends, where unavoidable, have been designed either as circular curve with transition at each end, or as a compound curve			
	• Inner & outer edge of the roadway should be concentric with respect to the centre line of the pavement			

S. No.	Parameter	Value		
		For 2-Lane	For Intermediate Lane	Standard / Code Reference
	• Minimum intervening distance of 60 m shall be provided between the successive hair-pin bend to enable the driver to negotiate the alignment smoothly			
	• Due to the existing terrain where we could not provide the Transition curves, Superelevation will be applied as per IRC: 73 1980 section 9.3.3			
	At hair-pin bends, preferably, full roadway width should be surfaced			

0.7.3 Design Speed

The design speed shall be the minimum design speed of 50 kmph for Mountainous and Steep (Hilly) terrain except at hairpin bend locations where design speed has been restricted to 30 kmph.

Structural width for minor bridges/ flyovers/ road over Rail Bridge (ROB)

- An overall width of 12.0 m has been proposed for all the minor bridges with a clear carriageway and crash barrier of 0.5 m on both sides.

0.7.4 Alternative Options Study and Engineering Designs

1) Alternative Alignment Options Study of proposed Kargil town bypass.
   - Three alternative alignment options (Alt-1 to Alt-3) were developed for the proposed Kargil town bypass from existing km 0.000 (Desing Chainage Ch. 0+000) to km 3.368 (Design Chainage Ch. 3+500) and submitted to for the review/ approval. Alignment option Alt-3 was approved and followed in subsequent surveys and investigations and designs etc.

0.7.5 Local Villagers Representations:

It is pertinent to mention here that during LA many representations of different villages approached the higher authorities including MORTH for realigning small stretches so as to avoid their private structures and agricultural land which are coming under the proposed alignment. The various locations for which the Authority received representations are given as under:

1. Km 11.000 to 15.000
2. Km 18.000 to 25.000
3. Km 39.000 to 42.000
4. Km 44.000 to 49.000
5. Km 57.000 to 64.000

The above cases of realignment suggested by the locals shall be taken up for consideration during actual execution of project. The cost of the realignement sections shall also be within the present estimated cost. Hence, there may not any cost complications arise during the construction.

0.7.6 Pavement Designs

Pavement designs have been carried out for 20 MSA for the flexible pavements for the new alignment/ bypass/ reconstruction/ raising/ widening potions and overlay has been designed for the existing bituminous pavement in good condition sections. A design life of 20 years has been considered for the pavement design.

The proposed pavement composition for the project road is given in **Table 0.9.**

Table 0.9.Proposed Pavement Composition for the Project Road

Layer Composition	Proposed Flexible Pavement Design Details
Bituminous Concrete (BC)	40 mm
Bituminous Macadam (DBM)	115 mm
Wet Mix Macadam (WMM)	250 mm (In two layers of 125 mm each)
Granular Sub-base (GSB)	200 mm

Subgrade shall be desined minimum CBR of 5% for flexible pavement as well as for rigid pavement.

Rigid pavement is recommended from Km 88.000 to Km 98.000, which is a avalanche zone. The proposed rigid pavement design is given in **Table 0.10.**

Table 0.10.Proposed Rigid Pavement Composition for the Project Road

Layer Composition	Proposed Flexible Pavement Design Details
PQC	280 mm
DLC	150 mm
Granular Sub-base (GSB)	150 mm

Proposed Thicknesses for the Layers of Overlay

From km 3.368 (Design Chaiange Ch. 3.500) to km 57.000 (Design Chaiange is Ch. 56.874) on existing bituminous surfaces, where deflections are within permissible limits and reconstruction is not warranted, an overlay with 40mm BC and 115mm DBM has been proposed. The summary of proposed overlay sections is given in **Table 0.11.**

Table 0.11.Summary of Proposed Overlay Sections

Existing Chainage (Km)		Design Chainage (Km)		Design Length (Km)	MSA	Recommended Overlay Thickness		Remarks
From	To	From	To			BC	DBM	
3.358	3.688	3+450	3+780	0.330	20	40	115	
6.822	8.946	6+910	9+030	2.120	20	40	115	
9.421	9.751	9+500	9+830	0.330	20	40	115	

Existing Chainage (Km)		Design Chainage (Km)		Design Length (Km)	MSA	Recommended Overlay Thickness		Remarks
From	To	From	To			BC	DBM	
9.940	11.468	10+020	11+550	1.530	20	40	115	
17.594	19.941	17+660	20+000	2.340	20	40	115	
20.252	22.124	20+310	22+180	1.870	20	40	115	
37.172	39.842	37+130	39+780	2.650	20	40	115	
40.191	40.811	40+130	40+750	0.620	20	40	115	
230.499	234.000	228+822	230+020	1.220	20	40	115	Padum

0.8 IMPROVEMENT AND DEVELOPMENT PROPOSALS

0.8.1 Proposed Right of Way (PROW)

Proposed Right of Way (PROW) is kept 18.00m only to minimize adverse social and environmental impacts.

0.8.2 Roadway and Carriageway widths

For package- 1 from Design change 0.000 to 30.040 the roadway width shall be 10m which includes 7.00m main carriageway and 1.5m Paved Shoulder on both sides. 1.0 m Earthern Shoulder will be proposed based on the type of cross section either on bothsides or oneside. Typical cross sections presented attached in the Drawing Volume.

0.8.3 Improvement of the Existing Road Geometrics and Hairpin Bends

Where improvement of the existing road geometrics to the prescribed standards is not possible, the existing road geometrics have been improved to the extent possible within the given right of way and proper road signs and safety measures have been provided.

0.8.4 Proposed Bus-bays/ Bus-shelter

Pairs of Bus-shelters are proposed as per the recommendations contained in IRC: 80 – 1981 at 16 locations near to town/ villages along the Project Highway. The list of the proposed bus stops is given in Table 0.12.

Table 0.12.Proposed Bus Stops along the Project Road

Sl. No.	Design Chainage	Side (LHS/RHS)	Remarks
1	0+200	LHS	Bus Shelter
2	3+550	LHS/RHS (Both Sides)	Bus Shelter
3	7+000	LHS/RHS (Both Sides)	Bus Shelter
4	7+850	LHS	Bus Shelter
5	7+900	RHS	Bus Shelter
6	8+840	LHS	Bus Shelter
7	8+870	RHS	Bus Shelter
8	10+950	LHS	Bus Shelter
9	11+000	RHS	Bus Shelter
10	18+150	LHS	Bus Shelter
11	18+200	RHS	Bus Shelter
12	20+200	LHS	Bus Shelter
13	20+220	RHS	Bus Shelter
14	22+000	LHS/RHS (Both Sides)	Bus Shelter
15	25+150	LHS	Bus Shelter
16	25+220	RHS	Bus Shelter

0.8.5 Proposed Truckllaybyes

Pairs of Truck Laybyes are proposed as per the recommendations at 4 locations in the entire project near to town/ villages along the Project Highway. No Truck Laybye's are proposed in Package 1.

0.8.6 Proposed Rest Areas

Rest Areas with basic facilities such as toilets, telephones, cafeteria, Restaurant, parking for cars, buses and trucks, dormitory, rest rooms, shops for travel needs, fuel stations and garage, first aid, etc have been proposed. No Rest Area is proposed in Package 1.

0.8.7 At-Grade Major/Minor Intersections/ Junctions

There are no Major junctions proposed to be developed; the summary of major junctions is given in **Table 0.13.**

Table 0.13.Summary of Major Junctions along the Project Road

Sl. No.	Location (Km)		Side	Type of Junction	Cross Road Leads Towards
	Existing Chainage	Design Chainage			
Nil					

0.8.8 Minor Junctions

All existing 18 Nos. minor junctions, which are deficient, have been proposed to improve to the prescribed standards. The summary of minor junctions is given in **Table 0.14.**

Table 0.14.Summary of Minor Junctions along the Project Road

Sl. No.	Location (Km)		Side	Type of Junction	Cross Road Leads Towards
	Existing Chainage	Design Chainage			
1	0	0+000	RHS	Y	N.H 1D Junction/Bypass Start
2	3.368	3+459	LHS	T	Village
3	7.533	7.611	LHS	T	Chutuk Hydel Project Road
4	8.418	8.499	LHS	Y	Village
5	9.645	9.719	LHS	T	Village
6	9.837	9.907	RHS	T	Goma Minjee Road
7	10.663	10.739	RHS	T	Goma Minjee Road
8	17.467	17.529	LHS	T	Tambis Road
9	19.018	19.073	LHS	T	Village
10	19.185	19.239	LHS	T	Luncchay Village
11	19.640	19.700	RHS	T	Village
12	20.086	20.139	LHS	T	Village Lunday
13	20.546	20.599	LHS	T	G.M. Pore
14	21.217	21.269	LHS	T	Sadat Abad Road
15	21.528	21.579	LHS	T	Village
16	22.348	22.399	LHS	T	Village Saliskote
17	24.424	24.469	RHS	T	Village
18	24.660	24.709	LHS	T	Village

0.8.9 Structures

Summary of improvement/ development proposals of existing structures as well as proposed additional new structures, mainly minor bridges and box culverts of Package 1 from design chainage 0+000 to design chainage 30+040 is given in **Table 0.15.**

Table 0.15.Summary of Structure Proposals

S. No.	Type of Structure	Existing / New	Nos.	Development/ Improvement Proposals
1	Major bridge	-	-	-
2	Minor Bridge	-	-	-
3	Minor Bridge	New	1	1 no.New Construction of Minor Bridge
4	Slab Culverts	Existing	46	46 Nos. Slab Culvert to be proposed as Reconstructed.
5	Pipe Culverts	Existing	Nil	Nil
6	New Box Culverts	New	49	All New Culverts are proposed as Balancing culvert wherever it is required.
7	Causeways	Existing	1	1 No. Existing Causeway to be reconstructed to Minor Bridge.

0.8.10 Safety Features

Adequate safety measures have been proposed, primarily as listed below:

1) Crash barriers
2) Reflectors
3) Proper superelevation and radii of curvature
4) Traffic signage
5) Drainage
6) Seismic Stoppers for bridge structures
7) Zebra crossings for pedestrians in urban areas
8) Extra widening at curves
9) Speed breakers / rambler strips at hairpin bends to bring down speed to 20 kmph with proper advance warning signs
10) Pavement markings including edge markings at curves, etc.

The safety during construction shall be achieved by providing.

1) Signs (regulatory, warning and direction)
2) Delineators
3) Traffic cones and cylinders
4) Drums
5) Barricades and appropriate diversions
6) Flagmen

0.9 ENVIRONMENTAL SCREENING AND INITIAL ASSESSMENT

The Project Highway is a National Highway which though more than 100 Km but doesn't involves additional right of way greater than 40m involving land acquisition and hence is not a Category A project as per the MoEF EIA Notification of 22 August 2013 and its subsequent amendments. The project thus doesn't require a Prior Environmental Clearance.

As part of the project preparations, MoRT&H shall seek tree felling permission from the Divisional Forest Officer. The application for forest land shall also be processed and submitted to the Nodal Officer in the Forest Department.

The concessionaire and the contractor shall seek the following clearances, NOCs & licenses from the authorities prior to his work initiation:

1. NOC and Consents under Air, Water, EP Acts & Noise rules of SPCB for establishing and operating plants from SPCB
2. NOC under Hazardous Waste (Management and Handling) Rules, 1989 from SPCB
3. PUC certificate for use of vehicles for construction from Department of Transport
4. Quarry lease deeds and license and Explosive license from Dept. of Geology and Mines & Chief controller of explosives
5. NOC for water extraction for construction and allied works from Ground Water Authority

Apart from the above clearances, the concessionaire also has to comply with the

following:

1. Clearance of Engineer for location and layout of Worker's Camp, Equipment yard and Storage yard.
2. Clearance of Engineer for Traffic Management Plan for each section of the route after it has been handed over for construction.
3. An Emergency Action Plan should be prepared by the contractor and approved by the Engineer for accidents responding to involving fuel & lubricants before the construction starts.
4. Submit a Quarry Management Plan to the Engineer along with the Quarry lease deeds

0.10 SOCIAL IMPACT ASSESSMENT AND LAND ACQUISITION PLAN

Proposed alignment of the Project Highway has been finalized keeping mainly in view of:

1. Least requirements of land acquisition by limiting proposed ROW to 18.0m for the entire Project Highway,
2. Least structures/ property acquisition by proposing Kargil bypass,
3. Safety of the road users
4. Overall socio-economic development of the Project Influence Area in near future

Based on the initial public and community consultation the key social issues identified were:

1. Employment opportunity during civil works
2. Location of labour camp and hot mix plant sites
3. Location of dumping sites
4. Health issues, such as water borne diseases, HIV & STD
5. Safety issues
6. Impact on property and land acquisition
7. Resettlement Options

The estimated R&R budget is Rs 316.815 has been worked out based on PWD, Kargil rates.

0.11 COST ESTIMATION

The unit rates for each construction items have been arrived by using the "**Jammu & Kashmir Schedule of Rates (SOR): 2020**".

The input rates of Bitumen, Emulsion, Cement, Steel,have been taken from market rates and Plant, Machinery, Labour and other materials like Metal, Sand etc. have been taken from "Jammu & Kashmir SOR 2020". For items where rates are not available in SOR, the rates have been adopted as per previous experience of the consultant or on the present market rates.

The details of the different costs for the project are summarized in the **Table 0.16.**

Table 0.16.Summary of Cost Abstract

S. No	Description	Total Amount (Rs. in Cr.) Pkg -I
	Length (in Km.)	**30.04**
1	Road works incl. e/w, site clearance, sub base, bituminous courses & junctions	92,56,82,700
2	Drainage Works	28,12,68,877
3	Cross Drainage works (culverts)	10,33,78,265
4	Bridges	11,26,39,365
5	Traffic signs, road markings and other road appurtenanaces	10,60,12,905
6	Miscellaneous works including Truck lay bye, Bus Shelter and rest area.	1,88,62,760
7	Protection work (Breast Wall, Gabion Wall, Retaining Wall)	70,14,99,330
8	Special slope stabilization of works (Wire mesh, soil nail, filter media)	1,31,00,000
9	Avalanche Protection Structures (Snow Gallery, Snow Net for prevention of avalanche)	-
A	**Civil Cost**	**2,26,24,44,202**
B	**Utility Shifting Cost (Excl. GST & Supervision Charges)**	10,71,92,710
C	**Estimated Project Cost (Excl. GST)**	**2,36,96,36,912**
D	Contingencies @ 2.8% of A	6,33,48,438
E	Maintenance cost for 5 years during DLP (0+0.5+0.5+0.5+1.0=2.5% of A)	5,65,61,105
F	Escalation @2.5% for 2 nd year on A	5,65,61,105
G	Supervision Charges @ 3% of A	6,78,73,326
H	Agency Charges @ 3% of A	6,78,73,326
I	GST @12% of A	27,14,93,304
J	Supervision Charges @10% of B to be paid to the utility owing department incl. 18% GST	1,26,48,740
K	Cost towards Pre-construction Activities (LA,R&R/EMP etc.)	87,64,00,000
M	**Total Project Cost (C+D+E+F+G+H+I+J+k)**	**3,84,23,96,256**
	Civil cost per km	7.53
	Total project cost per km	12.79

0.12 ECONOMIC ANALYSIS

Economic analysis of the project road has been carried out and values of NPV and EIRR presented in **Table 0.17.**

Table 0.17.Summary of the Economic Analysis Values of NPV & EIRR

Section	Proposed Length (km)	NPV Discounted (Rs. million)	EIRR (%)
Kargil to Zanskar	230.020	-3504.083	-2.0

The above analysis reveals that the EIRR for base case is less than 12%; and hence the project is economically not viable for up gradation to two lane road.

It may not be considered by the funding through the international funding agencies like International Bank for Reconstruction and Development (IBRD/World Bank), Asian Development Bank (ADB) etc.

Therefore, the Project Highway may be developed on EPC mode.

0.13 FINANCIAL ANALYSIS AND VIABILITY

To assess whether the project is a profitable proposition, the return to investors is measured in terms of the equity IRR, which is estimated on discounted cash flow technique. The returns expected by investors are function of the value of equity issued in Indian stock markets, interest rates on commercial loans, the risk profile of the investment and alternative investment opportunities.

The target equity IRR and project IRR, for the project to be done on commercial format, have been taken as 15 percent and 12 percent, respectively. Summary of financial analysis is given in **Table 0.18.**

Table 0.18.Summary of Financial Analysis

Concession period	Total Project Cost (INR)	Grant (% of TPC)	Grant (INR)	Debt (INR)	Equity (INR)	IRR Project %	IRR Equity %
29 Years	2,603.39 Crores	40%	1,041.36 Crores	1,093.42 Crores	468.61 Crores	Not Defined	Not Defined

0.14 CONCLUSIONS AND RECOMMENDATIONS

As project is neither economically nor financially viable therefore, considering developments of the project influence area in future as well necessities from strategic point of view the project may be undertaken on EPC mode on priority.

1 INTRODUCTION

1.1 BACKGROUND

Ministry of Road Transport & Highways (MoRT&H) is responsible for maintenance and developments of NH network in the country. MoRT&H through PWD Kargil intends to take up widening and upgradation of NH-301 (Kargil – Zanskar Road). Under this programme the existing NH proposed to be taken up for widening and upgradation to two lanes with paved shoulder conguration. Realignments in small stretches in order to ease grade/ improve geometrics, Replacement of weak structures, construction of bridges/ ROBs/ protection works/ culverts/ causeways/ pipe culverts/ and identification of black spots and their mitigation are integral part of this programme. Accordingly, Ministry has decided to take up feasibility study cum DPR for development of NH-301 (Kargil – Zanskar Road).

Therefore, District Superintending Engineer, PWD Circle, Kargil acting on behalf of Director General (RD) & SS, MoRTH issued RFP for the **"Consultancy Services for preparation of Feasibility Study cum detailed project report (DPR) for widening and up-gradation of NH-301 Kargil Zanskar road to 2-lane of National Highway in the State of Jammu and Kashmir"** under Job No.: **NH-301-J&K-2015-16-48.**

After competitive bidding process, The **MoRT&H**appointed **M/s. Feedback Infra Private Ltd. (FIPL)** as Consultants for providing the required consultancy services. The Contract Agreement [**Agreement No.: 107-SE/AGR/2015-16**] for the assignment was signed on 24th July 2015 between the District Superintending Engineer, PWD Circle, Kargil, Jammu and Kashmir and Feedback Infra Private Limited.

Later, the packages 1, 2, 3 & 8 (Design Chainages from Km 0.000 to 30.0340, Km 30.040 to Km 57.000, Km 57.000 to Km 87.000 & Km 196.250 to Km 230.030) of the project road is transferred to National Highway & Infrastructure Development Corporation Ltd. (NHIDCL), through Gazatte Notification No. 4027, dated 17th December 2020. The same is intimated by NHIDCL to the Consultants vide letter dated 11th December 2020. Later a meeting was held with MD, NHIDCL with MD, FIPL and it was decided to provide the project details and reports.

1.2 OBJECTIVE

The main objective of the consultancy service is to establish the technical viability of the project and prepare Feasibility and Preparation of Detailed Project Report for Rehabilitation and up-gradation of existing project road to two lanes with paved shoulder configruation.

The objective of this consultancy is to undertake feasibility studies and prepare a Feasibility Report of the Project Highway for the purpose of firming up the requirements in respect of development and construction of the Project Highway and Project Facilities and enabling the prospective bidders to assess the requirements in a clear and predictable manner with a view to ensuring:

(i) Enhanced safety and level of service for the road users.
(ii) Minimal adverse impact on environment.
(iii) Minimal additional acquisition of land.

1.3 PRIMARY TASKS

General Scope of Services shall cover but not be limited to the following major tasks:

i. Review of all available reports and published information about the Project Highway and the project influence area.

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

iii. Public consultation, including consultation with Communities located along the road, NGOs working in the area, other stake-holders and relevant Govt. deptts at all the different stages of assignment (such as inception stage, feasibility stage, preliminary design stage and once final designs are concretized).

iv. Detailed reconnaissance.

v. 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.

vi. Traffic studies including traffic surveys and Axle load survey and demand forecasting for next thirty years.

vii. Inventory and condition surveys for road.

viii. Inventory and condition surveys for bridges, cross-drainage structures and drainage provisions.

ix. Detailed topographic surveys using Total Stations and GPS.

x. Pavement investigations.

xi. 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.

xii. Identification of sources of construction materials.

xiii. 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.

xiv. Identification of the type and the design of intersections.

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

xvi. Value analysis / value engineering and project costing.

xvii. Economic and financial analyses.

xviii. Contract packaging and implementation schedule.

xix. 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 and planted and land acquisition requirements including schedule for LA: reports documents and drawings arrangement of estimates for cutting of trees and shifting of utilities from the concerned department;

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

1.4 PROJECT PREPARATION STAGES

Project preparation activities will be split into four stages as brought out below. Preliminary design work should commence without waiting for feasibility study to be completed.

Stage 1: Quality Assurance Plan (QAP) and Inception Report (IR)
Stage 2: Feasibility Report, Strip Plans, Kilometre-wise LAP, URPand felling of trees etc.,
Stage 3: Project Related Clearances
Stage 4: Detailed Project Report (DPR)

This Report covers the Stage-4, Detailed Project Report for Packages 1,2,3&8.

1.5 STRUCTURE OF THE DETAILED PROJECT REPORT

The Detailed Project Report is prepared as per ToR and presented as below:

Volume – I	-	Main Report Appendix to Main Report
Volume – II	-	Design Report
Volume – III	-	Materials Report:
Volume -- IV	-	Environmental Assessment Report including Environmental Management Plan (EMP)
Volume – V	-	Technical Specifications:
Volume – VI	-	Rate Analysis:
Volume – VII	-	Cost Estimates:
Volume – VIII	-	Bill of Quantities
Volume – IX	-	Drawing Volume:
Volume – X	-	Civil Work Contract Agreement:
Volume – XI	-	Project Clearances

1.6 PROJECT DESCRIPTION

The Site of the Project Highway comprises the Kargil to Zanskar section from km 0+000 (design chainage is 0+000) to km 234.000 (design chainage is 230+020) of National Highway 301 in the Ladakh, Union Territory of India. It passes through Ladakh district in the Ladakh Union Terriotory. Existing length of the Project Highway is 234.000 Kms and Design Length of the project road is 230.020 Kms.Key plan of the project road is shown in **Figure 1.1.**

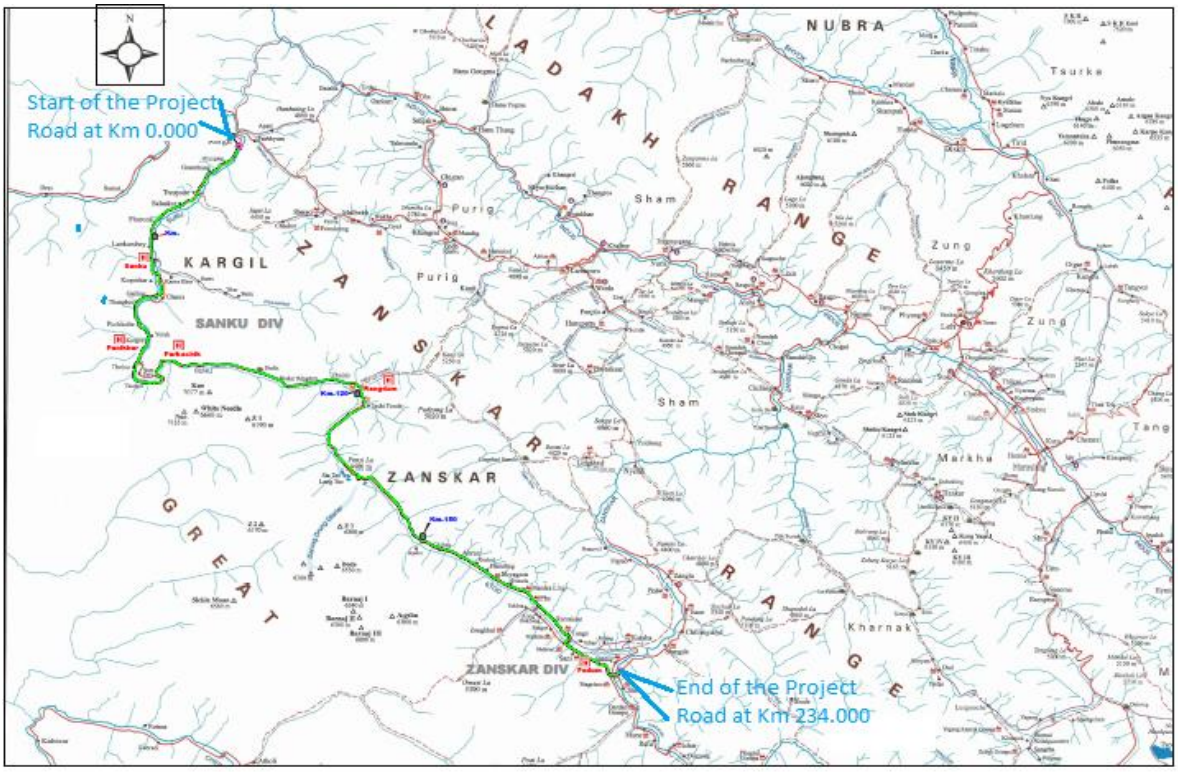


Figure 1.1: Key Plan of the Project Road

1.7 CONSTRUCTION PACKAGING

The entre project road is divided into Eight construction packages. The details of the construction packages are given in table below.

Table 1.1: Summary of Proposed Construction Packages

Package No	Design Chainage (Km)		Design Length (Km)	Exisitng Chainage (Km)		Existing Length (Km)	Proposed Lane Configuration
	From	To		From	To		
1	0.000	30.040	30.040	0.000	30.000	30.000	2-Lane +PS
2	30.040	57.000	26.960	30.000	57.905	27.905	2-Lane +PS
3	57.000	87.000	30.000	57.905	88.249	30.344	2-Lane +PS
4	87.000	98.524	11.524	88.249	105.000	16.751	Intermediate lane + ES
5	98.524	117.180	18.656	105.000	115.000	10.000	Intermediate lane + ES
6	117.180	148.320	31.140	115.000	150.000	35.000	Intermediate lane + ES
7	148.320	196.250	47.930	150.000	194.790	44.790	Intermediate lane + ES
8	196.250	230.020	33.770	194.790	231.692	36.902	2-Lane +PS
			230.020			**231.692**	

As per MoRTH circular *No.NH·12014/1234/2017 I* J&K/Zone-11, the proposal for Project road from km 0.000 to 87.000 (existing chainage) is 2 Lane with paved shoulder and from km 87.000 to 196.250 (existing chainage) is intermediate lane, from km 196.250 to 230.020 (existing chainage) is 2 Lane with paved shoulder .

Later, it was decided in the meeting held at NHIDCL, HO on 24/12/2/2020 to carry out the packages 1,2,3 & 8 by two lanes with paved shoulder configuration. Acoordinlgy conultants prepared the DPR with two lanes with paved shoulder configuration.

This report covers the section from design chainage Km 0.000 to Km 30.040 (Package-1) of the project road.

1.7 PROPOSED BYPASSES/REALIGNMENTS

One bypass has been proposed for this package of project highway. All the bypasses as well as the realignment shall be of two lanes with paved shoulder configuration. The details of stretches to be bypass are given in table bewlo.

Table 1.2: Proposed Bypass Locations

Name of the Town/Village	From (Km)	To (Km)	Side from Existing Road	Design Length of Bypass (Kms)
Kargil	0+000 (Design Ch.) 0.000 (Existing Ch.)	3+500 (Design Ch.) 3.368 (Existing Ch.)	LHS	3.302

2 SURVEYS AND INVESTIGATIONS

2.1 GENERAL

Detailed road inventory, visual Pavement condition survey, topographic survey, structure inventory and condition survey, roughness survey, BBD survey, subgrade investigations, material surveys, and Geotechnical Investigation were conducted during the feasibility study.

2.2 INVENTORY AND CONDITION SURVEY OF ROAD

2.2.1 Road Inventory

An inventory of the project road has been carried out by visual observations supplemented with sample measurements using tape etc. Kilometer wise features like terrain, land-use, surfacing type and width, shoulder, curve details, intersectional details, retaining structures details, location of water bodies, location of forest areas height of embankment or depth of cut, ROW, CD structures, road side arboriculture, existing utility services, Existing Railway crossings, cross roads, structures, junctions and general drainage condition etc., were recorded. The road inventory has been referenced to the existing km posts established along the roadside. Thes existing kiolometer stones are available upto Km 30.000 and hence considered the existing chainage as per the vehicle reading. A detailed road inventory is presented in **Appendix-A**. An overview of the existing road is given below:

2.2.1.1 Start and End Points

The project road is starting from Km 0+000 (Design Chainage is Ch. 0.000) at Kargil to Km 234+000 (Desing Chainage is Ch. 230.020) at Zanskar. The total existinglength of the project road is 234.00 Kms and design length is 230.020 Kms.

	
Start of Project road at Km 0+000 (Existing)	End of Project road at Km 234+000 (Existing)

2.2.1.2 Terrain

The project highway passes through Hilly Terrain. Terrain along the Project stretches is shown in **Table 2.1**.

Table 2.1.Terrain of the Project Road

Terrain	From (Km)	To (Km)	Length (Km)	Total Length (%)
Hilly	0+000	234.000	234.000	100%

Hilly Terrain at Km 145+800

Hilly Terrain at Km 203+100

2.2.1.3 Land use

The land use pattern along the project road is built up, barren and Agricultural in which predominant land use pattern is Barren. There is ribbon development along most of the road with small settlements were observed at frequent intervals. Land use along the Project stretch is shown in **Table 2.2.**

Table 2.2.Land Use Pattern

Land Use	LHS		RHS	
	Length (Km)	Length (%)	Length (Km)	Length (%)
Agricultural	8.400	3.600	20.000	8.500
Built Up	44.200	18.900	31.200	13.300
Barren	181.400	77.500	182.800	78.100

Built-up at Km 1.200

Agriculture Land at Km 58.800

	
Barren Land at Km 131.200	**Barren Land at Km 153.200**

a) Alignment

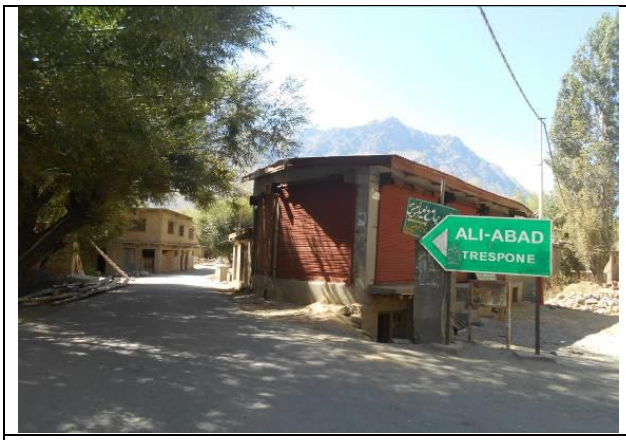
The existing intermediate/single lane carriageway alignment comprises of many sharp horizontal and deficient vertical curves which require geometric corrections as per IRC: SP: 73-2015.

b) Villages and Towns

There are 47 villages/towns along the project highway, in which most of the settlements are ribbon developed along the main carriageway. The villages and towns through which the project highway passes are listed in **Table 2.3**

Table 2.3.Villages/Towns along the Project Road

Sl No	From (Km)		To (Km)		Village Name
	Existing	Design	Existing	Design	
1	-	0+000	3.375	3+449	Kargil
2	3.358	3+449	3.691	3+779	Titichumik
3	5.984	6+069	6.404	6+489	Zamstiang
4	6.825	6+909	8.949	9+029	Chhutuk
5	9.425	9+499	9.764	9+839	Minji
6	9.943	10+019	11.472	11+549	Gogama Minji
7	12.125	12+199	12.456	12+529	Gramthang
8	14.090	14+159	14.260	14+329	Kanore
9	17.287	17+349	17.538	17+599	Kanore
10	17.598	17+659	19.946	19+999	Lundaya
11	20.256	20+309	20.466	20+519	Lunchhay
12	20.466	20+519	22.128	22+179	Lunchhay
13	24.339	24+389	25.231	25+279	Lunchhay
14	26.529	26+559	26.680	26+709	Jusgund
15	26.900	26+929	27.201	27+229	Jusgund
16	27.451	27+479	27.601	27+629	Jusgund
17	29.104	29+129	29.806	29+829	Jusgund
18	30.257	30+279	30.708	30+729	Khachan

	
Built-up at Km 18+200 Ali-abad Trespone Village	**Built-up at Km 38+200 Sankoo**

c) Carriageway and Roadway width

The existing road of the Project Highway NH 301 has intermediate lane and single lane carriageway with earthen shoulder configuration, except in Kargil (1.6 Km) where it is 2-Lane with paved shoulder carriageway configuration. The existing pavement type is flexible pavement (34%) and gravel pavement (66%).The details of carriageway widths and shoulders are shown in **Table 2.4.**

Table 2.4.Carriageway Widths and Shoulder Details

Chainage (Km)		Length (Km)	Carriageway Details			Shoulder Details		
From	To		Type	Condi - tion	Width (m)	Type	Condi - tion	Width (m)
0.00	0.20	0.200	Bituminous	Fair	7.5	Bituminous	Fair	3.0
0.200	2.00	1.800	Bituminous	Fair	7.5	Earthen	Fair	3.0
2.00	6.50	4.50	Bituminous	Fair	5.5 to 6.0	Earthen	Fair	1.5 to 2.0
6.50	8.00	1.50	Bituminous	Fair	9.0	Earthen	Fair	1.5 to 2.0
8.00	58.00	50.00	Bituminous	Fair	5 to 5.5	Earthen	Fair	1.5 to 2.0

d) Surfacing Type

The existing pavement is flexible type (34%) and gravel type (66%).

e) Shoulder

Earthen shoulder is observed on both sides along the project road except at 2 lane urban locations, with varying width 1.0 to 2.0 m. The condition of earthen shoulder varies from fair to poor with rain cuts and erosion of shoulder is observed at some locations along project highway**.**

	
Fair Condition of Earthen Shoulder at Km 29.200	**Poor Condition of Shoulder at Km 101.200**

f) Embankment and Cutting sections

Average height of embankment generally varies between 0 to 3 m except for reaches near the bridges. The condition of the embankment is fair to poor. The Details of cutting sections lies in hill and valley area is given in **Appendix-A.**

g) Right of Way

Existing ROW pillars are not available along the project road, hence collected from PWD, Kargil. The available ROW varies from 7 m to 10 m (approximately) but in built up sections except few locations where it seems on lesser side are given in **Table 2.5.**

Table 2.5.ROW along the Project Road

Sl.No	Existing Chainage (Km)		Length in (Km)	ROW (m)
	From	To		
1	0.000	12.000	12	7 to 10
2	12.000	40.000	28	7 to 10

h) Road Junctions

There are 45 minor junctions are present along the project highway with various categories of roads. The list of existing intersections in package 1 which would fall along the Existing alignment is presented **Table 2.6**.

Table 2.6.List of Intersections

Sl. No.	Location		Direction	Type of Junction	Cross Road Leads Towards
	Existing Chainage (m)	Design Chainage (Km)			
Minor Junctions					
1	0	0+000	RHS	Y	N.H 1D Junction/ Bypass Start
2	3368	3+500	LHS	T	Village
3	7.533	7.611	LHS	T	Chutuk Hydel Project Road
4	8.418	8.499	LHS	Y	Village
5	9.645	9.719	LHS	T	Village
6	9.837	9.907	RHS	T	Goma Minjee Road
7	10.663	10.739	RHS	T	Goma Minjee Road
8	17.467	17.529	LHS	T	Tambis Road
9	19.018	19.073	LHS	T	Village
10	19.185	19.239	LHS	T	Luncchay Village
11	19.640	19.700	RHS	T	Village
12	20.086	20.139	LHS	T	Village Lunday
13	20.546	20.599	LHS	T	G.M. Pore
14	21.217	21.269	LHS	T	Sadat Abad Road
15	21.528	21.579	LHS	T	Village
16	22.348	22.399	LHS	T	Village Saliskote
17	24.424	24.469	RHS	T	Village
18	24.660	24.709	LHS	T	Village

Junction at Ch. 0+000

Junction at Ch. 41+915

i) Side Drains

Unlined drains are present on either side of the project road. Lined drains and covered drains were found in built-up areas. The drainage details along the project road are given in **Table 2.7**.

Table 2.7.Details of Drains

S. No.	Type of Drains	Length (m)
1	Covered Drain	200
2	Lined Drain	1600
3	Unlined Drain	500

j) Religious Structures

There are 64 religious structures located along the project road with most of them very close to the edge of the pavement, enlisted in **Table 2.8**.

Table 2.8.List of Religious Structures

Sl. No.	Direction	Chainage (Km)	Name of the Religious Structrue
1	RHS	18.260	Masjid
2	RHS	18.422	Masjid
3	RHS	19.253	Masjid Complex
4	RHS	29.520	Masjid
5	RHS	57.249	Masjid
6	RHS	102.387	Maktab Noori islam
7	RHS	64.727	Masjid
8	RHS	72.862	Masjid Bathroom
9	RHS	119.228	Mane/Gompa
10	RHS	119.250	Mane/Gompa
11	RHS	185.076	Mane/Gompa
12	RHS	188.396	Mane/Gompa
13	RHS	188.414	Mane/Gompa
14	RHS	189.678	Mane/Gompa
15	RHS	189.688	Mane/Gompa
16	RHS	201.740	Mane/Gompa
17	RHS	204.015	Mane/Gompa
18	RHS	204.025	Masjid
19	RHS	204.030	Mane/Gompa
20	RHS	204.108	Mane/Gompa
21	RHS	204.112	Mane/Gompa
22	RHS	204.117	Mane/Gompa
23	RHS	204.290	Mane/Gompa
24	RHS	204.323	Mane/Gompa
25	RHS	204.345	Mane/Gompa
26	LHS	17.762	Maktab Imamiya Ali Asger
27	LHS	20.866	Jamiya Masjid Saliskote
28	LHS	38.395	Maktab Sankoo
29	LHS	55.170	Masjid
30	LHS	57.331	Masjid

Sl. No.	Direction	Chainage (Km)	Name of the Religious Structrue
31	LHS	57.996	Masjid
32	LHS	72.794	Masjid
33	LHS	82.758	Mane/Gompa
34	LHS	112.973	Mane/Gompa
35	LHS	112.994	Mane/Gompa
36	LHS	118.752	Mane/Gompa
37	LHS	182.673	Mane/Gompa
38	LHS	184.312	Mane/Gompa
39	LHS	184.896	Mane/Gompa
40	LHS	184.902	Mane/Gompa
41	LHS	193.182	Mane/Gompa
42	LHS	196.077	Mane/Gompa
43	LHS	196.099	Mane/Gompa
44	LHS	196.604	Mane/Gompa
45	LHS	196.752	Mane/Gompa
46	LHS	199.513	Mane/Gompa
47	LHS	199.525	Mane/Gompa
48	LHS	201.142	Mane/Gompa
49	LHS	201.841	Mane/Gompa
50	LHS	203.130	Mane/Gompa
51	LHS	203.251	Mane/Gompa
52	LHS	203.911	Mane/Gompa
53	LHS	203.950	Masjid
54	LHS	203.965	Mane/Gompa
55	LHS	204.022	Mane/Gompa
56	LHS	204.042	Mane/Gompa
57	LHS	204.092	Mane/Gompa
58	LHS	204.096	Mane/Gompa
59	LHS	204.101	Mane/Gompa
60	LHS	204.104	Mane/Gompa
61	LHS	204.109	Mane/Gompa
62	LHS	204.115	Mane/Gompa
63	LHS	204.123	Mane/Gompa
64	LHS	204.131	Mane/Gompa

Mosque LHS at Km 19+253

Temple LHS at Km 201+841

k) Utilities

High tension line, telephone line & OFCs, electrical poles and transformers are required to be shifted for implementation of the project. Water pipelines and sewage lines do not exist along the project highway. OFC lines of various telecom service providers are running parallel to the project road on both sides. The lists of utilities are shown in below **Table 2.9.**

Table 2.9.List of Utilities

S. No.	Chainage (Km)	Description	Distance from Road Edge
1	10.200	H.T.Line Crossing	20m
2	37.000	H.T.Line Crossing	20m

HT Line Crossing at Km 37.000

l) Bus Stops

There are 03 pick-up bus stops with shelters present along the project road. Details of these are provided in **Table 2.10**.

Table 2.10.Locations of Bus Stops

SL No	Chainage (Km)	Direction
1	0.80	LHS
2	38.50	LHS
3	233.20	LHS

m) Truck Lay-bye

There are no parking lay-byes for commercial vehicles along the project road.

2.3 Pavement Condition Survey

Detailed field studies have been carried out to collect pavement/shoulder/drainage conditions and are presented in **Appendix-B.**

The survey on general pavement condition was primarily a visual exercise undertaken by means of slow drive-over survey and supplemented with measurements wherever necessary. Visual assessment was carried out from a vehicle, with speed not exceeding 15 km/hr and stopping at various locations at suitable intervals and wherever necessary, depending on variations in pavement conditions. Aspects of pavement conditions assessed include surface defects, rut depth, cracking, potholes, patched areas, shoulder condition etc. An overall assessment of performance serviceability of the road was also done to qualitatively rate the existing pavement and shoulder condition.

The pavement condition was recorded under the following sub-heads:

- Shoulder
  - Composition / Condition / material Loss
  - Riding Quality (Good / Fair / Poor / Very Poor)
- Pavement Condition (surface distress type & extent)
  - Cracking (%)
  - Raveling (%)
  - Potholes (%)
  - Patching (%)
  - Rut depth (mm)
  - Edge break (m)
  - Pavement edge Drop (mm)
- Embankment Condition (Good / Fair / Poor)
- Roadside Drain (Non-Existing / Partially Functional / Functional)
- Drainage condition

	
Fair Condition of Road at Km 1+800	**BT washed away at Km 60+800**

	
BT washed away at Km 221+100	**Poor section at Km 230+000**

For determining the pavement condition of project road, the yardstick as given in **Table 2.11** has been used to designate the pavement condition.

Table 2.11.Yardstick for Pavement Condition

Condition	Potholes (%)	Cracking (%)	Patching (%)	Raveling (%)	Rutting (mm)
Excellent	Nil	>5.0	Nil	<1.0	>5
Good	> 0 < 0.05	> 5< 10	> 0 < 5	>1.0< 5.0	> 5 < 10
Fair	>.05<0.25	> 10 < 20	> 5 < 15	> 5.0< 10	> 10 < 20
Poor	>0.25<0.5	>20 < 30	>15 < 25.0	>10 <30.0	>20 < 30
Very poor	>0.5	>30	>25.0	>30.0	>30

2.3.1 Summary of Condition Survey Results

Based on the yardstick the overall condition of the flexible pavement that is of 79.20 Km out of 234 Km pavement has been analyzed and it varies between Good to Very Poor condition. Out of 79.20 kms from Kargil to Zanskar on NH-301, 84.09% of road is in excellent to good condition, 0.38% of road is in good to fair condition, 1.70% of road is in fair to Poor condition, 3.60% of road is in poor condition and 10.29% of road is in very poor condition. The summary of pavement condition is given in **Table 2.12**.

Table 2.12.Summary of Pavement Condition Survey

Summary	Length (km)	% of Total Length
Excellent	66.60	84.03
Good	0.30	0.38
Fair	1.35	1.70
Poor	2.85	3.60
Very Poor	8.15	10.29
Total	**79.2**	**100.00**

The condition of gravel portion of project highways that is of 154.8Km is in very poor condition

Shoulder Condition

Earthen shoulder is observed on along the project road with varying width from 1 to 3 m. Failures like shoulder drop, rain cuts and corrugations were observed. Condition of shoulder is fair to poor.

Drainage Condition

The general condition of the roadside drains is Partial Fair.

2.4 TOPOGRAPHIC SURVEYS

The basic objective of the topographic survey is to collect the essential ground features along the existing alignment using LIDAR, so as to take care of design requirements of new carriageway, possible improvements in highway geometrics, identifying areas of restrictions & their remedies and relocation of utilities by using appropriative Highway software packages. The data collected is result in the final design and for the computation of earthwork and other quantities required.

2.4.1 Use of Terrestrial Mobile LiDAR (Light Detecting and Ranging)

a. The detailed field surveys have been carried out using high precision engineering grade LiDAR and imaging system. The data from the system has been complemented and checked with traditional survey equipment i.e. Total stations, DGPS etc. Control stations was fixed using DGPS and RL is transferred from nearest GTS benchmark using auto level/ Total stations at intervals not more than 5 kms including one at beginning and other at end of the project road.

b. The data was collected in detail in a format prepared by consultant with the consent of Client. The data is compiled and presented in tabular as well as graphical form. The inventory data is stored in computer files using simple utility packages, such as EXCEL. The data is linked to graphical information with hot links in GIS platform.

c. The density and coverage of the LiDAR point cloud is high enough to derive Longitudinal section having levels along final centre line at 25 m interval and Cross section at every 50 m interval in full extent of survey covering sufficient number of spot levels on existing carriageway and adjacent ground for profile correction course and earth work calculations. Cross section shall be at lesser intervals at the locations of curve points, small streams, intersections, locations of change in elevation and at higher road gradient locations etc. with sufficient number of ground points on existing carriageway and adjacent ground.

2.5 PAVEMENT ROUGHNESS SURVEY

The Vehicle Mounted Bump Integrator (VMBI) is a component of the Road Measurement Data Acquisition System (ROMDAS) which is a response-type road unevenness meter mounted in a vehicle to monitor pavement unevenness. It records the displacement of the vehicle chassis relative to the rear axle per unit distance travelled, usually in terms of counts/km or m/km. Since each vehicle responds differently to unevenness due to its own unique springs and shocks, as these changes over time with wear, it is necessary to calibrate each vehicle against a standard unevenness measure.

For the present survey, the roughness was measured using Vehicle Mounted Bump Integrator linked to ROMDAS software to be controlled by the operator from a laptop computer in the survey vehicle

Two runs, one on each direction of wheel path have been carried out by maintaining a running speed of 30kmph. The Kilometer values of roughness in BI values and International Roughness Index (IRI) observed on project road have been tabulated in **Table 2.13** and graphically presented in **Figure 2.1:**. Details of the survey results are present in **Appendix-C.**

Table 2.13.Pavement Roughness Values, BI (mm/Km) Both Directions

Existing Chainage (Km)		Average BI Values mm/km	Average IRI Values	Riding Quality
From	To			
0	1	1388	2	Good
1	2	1430	2	Good
2	3	1242	2	Good
3	4	1497	2	Good
4	5	1072	2	Good
5	6	1655	2	Good
6	7	1467	2	Good
7	8	1801	3	Good
8	9	1473	2	Good
9	10	1266	2	Good
10	11	1284	2	Good
11	12	1321	2	Good
12	13	907	1	Good
13	14	1072	2	Good
14	15	877	1	Good
15	16	719	1	Good
16	17	1254	2	Good
17	18	1260	2	Good
18	19	1193	2	Good
19	20	1126	2	Good
20	21	1072	2	Good
21	22	1126	2	Good
22	23	1351	2	Good
23	24	1138	2	Good
24	25	1005	1	Good
25	26	1059	2	Good
26	27	993	1	Good
27	28	907	1	Good
28	29	1035	1	Good
29	30	920	1	Good
30	31	1023	1	Good
31	32	1053	1	Good
32	33	1029	1	Good
33	34	1394	2	Good
34	35	1224	2	Good
35	36	1382	2	Good

Existing Chainage (Km)		Average BI Values mm/km	Average IRI Values	Riding Quality
From	To			
36	37	719	1	Good
37	38	1698	2	Good
38	39	1284	2	Good
39	40	1394	2	Good
40	41	1588	2	Good
41	42	1449	2	Good
42	43	2300	3	Average
43	44	1649	2	Good
44	45	1528	2	Good
45	46	1558	2	Good
46	47	1892	3	Good
47	48	2032	3	Average
48	49	1436	2	Good
49	50	2592	4	Average
50	51	1394	2	Good
51	52	2020	3	Average
52	53	1971	3	Good
53	54	1339	2	Good
54	55	1163	2	Good
55	56	1017	1	Good
56	57	1157	2	Good
57	58	2701	4	Average
58	234.00	Poor to very poor condition and hence not required		

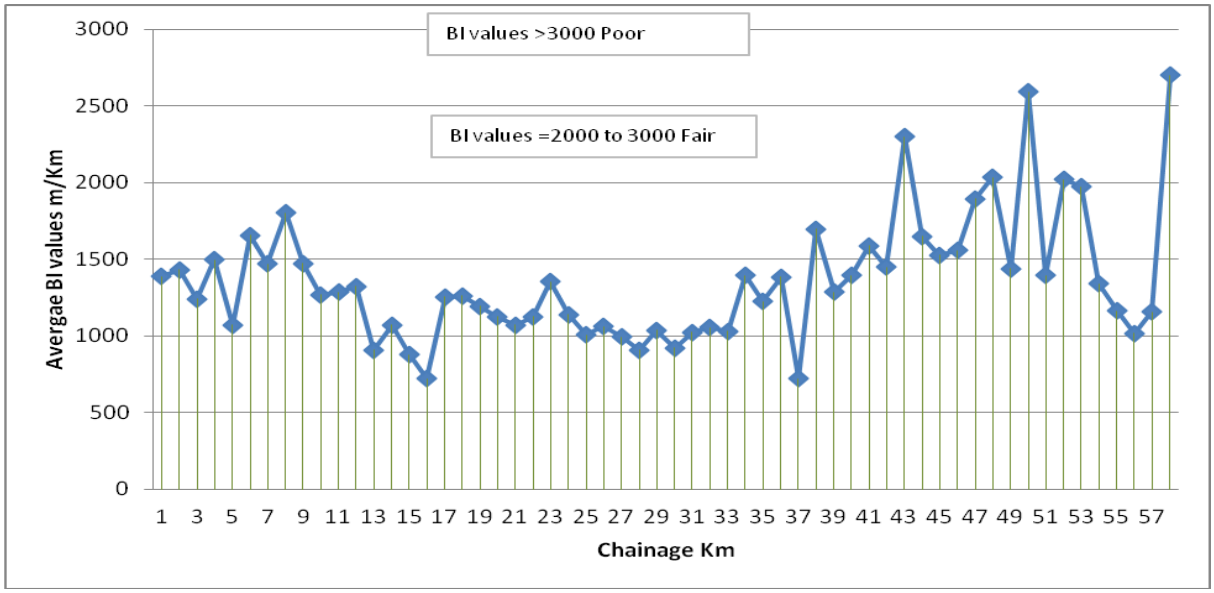


Figure 2.1: Roughness Values

It is observed that the BI values are generally in between 719 mm/km to 2701 mm/km.

2.6 BENKELMAN BEAM DEFLECTION TECHNIQUE

The evaluation of structural strength of existing flexible pavement was carried out using a Benkelman Beam in accordance with the procedure given in IRC 81-1997.

For measuring pavement deflection, the C.G.R.A procedure that is based on testing under static load was adopted. A standard truck having a rear axle weighing 8200 kg fitted with dual tyre inflated to a pressure of 5.60 kg/sq.cm was used for loading the pavement. The beam was calibrated using metal plates of known thickness prior to testing. The dual wheels of the truck are centred above the selected point.

The deflection tests have been carried out at every 50m interval in staggered manner. The selection of homogeneous segment shall be carried out based on pavement condition survey. Pavement temperature was recorded at every one hour during the testing period by inserting a thermometer in a hole (approximately 5 cm deep and 10 mm diameter) drilled in the pavement and filled with glycerol. At any deviation of the pavement temperature during measurements from the standard temperature of 35^{o} C, correction has been applied to the deflection measured in accordance with the procedure described in IRC: 81-1997. Seasonal correction was carried out using the moisture correction factors given in Figures 2 to 7 in IRC: 81-1997. PI and moisture content of the sub-grade were established from test pit excavations carried out simultaneously with Benkelman Beam tests. The Benkelman Beam Deflection data is presented in **Appendix-D.**

The observed characteristic deflection for the project road has been given in **Table 2.14**.

Table 2.14.Observed Characteristic Deflection

Chainage (Km)		Length (Km)	Characterstic Deflection
From	To		
0	1	1	1.591
1	2	1	1.555
2	3	1	1.737
3	4	1	1.828
4	5	1	1.777
5	6	1	1.587
6	7	1	1.383
7	8	1	1.837
8	9	1	1.863
9	10	1	1.797
10	11	1	1.759
11	12	1	1.927
12	13	1	1.614
13	14	1	1.457
14	15	1	1.723
15	16	1	1.687
16	17	1	1.631
17	18	1	1.775
18	19	1	1.597
19	20	1	1.413
20	21	1	1.497
21	22	1	1.450

Chainage (Km)		Length (Km)	Characterstic Deflection
From	To		
22	23	1	1.466
23	24	1	1.385
24	25	1	1.287
25	26	1	1.678
26	27	1	1.426
27	28	1	1.763
28	29	1	1.601
29	30	1	1.523
30	31	1	1.852
31	32	1	1.627
32	33	1	1.623
33	34	1	1.604
34	35	1	1.543
35	36	1	1.891
36	37	1	1.602
37	38	1	1.737
38	39	1	1.599
39	40	1	1.949
40	41	1	1.650
41	42	1	1.645
42	43	1	1.675
43	44	1	1.624
44	45	1	1.576
45	46	1	1.779
46	47	1	1.685
47	48	1	1.827
48	49	1	1.491
49	50	1	1.389
50	51	1	1.744
51	52	1	1.636
52	53	1	1.592
53	54	1	1.642
54	55	1	1.872
55	56	1	1.784
56	57	1	1.689

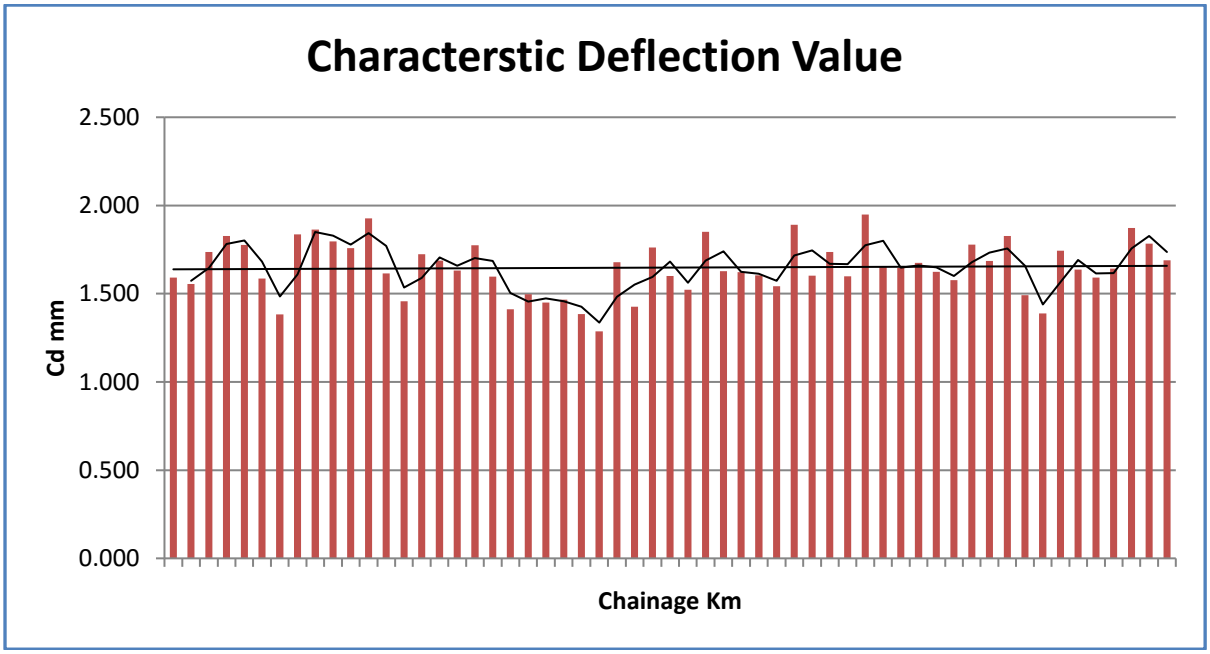


Figure 2.2: Characterstic Deflection along the Project Road

2.7 AXLE LOAD SURVEY

The purpose of conducting Axle load survey is to calculate vehicle damage factors (VDF).Hence fresh axle load survey has been carried out at Km 35.000, Km 215.000 and analysis has been carried out as per IRC: 37-2012 guidelines.

2.7.1 Vehicle Damage Factors (VDFs)

The vehicle damage factor (VDF) 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. It is defined as the equivalent number of standard axles per commercial vehicle. Universally accepted standard axle load weighs 8,160 Kg. ESAL is determined by the relationships recommended in IRC: 37-2012 'Guidelines for the design of Flexible Pavements'. The equations for computing equivalency factors for single, tandem and tridem axles are given below and these equations has been used to convert different axle load repetitions into equivalent standard axle load repetition.

1) Single axle with single wheel on either side:
   Equivalency Factor = (Axle load in tonnes /6.6)^4

2) Single axle with dual wheels on either side:
   Equivalency Factor = (Axle load in tonnes /8.16)^4

3) Tandem axle with dual wheels on either side:
   Equivalency Factor = (Axle load in tonnes /15.1)^4

4) Tridem axles with dual wheels on either side:
   Equivalency Factor = (Axle load in tonnes /22.84)^4

The relationship is referred to as the 'Fourth Power Rule', which states that the damaging

effect of an axle load increases as the fourth power of the weight of an axle. In order to convert axle loads from the survey data into ESAL, each axle of each category of vehicle is multiplied by the equivalency factor of that type of axle. The output is called the 'damage' caused by that particular axle on the pavement. Damages by all axles are then added to find the cumulative damage by that type of vehicle. The cumulative damage is divided by the number of vehicles of that category surveyed to obtain the average damage, which is also called the Vehicle Damage Factor (VDF) of that category of vehicle.

$$VDF = \frac{\text{Cumulative Damage}}{\text{Sample Size}}$$

Detailed VDF calculations are given as **Appendix-E.**

2.8 PAVEMENT COMPOSITION AND SUBGRADE INVESTIGATIONS

2.4.2 Methodology (Test Pits)

Investigations have been carried out by digging test pits to assess the adequacy of existing pavement layers including sub-grade soil properties to establish the strengthening/ reconstruction requirements to cater for design traffic during service life. Test pits were excavated at the pavement-shoulder interface, extending through the pavement layers and down to the level of the sub-grade. Test pits made were of two types – large pits and small pits for the investigation along the project road.

Large Test Pits	-	1.0m x 1.0m at every change of soil strata
Small Test pits	-	0.5m x 0.5m at every Km

The details and test results are provided in the subsequent paragraphs.

2.4.3 Large Pits (1.0 m x 1.0 m)

Large pits were dug at the pavement-shoulder interface extending through the pavement layers. Pits were made in such a way that one third of the pit (30 cm) was within the carriageway and the remaining two third (70 cm) in the shoulder, ensuring minimum damage to the original pavement and disruption to the traffic. The pits were backfilled and compacted after completion of work. The sequence of operations for large pits was as follows:

- Manual excavation of 1.0 m x 1.0 m pit down to sub-grade level. After reaching the sub-grade level, the thickness of the different pavement layers was measured, and type of material examined. Sub-grade soil samples were collected, and field moisture content was determined at site by using moisture meter method as per IS 2720: Part 2.
- One sample of 40 kg sub-grade soil was collected from the top 100 mm of sub-grade for the following laboratory tests:

-	Field moisture content	:	As per IS: 2720
-	Grain size analysis	:	As per IS: 2720
-	Atterberg limits	:	As per IS: 2720
-	Free swell index	:	As per IS: 2720
-	Moisture-Density test (Heavy Compaction)	:	As per IS: 2720
-	CBR (un- soaked, and	:	As per IS: 2720

4 days soaked)

2.4.4 Small Pits (0.5 m x 0.5 m)

Small pits were dug in between the large pit locations staggered left/right along the pavement edge in line with the principles of large pits at every 500m. The pits were dug such that at least 20 cm was within the carriageway and the rest on the shoulder. The pits were backfilled and compacted properly after completion of the work. The sequences of operation for small pits were as follows:

- Manual excavation of 0.5 m x 0.5 m size pit down to the sub-grade level.
- Thickness of each pavement layer was measured, and type of materials was examined, soil samples were collected, and field moisture content was determined at site by using moisture meter method as per IS 2720: Part 2.
- Photographs were taken of the pavement layers at a few locations.

2.4.5 Pavement Composition

For each test pit, the following information was recorded:

- Test pit reference (Identification number, location):
- Pavement composition (material type and thickness)
- Sub-grade type (textural classification) and condition (dry, wet)

Broad variation in pavement thickness was observed along the project road. However, the pavement composition of the existing pavement is generally same as bituminous, Base and Sub-base. The wearing coat (Bituminous) varies from 20 mm to 150 mm, base course varies from 70 mm to 230 mm and Subbase course varies from 90 mm to 250 mm. The bituminous course consists of one layer and appears to be fair to poor in condition. The base course material was moderately strong and dry in general. The sub-grade below the base course was observed to be fine grained clay and silty soil at some locations. The existing pavement crust composition and thicknesses is presented in **Table 2.15.**

Table 2.15.Exisiting Crust Composition

Location (Km)	Direction	Existing Crust Thickness (mm)				
		Bituminous	WMM	WBM /GSB	Granular Layers	Total
0.500	LHS	70	140		200	410
1.000	RHS	130	150		140	420
2.000	RHS	90	120		130	340
3.000	RHS	65	140		160	365
4.000	LHS	90	170		140	400
5.000	RHS	80	140		220	440
6.000	RHS	70		175	200	445
7.000	RHS	60	185		200	445
8.000	RHS	60		140	180	380
9.000	RHS	50	180		200	430
10.000	RHS	65	120		250	435
11.000	LHS	100	90		250	440
12.000	LHS	55	145		240	440

Location (Km)	Direction	Existing Crust Thickness (mm)				
		Bituminous	WMM	WBM /GSB	Granular Layers	Total
13.000	RHS	90	200		180	470
14.000	RHS	50		140	200	390
15.000	LHS	70		155	190	415
16.000	RHS	70		150	160	380
17.000	RHS	70		190	210	470
18.000	LHS	90		130	190	410
19.000	LHS	60		100	150	310
20.400	LHS	90		100	120	310
21.000	RHS	80		130	160	370
22.000	LHS	70		150	200	420
23.000	LHS	60		100	160	320
24.000	RHS	50		100	150	300
25.000	RHS	70		120	200	390
26.000	RHS	50		100	120	270
27.000	RHS	60		110	150	320
28.000	RHS	90		100	140	330
29.000	RHS	70		110	150	330
30.000	RHS	100		180	120	400
31.000	RHS	90		200	130	420
32.000	RHS	50		170	90	310
33.000	LHS	130		200	120	450
34.000	LHS	100		120	170	390
35.000	RHS	90		100	150	340
36.000	RHS	90		110	130	330
37.000	RHS	60		120	110	290
38.000	RHS	90		190	130	410
39.000	RHS	80		150	130	360
40.000	LHS	100		140	150	390
41.000	RHS	90		120	140	350
42.000	RHS	80		170	150	400
43.000	RHS	100		120	150	370
44.000	LHS	150		110	160	420
45.000	RHS	90		100	160	350
46.000	RHS	70		80	170	320
47.000	LHS	140		100	150	390
48.000	LHS	130		90	120	340
49.000	RHS	110		100	160	370
50.000	RHS	90		100	140	330
51.000	LHS	80		90	110	280
52.000	LHS	90		110	160	360
53.000	RHS	80		70	120	270
54.000	RHS	80		130	150	360
55.000	LHS	80		120	110	310
56.000	LHS	120		70	150	340
57.000	LHS	80		100	150	330
58.000	LHS	40		180	170	390
59.000	RHS	60		90	110	260

Location (Km)	Direction	Existing Crust Thickness (mm)				
		Bituminous	WMM	WBM /GSB	Granular Layers	Total
222.000	RHS	30	225		100	355
223.000	RHS	25	200		110	335
224.000	RHS	25	190		150	365
225.000	RHS	25	75	120	110	330
226.000	RHS	20	110	70	150	350
227.000	RHS	25	90	120	120	355
228.000	RHS	25	100	80	130	335
229.000	RHS	20	230		120	370
230.000	LHS	25	225		110	360
232.000	LHS	25	175	125	130	455
234.000	LHS	25	180	110	120	435

2.4.6 Characterisation of Sub-grade

The following tests were conducted on each of the sub-grade samples collected from trial pits:

- Grain size distribution (Wet)
- Atterberg's Limits (Liquid limit and plastic limit)
- Modified Proctor Density at three compaction levels
- Four days soaked CBR at three energy levels

The methods of testing adopted for materials investigations are given in **Table 2.16.**

Table 2.16.Method of Testing

S. No.	Type of Tests	Unit	Test Method
1	Grain Size Analysis (Wet Sieve)	% by wt.	IS: 2720 (Part 4)
2	Atterberg's Limits (LL, PL, PI)	% by wt.	IS: 2720 (Part 5)
3	Laboratory Moisture Density Characteristic (Modified AASHTO compaction)	Gm/cc and % by wt.	AASHTO T-180-97
4	Laboratory CBR (4 day soaked compacted at three energy level)	%	AASHTO T-193-99

The collected sub-grade soil samples have been tested and the summary of obtained test results is given in **Table 2.17.** Detailed test results are given as Material Report (Volume-III).

Table 2.17.Test Results of Sub-grade Soil Samples

Sample Location (Km)	Property							
	Consistency Limits				Compaction Parameters		CBR(%)	
	LL(%)	PL(%)	PI (%)	Type of Soil	OMC (%)	MDD (g/cc)	Soaked	Un-Soaked
64.500	27.80	-	-	NP	16.07	1.79	8.00	12.00
55.000	21.50	-	-	NP	11.95	1.99	10.66	11.20

Sample Location (Km)	Property							
	Consistency Limits				Compaction Parameters		CBR(%)	
	LL(%)	PL(%)	PI (%)	Type of Soil	OMC (%)	MDD (g/cc)	Soaked	Un-Soaked
45.000	-	-	-	NP	10.28	2.09	7.74	16.40
75.000	20.40	12.46	7.94	CL	9.11	2.06	13.14	32.85
85.000	29.80	27.60	2.20	OL	17.96	1.79	3.43	10.22
10.000	22.00	-	-	NP	7.50	2.30	27.40	27.40
25.000	24.92	21.00	3.92	CL-ML	6.50	2.45	29.19	24.40
35.000	28.40	24.39	4.00	OL	6.33	1.97	4.10	23.00
94.000	23.83	-	-	NP	11.37	2.02	7.60	13.50
105.000	24.00	-	-	NP	18.00	1.70	3.80	11.70
115.000	28.50	-	-	NP	15.50	1.71	5.50	9.30
125.000	-	-	-	NP	15.00	2.01	19.70	27.00
156.000	26.50	20.90	5.60	ML	15.00	1.80	1.50	3.40
145.000	40.80	32.20	8.80	MI	17.60	1.70	2.50	6.70
175.000	21.30	-	-	NP	10.70	2.10	6.10	7.50
165.000	23.00	-	-	NP	11.50	2.00	9.60	22.60
135.000	32.00	-	-	NP	15.53	1.70	5.40	12.20
183.000	25.00	-	-	NP	14.10	2.00	10.00	29.60
196.000	25.00	24.00	1.00	NP	17.70	1.80	1.89	11.10
208.000	29.70	28.00	1.70	NP	18.22	1.82	3.00	11.20
218.000	27.00	25.00	2.00	NP	17.26	1.84	1.50	3.30
227.000	17.50	17.00	0.50	NP	9.00	2.10	3.00	39.00

2.9 MATERIAL INVESTIGATION

2.4.7 General

The material investigation for road construction has been carried out to identify the potential sources of construction materials and to assess their general availability, mechanical properties and quantities. This is one of the most important factors for stable, economic and successful implementation of the road program within the stipulated time. For improvement work as well as for new carriageway / bypass the list of materials includes the following:

- Granular material for lower sub-base works
- Crushed stone aggregates for upper sub-base, base, surfacing and cement concrete works
- Sand for filter material and cement, concrete works, sub-base and filling material
- Borrow material for embankment, sub-grade and filling
- Manufactured material like cement, steel, bitumen, geo-textiles etc. for other related works.

2.4.8 Objectives and Information Sources

The information on material sources was carried out with the following basic objectives.

- Source location, indicating places, chainage, availability and the status whether in operation or new source.
- Access to source, indicating the direction and nature of the access road i.e. left / right of project road, approximate lead distance from the gravity centre and type of access road.
- Ownership of land / quarries, either government or private.
- Test results, indicating the quality of materials along with their classification in details.
- Probable uses indicating the likely use of materials at various stages of construction work i.e. fill materials, sub-grade, sub-base, base and wearing course and cross drainage structures.
- During the process of investigation, due consideration has been given to the locally available materials for reducing the cost of construction. The samples from various identified sources have been collected for laboratory testing as per IRC / MoRT&H / BIS standards.

2.4.9 Material for Embankment and Sub-grade

Potential sources of earth for the construction of embankment and sub-grade (for Reconstruction / New Carriageway) were identified on either side of project road. The details of all the borrow areas investigated with their respective locations, corresponding chainage, description of material and approximate quantities are tabulated in **Table 2.18**.

Table 2.18.Details of Borrow area along the Project Road

S. No	Chainage (Km)	Direction	From Quarry to Project Stretch Distance in (km)	Name of Village	Approx. Quantity (Cum)
1	25.500	RHS	0.1	Kumbthang	55000
2	14.000	RHS	0.1	Tresspan	40460
3	26.400	RHS	0.1	Kumbthang	50000
4	46.000	RHS	0.1	Sangrathang	63000
5	56.200	LHS	0.1	Damsana	38500
6	57.400	Both side	0.1	Damsana	65200
7	59.000	Both side	0.1	Damsana	70200
8	62.200	LHS	0.1	Maitia	42000
9	65.200	LHS	0.1	Maitia	32500
10	124.500	LHS	0.1	Barren area Govt land	25500
11	155.300	LHS	0.1	Barren area Govt land	29300
12	186.000	LHS	0.1	Chibra	42200
13	227.500	RHS	0.1	Padam	20220

The following test has been conducted to check the suitability of the fine-grained materials:

- Grain size analysis
- Atterberg limits

- Maximum laboratory dry unit weight (Heavy Compaction)
- Optimum moisture content
- CBR (4 days soaked)

Labobroatory testing of the borrow area soil samples have been completed and the summary of test results are shown in **Table 2.19.** Detailed test results are given as Material Report (Volume-III).

Table 2.19.Test Results of Borrow Area Soil Samples

Sample Location (Km)	Property							
	Consistency Limits				Compaction Parameters		CBR(%)	
	L L(%)	P L(%)	PI (%)	Type of Soil	OMC (%)	MDD (g/cc)	Soaked	Un-Soaked
25.500	19.65	-	-	NP	14.20	1.60	7.20	7.30
56.200	25.00	-	-	NP	13.00	1.90	3.90	7.80
82.500	18.00	-	-	NP	11.20	2.00	6.30	6.70
124.500	21.00	19.00	2.00	NP	11.30	2.10	9.80	12.40
155.000	29.00	-	-	NP	11.90	2.00	4.00	21.80
186.000	23.00	-	-	NP	11.20	1.99	4.50	5.80
227.000	21.00	-	-	NP	11.10	1.85	2.80	2.80

2.4.10 Stone Aggregates

The availability and quality of material as coarse and fine aggregate was explored, and samples are taken from some of the quarries where large quantities were available. The details are given in **Table 2.20.**

Table 2.20.Details of Stone Aggregates Quarries

Chainage (Km)	Direction	Lead (Km)	Type	Name of Quarry	Place	Remarks
26.000	LHS	0.50	Quarry/Crusher	Kumbthang Aggregates	Kumbthang	Private
31.000	LHS	2.00	Quarry		Skimmarchey	Private
42.000	RHS	2.50	Crusher		Karpokhar	Private
220.000	RHS	1.00	Quarry		Shimiling	Private

Representative samples from the above stone quarries were collected for testing in the laboratory. The following tests have been conducted on the samples collected.

- Los Angeles Abrasion Test : As per IS: 2386 (Part-4)
- Aggregate Impact value : As per IS: 2386 (Part-6)
- Combined flakiness and elongation indices : As per IS: 2386 (Part-7)
- Soundness : As per IS: 2386 (Part-5)
- Water absorption : As per IS: 2386 (Part-3)

MoRT&H requirement of stone aggregates for their use in base / surfacing courses of pavement are as follows:

- Los Angeles Abrasion Value < 40%
- Aggregate Impact Value < 30%
- Flakiness and Elongation indices (combined) < 30%
- Water absorption < 2%

The laboratory test results of the coarse and fine aggregate are given in **Table 2.21.** Detailed test results are given as Material Report (Volume-III).

Table 2.21.Test Results of Coarse and Fine Aggregate Samples

Sample location (Km)	Sample size / Description	Property							
		Aggregate Impact Value (%)	Specific Gravity	Flakiness index (%)	Elongation index (%)	Water Absorption (%)	Stripping Value (%)	Fineness Modulus (%)	Bulk Density (g/cc)
30.000	40mm Coarse Aggregate Sample	-	2.80	8.0	26.0	0.29	5.5	-	-
	20mm Coarse Aggregate Sample	12	2.70	15	29	0.40	6.4	-	-
	10mm Coarse Aggregate Sample	10	2.74	22	30	1.40	6.5	-	-
	Crushed Sand/ Stone Dust/Stone Chippings, 4.75mmDown	-	2.62	-	-	2.2	-	1.50	1.56
57.000	Fine Aggregate Sample/Sand	-	2.65	-	-	1.85	-	2.62	1.44
220.000	40mm Coarse Aggregate Sample	-	2.69	09	13	0.60	4.25	-	-
	20mm Coarse Aggregate Sample	15	2.68	12	31	1.0	4.8	-	-
	10mm Coarse Aggregate Sample	17	2.66	25	21	1.20	5.0	-	-
	Crushed Sand/ Stone Dust/Stone Chippings, 4.75mmDown	-	2.63	-	-	2.4	-	2.26	1.52
	Fine Aggregate Sample/Sand	-	2.62	-	-	2.02	-	1.01	1.43

2.4.11 Quarries for Natural Sand

The bed of the following river flowing in the vicinity of the project road is the only potential source for good quality coarse sand in sufficient quantities. The details of quarry are given in **Table 2.22.**

Table 2.22.Details of Natural Sand Sources

Sl.No	Chainage (Km)	Direction	From Quarry to Project Stretch Distance in (km)	Remarks
1	56.000	LHS	0.1	Sand Suru River
2	220.000	LHS	0.2	Sand Suru River
3	111.300	RHS	0.2	Sand Suru River

The locations of quarries and the approximate distance of each quarry from the project road are compiled in **Figure 2.3:**

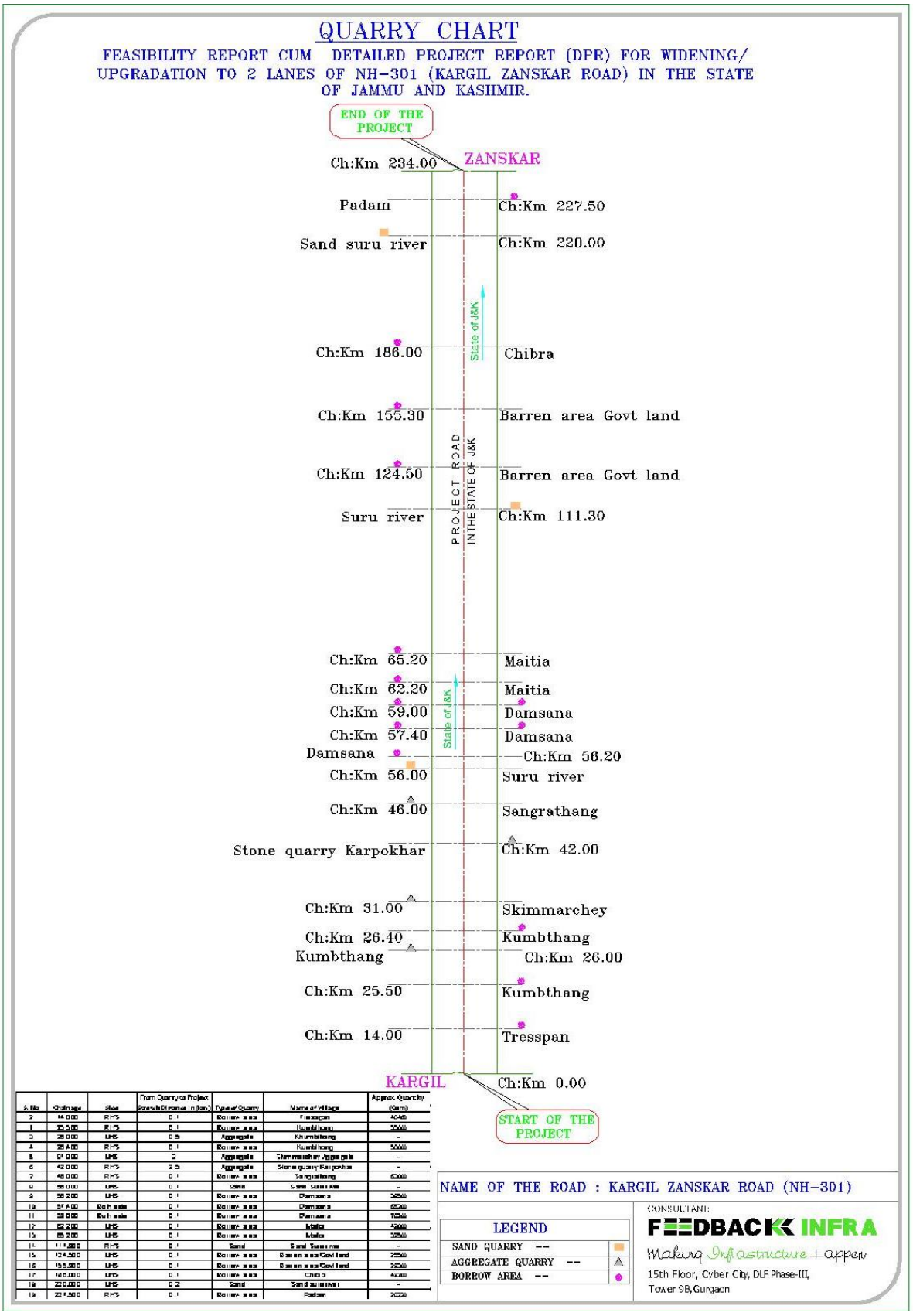


Figure 2.3: Lead Chart

	
Sand Quarry Suru River at km -56.00(LHS) at a lead distance of 200m Village Damasna.	Quarry cum Crusher at km 42.00 (RHS) at a lead Distance of 2.50km Village Karpokhar.
	
Quarry cum Crusher at km 220.500 (RHS) at a lead Distance of 500m Village Shimiling.	Borrow Area at km 25.500 (RHS)
	
Borrow Area at km 57.400(Bothside)	Borrow Area at km 186.000(LHS)

2.10 INVENTORY AND CONDITION SURVEYS FOR STRUCTURES

2.10.1 GENERAL

A detailed condition survey along with visual inspection of the existing structures has been carried out by the concerned key professionals to assess and ascertain the existing condition/ of the bridges and other Cross Drainage structures. Inventory of bridges has been prepared based on the condition survey, which consists of recording relevant technical data for each bridge.

The existing road consists of 28 Minor Bridges, 935 Culverts (slab/pipe) including 30 causeways. Two minor bridges are constructed beside the old bridges

2.10.2 STRUCTURE INVENTORY AND CONDITION SURVEY

Major Bridges

No major bridge exists on this package of project road.

Minor Bridge

There are 01 minor bridges along this package-1 of the project road.

Culverts and Causeways

The existing road consists of 48 Culverts (slab/pipe) including 1 causeways along this package of the project road.

2.11 GEOTECHNICAL INVESTIGATION

Geotechnical invsetigaitons have been carried out at all the structure locations. The detailed geotechnical investigations are given as Appendix to Design Report as a separate report.

3 TRAFFIC SURVEYS, ANALYSIS AND TOLL REVENUES

3.1 INTRODUCTION

This report presents the traffic studies and analyses carried out for addressing various objectives and issues pertaining to widening/up gradation to 2 lane with paved shoulder lane of NH-301 (Kargil - Zanskar road) in the state of Jammu & Kashmir. The results of this analysis will form inputs for forecasting future traffic, planning and designing the pavement, developing capacity augmentation proposals and design of intersections along on the project road.

A thorough knowledge of the travel characteristics of the traffic using NH 301 is essential for future traffic estimation. Hence, detailed traffic surveys have been carried out to assess the baseline traffic characteristics on NH 301 between Kargil and Zanskar.

The study aims to obtaining the existing traffic and travel characteristics on the project corridor and forecasting the average annual daily traffic for project horizon year considering various constituent streams and for various scenarios.

3.2 IDENTIFICATION OF HOMOGENEOUS ROAD SECTIONS

The Project Road, section of NH-301 in the state of Jammu & Kashmir, starts at km 0.000 (design chainage is Ch. 0.000) near Baroo Kargil and ends at km 234.000 (design chainage is Ch. 230.735) near Zanskar. The Project Road passes through the district of Kargil via important towns and villages namely Baroo, Minjee, Gramthang, Kanore, Saliskote, Lankarche, Sankoo, Purtikche, Damsna, Panikhar, Tongul, Parkachik, Rangdum, Abran, Phe, Tungri, Padum, and Zanskar and with total desing length of project road is 230.735 kms.

Considering the above-mentioned traffic generation/diversion points, the project stretch is divided into four homogeneous sections for the purpose of analysis and presentation of traffic and travel characteristics. **Table 3.1**gives the details of the homogeneous sections defined for the study.**Figure 3.1** shows Survey Location Map with homogeneous sections.

Table 3.1.Homogeneous traffic sections

Section No.	Starting		Ending		Length (Km)
	Existing (Km)	Place	Existing (Km0	Place	
I	0.000	Kargil	40.000	Sankoo	40.0
II	40.000	Sankoo	125.000	Rangdum	85.0
III	125.000	Rangdum	210.000	Phe	85.0
IV	210.000	Phe	234.000	Zanskar	24.0

3.3 TRAFFIC SURVEY METHODOLOGY

3.3.1 Primary surveys and considerations

To capture traffic flow characteristics, travel pattern, speed characteristics, users' preference regarding toll imposition on traffic passing through the project road and other characteristics related to miscellaneous requirements on the project road, following primary traffic surveys were conducted.

- Classified traffic volume count (CTVC)
- Origin – Destination survey (OD)
- Pedestrian Count Survey (PC)
- Speed Delay Survey (SD)

Traffic survey stations for carrying out CTVC and OD surveys were selected after a site reconnaissance considering the following parameters.

- The station should represent homogeneous traffic section
- The station should be free from urban and local traffic influence
- The station should be located in a reasonably level terrain with good visibility.

3.3.1 Classified traffic volume counts

The CTVC survey was conducted at 7 locations, representing four homogeneous sections of project stretch. The count was conducted continuously for 7 consecutive days for 24 hours on all 7 locations. The surveys were as per guidelines illustrated in **IRC: SP: 19 – 2001**, 'Manual for Survey, Investigation and Preparation of Road Projects'. For carrying out the counts, the vehicles were grouped under the following categories.

Motorised traffic	
2 wheelers: Scooters, bikes, motorcycles and mopeds etc	
3 wheelers including auto rickshaw	
Passenger Car	Car, jeep, taxi & van
Bus	Minibus
	Govt. Bus
	Private bus
Truck	Light commercial vehicles (LCV)
	2 Axle truck
	3 Axle truck
	4 to 6 Axle Truck
	Truck with more than 6 Axle
Other Vehicles	Agriculture Tractor, Tractor & Trailer
Slow Moving Vehicles	Bicycle
	Cycle rickshaw
	Animal drawn
	Hand cart

For the purpose of counts, a day was divided into two shifts of 12 hours each and different groups of enumerators with a supervisor were assigned for each shift. The count data was recorded at 15-minute intervals for each vehicle group for each direction of travel separately. Trained enumerators were deployed for counting and recording by making tally marks in the five-dash system. This traffic data is used for working out traffic characteristics analysis and forecast, capacity augmentation and toll analysis. The schedule of survey is given in **Table 3.2**.

Table 3.2.Schedule of Traffic Volume Count Survey

Location	Survey Location	Chainage (Km)	Date
CVC 1	Lankerchen	35.000	20.08.2015 – 28.08.2015
CVC 2	Sangra	45.000	20.08.2015 – 28.08.2015
CVC 3	Panikhar	60.000	20.08.2015 – 28.08.2015
CVC 4	Rangdum	120.000	26.08.2015 – 03.09.2015
CVC 5	Abran	185.000	26.08.2015 – 03.09.2015
CVC 6	Phe	208.000	27.08.2015 – 04.09.2015
CVC 7	Padum	215.000	27.08.2015 – 04.09.2015
OD-1	Lankerchen	35.000	26.08.2015
OD-2	Padum	215.000	28.08.2015
PC-1	Panikhar	60.000	24.08.2015
PC-2	Padum	215.000	28.08.2015
Speed Delay	Along the project Road		

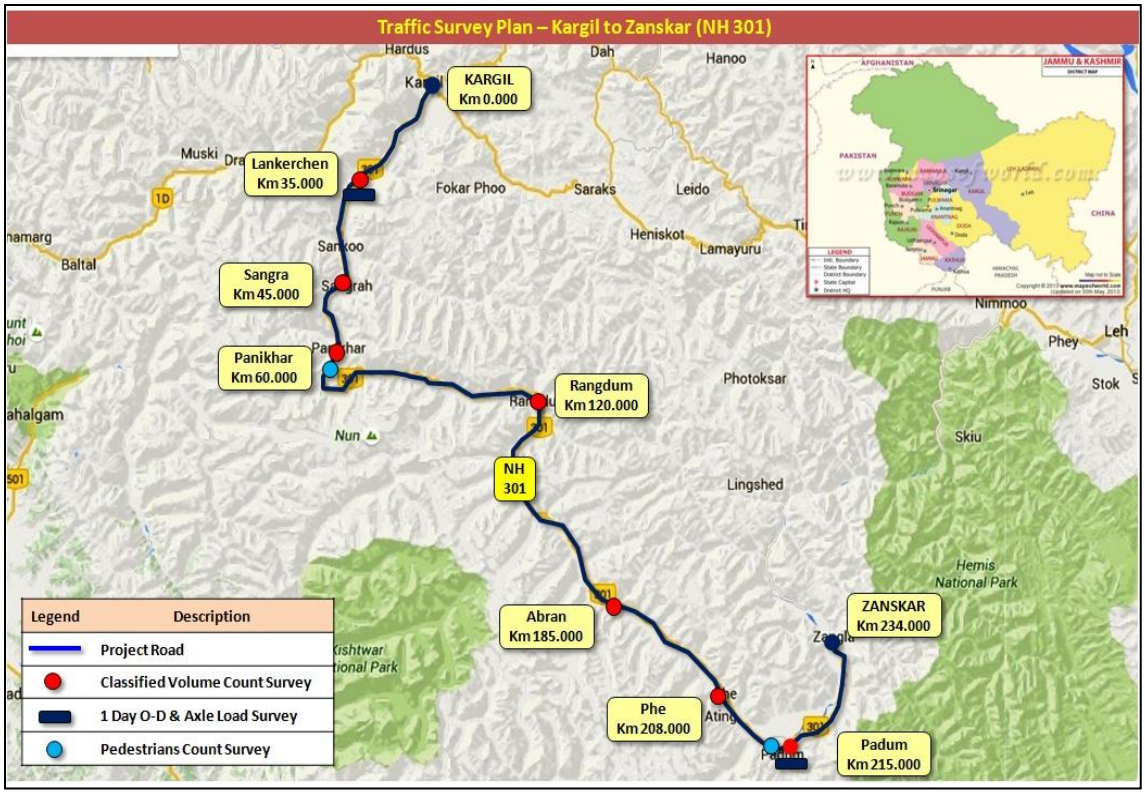


Figure 3.1: Traffic Survey Location Map

3.3.2 Origin-Destination Survey

The origin-destination survey was carried out with the primary objective of studying the travel pattern of goods and passenger traffic along the study corridor. The results have also been useful for identifying the influence area of the project road, estimating the growth rates of traffic and planning tolling strategies and locating toll plazas on the most viable sections of the project road.

The survey was conducted at two locations for a day (24 hours) as stated in Table Roadside interview method was adopted for the survey, in accordance with guidelines given by **IRC: SP 19 – 2001**. The road users were interviewed by trained enumerators to obtain the required data under the guidance of traffic engineers and supervisors. During the surveys the information pertaining to trip length, trip purpose and occupancy as applicable for various vehicle types were recorded.

Table 3.3.Schedule of Origin – Destination Survey

Location	Survey location/ section	Chainage (Km)	Date
OD 1	Lankerchen	35.000	26.08.2015
OD 2	Padum	215.000	28.08.2015

3.4 DATA ANALYSIS

3.4.1 Traffic volume count

The classified traffic volume survey data for seven count locations is analysed in order to obtain the following traffic characteristics:

- Average hourly variation of traffic volume
- Daily variation of traffic volume
- Average Composition of traffic
- Directional distribution of traffic
- Average Daily Traffic (ADT) volume

Daily and hourly variation of classified traffic flow is recorded by conducting traffic count at five strategically selected traffic count stations. Recorded traffic data has been converted into Passenger Car Units using PCU factors as shown in **Table 3.4**. These equivalency factors are extracted from **IRC: 64 – 1990**, 'Guidelines for Capacity of Roads in Rural Areas'.

Table 3.4.Passenger car equivalency factors

Sl. No.	Vehicle Type	PCU Factors
1.	Two-Wheeler	0.50
2.	Auto–rickshaw	1.00
3.	Car / Jeep / Van / Tempo	1.00
4.	Minibus	1.50
5.	Standard Bus	3.00
6.	Light Commercial Vehicle (LCV), Agricultural Tractor	1.50
7.	Two Axle Truck	3.00
8.	Three Axle Truck	3.00
9.	Truck Trailer	4.50
10.	Agriculture Tractor-trailer	4.50
11.	Animal Drawn	8.00
12.	Cycle	0.50
13.	Hand Cart	3.00
14.	Cycle Rickshaw	2.00

3.4.2 Average daily traffic (ADT)

Traffic volume count data for 7 days at each location was averaged to determine Average Daily Traffic (ADT). Traffic volume count summary sheets for seven count locations along with ADT tables are presented in **Appendix H** to this Detailed Project Report. The location wise ADT by vehicle type is presented in **Table 3.5**.

The entire project section was divided into four homogenous sections. Each count location represents separate homogenous section.

Table 3.5.Average Daily Traffic at count locations

Vehicle Type	Km 35.000	Km 45.000	Km 60.000	Km 120.000	Km 185.000	Km 208.000	Km 215.000
	Lankerchen	Sangra	Panikhar	Rangdum	Abran	Phe	Padum
Car / Jeep / Van (Private)	281	104	28	21	14	43	595
Car / Jeep (Taxi)	131	53	19	17	12	7	57
Shared Jeep	0	0	0	0	0	0	0
Minibus	20	7	4	4	5	2	0
School. Bus	0	0	0	0	0	0	4
Govt. Bus	4	0	4	4	1	0	0
Pvt. Bus	4	0	0	0	1	0	1
Maxx/Pick-Up	49	21	5	5	7	26	66
LCV (4 tyre)	0	0	0	0	1	0	0
LCV (6 tyre)	3	0	1	1	5	0	1
2 Axle trucks	83	30	6	6	17	36	36
3 Axle trucks	0	0	0	0	1	2	0
MAV (4 to 6 Axles)	0	0	0	0	0	0	0
MAV (> 6 Axles)	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0
3-Wheeler	0	0	0	0	0	0	0
2-Wheeler	40	16	3	3	1	7	89
Agriculture Tractor	1	0	1	1	0	0	2
Agriculture Tractor with Trailer	9	0	24	19	0	9	20
Cycle	5	4	0	0	0	3	18
Cycle Rickshaw	0	0	0	0	0	0	6
Animal Drawn Cart	0	0	0	0	0	0	16
Grand Total (Nos.)	**630**	**235**	**95**	**81**	**65**	**135**	**911**
Grand Total (PCUs)	**833**	**289**	**201**	**169**	**110**	**239**	**1097**

- The project road mainly caters to the passenger traffic while the commercial traffic is very less and consists of light commercial vehicles.
- The traffic on the project road is mainly local in nature with negligible share of through traffic.

3.4.2.1 Annual Average Daily Traffic (AADT)

AADT is the base year (2015) traffic. This is a product of ADT and seasonal variation factor. Seasonal variation factor can be derived using various methods. Vehicle data from toll booths check posts etc. or sale details of petrol and diesel fuels along the corridor are the commonly used sets of data. In the present case fuel sale data is used, which is collected from various fuel outlets along the project stretch. Sales of petrol and diesel in each month for the last two years are used to arrive at seasonal correction factors. **Table 3.6**shows the seasonal factors calculated.

Table 3.6.Seasonal Factors

Month	Petrol	Diesel
April	1.00	1.06
May	1.05	1.04
June	1.05	0.98
July	1.16	0.94
August	**0.86**	**0.90**
September	0.88	0.97
October	1.00	1.02
November	1.03	1.00
December	1.01	1.05
January	1.06	1.14
February	1.05	1.00
March	0.92	0.95

The traffic volume survey along the project road has been carried out in month of August 2015 and seasonal factor for this has been considered for converting ADT to AADT. AADT vehicle type wise at various locations along the project road is shown in **Table 3.7**Summary of ADT & AADT.

Table 3.7.Annual Average Daily Traffic at Count Locations

Vehicle Type	Km 35.000	Km 45.000	Km 60.000	Km 120.000	Km 185.000	Km 208.000	Km 215.000
	Lankerchen	Sangra	Panikhar	Rangdum	Abran	Phe	Padum
Car / Jeep / Van (Private)	248	92	25	18	12	38	524
Car / Jeep (Taxi)	118	48	17	15	11	6	51
Shared Jeep	0	0	0	0	0	0	0
Minibus	20	7	4	4	5	2	0
School. Bus	0	0	0	0	0	0	4
Govt. Bus	4	0	4	4	1	0	0
Pvt. Bus	4	0	0	0	1	0	1
Maxx/Pick-Up	44	19	5	5	6	23	59

Vehicle Type	Km 35.000	Km 45.000	Km 60.000	Km 120.000	Km 185.000	Km 208.000	Km 215.000
	Lankerchen	Sangra	Panikhar	Rangdum	Abran	Phe	Padum
LCV (4 tyre)	0	0	0	0	1	0	0
LCV (6 tyre)	3	0	1	1	5	0	1
2 Axle	74	27	6	6	15	32	33
3 Axle	0	0	0	0	1	2	0
MAV (4 to 6 Axles)	0	0	0	0	0	0	0
MAV (> 6 Axles)	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0
3-Wheeler	0	0	0	0	0	0	0
2-Wheeler	40	16	3	3	1	7	89
Agriculture Tractor	1	0	1	1	0	0	2
Agriculture Tractor with Trailer	9	0	24	19	0	9	20
Cycle	5	4	0	0	0	3	18
Cycle Rickshaw	0	0	0	0	0	0	6
Animal Drawn Cart	0	0	0	0	0	0	16
Grand Total (Nos.)	**570**	**213**	**90**	**76**	**59**	**122**	**824**
Grand Total (PCUs)	**755**	**261**	**196**	**164**	**100**	**218**	**1004**

In the**Table 3.8** given above clearly suggests that traffic at Km 35.000 (Lankerchen) and Km 215.000 (Padum), starting and end point of the corridor is the maximum. This traffic is mainly due to the presence of settlements in close vicinity of the two locations. We see a downslide in traffic in between the two points.

Table 3.8.Summary of ADT and AADT at count locations

Location (Km)	ADT		AADT	
	Nos.	PCUs	Nos.	PCUs
35.000	630	833	570	755
45.000	235	289	213	261
60.000	95	201	90	196
120.000	81	169	76	164
185.000	65	110	59	100
208.000	135	239	122	218
215.000	911	1097	824	1004

3.4.2.2 Daily Variation of traffic

Daily variation of traffic for all locations is shown in **Figure 3.2**. Daily variation of traffic in terms of day factors at each of the count location is presented in **Table 3.9.**

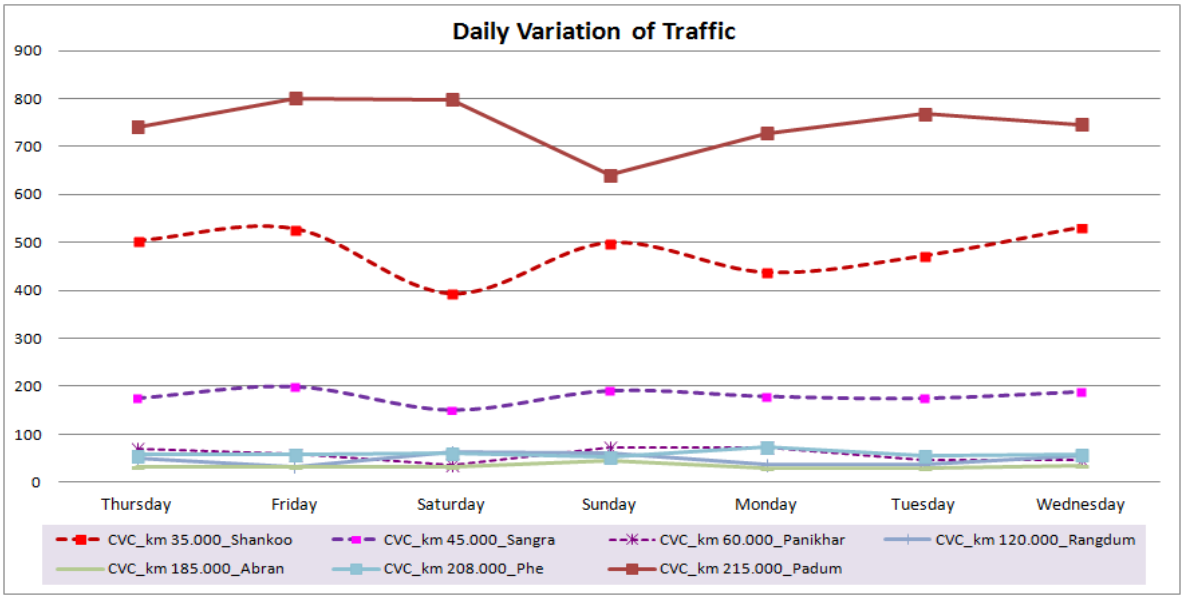


Figure 3.2: Daily Variation of Traffic

Figure 3.2 shows the variation of flow in commercial and passenger vehicles at all count locations, separately. The passenger and commercial vehicle flow at all locations had different trend in variation.

Table 3.9.Day Factors and Maximum Variations

Location (Km)	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Maximum Variation	
								-ve (%)	+ve (%)
35.000	4.9%	8.4%	-23.5%	3.4%	-10.6%	4.4%	16.1%	***-23.5%***	***16.1%***
45.000	0.2%	9.4%	-25.6%	18.5%	5.2%	1.7%	-3.3%	***-25.6%***	***18.5%***
60.000	10.2%	-5.7%	-44.1%	41.1%	23.2%	-7.2%	-31.2%	***-44.1%***	***41.1%***
120.000	-9.5%	-42.0%	40.2%	26.3%	-5.9%	-29.0%	5.9%	***-42.0%***	***40.2%***
185.000	-11.4%	-9.5%	10.9%	25.0%	10.9%	-18.6%	-4.5%	***-18.6%***	***25.0%***
208.000	-9.2%	-8.4%	-10.5%	4.8%	18.9%	11.9%	-15.3%	***-15.3%***	***18.9%***
215.000	2.0%	6.6%	8.2%	-13.7%	-3.1%	1.4%	0.0%	***-13.7%***	***8.2%***

Day factor is the variation of each day's traffic to the average daily traffic. Maximum traffic is seen at Padum (Km 215.000) any day of the week followed by Shankoo (Km 35.000).

3.4.2.3 Hourly variation of traffic

Average hourly variation of traffic for all 7 count locations is shown in **Figure 3.3**. The peak hour at various locations along the project road varies and is different for different locations. The morning peak is observed at km 45, km 60 and km 120, while the evening peak is observed at km 35 and km 215. At all other locations the peak hour is in the afternoon.

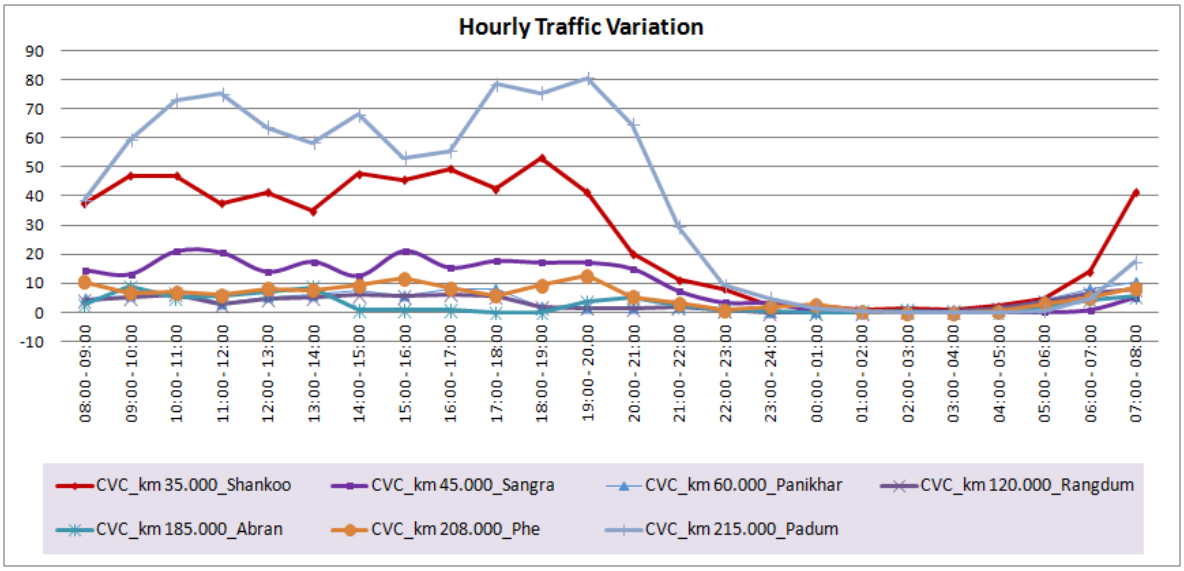


Figure 3.3: Hourly Traffic Variation

3.4.2.4 Peak hour traffic

The peak hour traffic at all locations is presented in **Table 3.10** below.

Table 3.10.Peak Hour of Traffic

Location (Km)	Peak hour	PHF	Peak hour PCU
35.000	18:00-19:00	7.75	837
45.000	11:00-12:00	8.96	291
60.000	07:00-08:00	9.48	197
120.000	07:00-08:00	9.88	166
185.000	13:00-14:00	16.17	110
208.000	15:00-16:00	9.27	236
215.000	19:00-20:00	10.03	1099

3.4.2.5 Directional Distribution of Traffic

Directional split at each of the location is shown in **Table 3.11**. This is a useful input for capacity analysis. As seen, the directional split for up and down traffic is nearly equal.

Table 3.11.Directional Split

Location (Km)	Kargil-Zanskar	Zanskar-Kargil
35.000	49.8%	50.2%
45.000	49.8%	50.6%
60.000	46.3%	52.6%
120.000	45.7%	50.6%
185.000	60.0%	40.0%
208.000	52.6%	46.7%
215.000	49.7%	50.3%

3.4.3 Origin – Destination Survey

The O – D survey has been carried out on random sample basis and sample size obtained for each class of vehicle is shown in **Table 3.12**.

Table 3.12.Sample Size for O&D Survey

Vehicle Type	Km 35.000	Km 215.00
Car / Jeep / Van (Private)	84.5	49.8
Taxi	79.0	62.7
Minibus	45.0	-
Pvt. Bus	75.0	80.0
Mini LCV, Tata ACE	58.1	46.7
LCV (6 tyre)	66.7	-
2 Axle	75.0	82.1

The collected data were entered into the computer and checked manually. Incorrect entries were corrected by cross-checking it with original field data sheets. The data was also checked for inconsistencies. The checking included:

- Trips from zones to zones which cannot possibly ply through the survey location
- Vehicle type with their corresponding lead / load / occupancy for any inconsistencies

The checked and corrected data were used for final analysis.

3.4.3.1 Zoning System

For analysis of data collected from the field, it is required to code them for developing origin and destination matrices of trips. To assess the local traffic more precisely the zoning system is considered in four levels. The project corridor is in the state of Jammu and Kashmir in the Ladakh district. The project stretch is situated in Kargil. The zones were decided based on these facts.

37 zones were considered along the project corridor and other zones are put under Kargil and Leh. Neighboring districts and remaining districts of Jammu and Kashmir considered as IIA region and rest of India were grouped to form external influencing zones. The zones are listed in **Table 3.13.**

Table 3.13.Adopted Zoning System for the Study

Zone No.	Zone Name	District
1	Kargil	**Along the project Road**
2	Kargil Airport	
3	Minjigum	
4	Gramthang	
5	Shimsha, Minji	
6	Trespone	
7	Salaskot	
8	Pharona, Kanore	

Zone No.	Zone Name	District
9	Lankarchey	
10	Sanku	
11	Karporkar	
12	Stakpa	
13	Gailing	
14	Thangboo	
15	Purtikche	
16	Yuluk	
17	Kargee	
18	Panikhar	
19	Tholus, Thangol, Nam Suru	
20	Parkachik	
21	Shafat, Shakar Rangdum	
22	Zhuldo	
23	Rangdum	
24	Tashi Tonde	
25	Pensi La	
26	Agshu, Chibra,	
27	Abran	
28	Kushul, Hamiling	
29	Skyagam, Rimalla, Mandra Ling	
30	Phe	
31	Tokhta, Ating, Dokhang, Shagar, Markim	
32	Shilatse, Rantaksar, Tungri, Sani, Tahan	
33	Rizing, Karsha, Pibiting	
34	Padum	
35	Stongde, Chillingskyd	
36	Zanskar	
37	Pishu, Zangla	
38	Kakshar, Kharbu, Hardus	**Kargil**
39	Bimbat, Dras, Muski	
40	Batalik	
41	Fokar Phoo, Shargole, Wakha	
42	Saraks, Heniskot, Chiktan	
43	Leh	**Leh**
44	Dah, Leido, Lamayuru, Tingmosgang, Alchi	
45	Diskit, Hunder, Sumur, Panamik, Murgo, Tegar	
46	Srinagar, Anantnag, Kulgam	**Kashmir valley division**
47	Pulwama, Shopian, Budgam, Ganderbal, Bandipora, Baramulla, Kupwara	
48	Samba, Kathua, Jammu, Doda, Kishtwar, Udhampur	**Jammu Division**
49	Rajouri, Reasi, Ramban, Poonch	
50	Punjab	**Other States of India**
51	Himanchal	
52	Haryana	
53	Uttrakhand & Uttar Pradesh	
54	Delhi	
55	Rajasthan, Gujarat, Madhya Pradesh	

Zone No.	Zone Name	District
56	Maharashtra, Goa	
57	Kerala, Karnataka, Tamil Nadu, Pondicherry	
58	Andhra Pradesh, Chhattisgarh, Orrisa	
59	Bihar, Jharkhand, West Bangal,	
60	North Eastern States	

3.4.3.2 Expansion Factors and Development of O – D Matrices

The origin – destination details were collected from the trip makers during the survey on sample basis. Sampling varied with the changes in traffic flow across the day. Care has been taken to eliminate any element of bias in sampling. Since data was collected on sample basis, expansion factors are required to replicate the pattern as reflected in the sample to the total number of vehicular trips made during the day. These expansion factors are calculated separately for each class of vehicle. For example, if xc is number of cars interviewed and Xc is the total number of cars counted during the day, then Xc/xc would be the expansion factor for cars.

O – D matrices are developed to assess the traffic movement pattern. These matrices actually speak about distribution of trips for each zone as intra zonal and inter zonal movements. The vehicle wise O – D matrices are developed by multiplying the sample O – D matrix obtained from survey data with expansion factors. O – D matrices for different vehicle type for project road are presented in **Appendix I** to this detailed project report.

3.4.3.3 Lead Distribution

The lead distribution of vehicles as revealed from O – D survey is given in Table below. Minibus is included in this, as its trips also impart important characteristics about distances.

Table 3.14.Trip Lead Distribution

Vehicle type	0-20	20-50	50-100	100-200	200-500	500-1000	> 1000	Total
km 35.000								
Car/Jeep/Van	1.6	15.1	9.8	26.5	46.9	0.0	0.0	100
Taxi	0.8	12.6	7.6	34.5	44.5	0.0	0.0	100
Minibus	0.0	35.0	60.0	5.0	0.0	0.0	0.0	100
Pvt. Bus	0.0	0.0	50.0	37.5	12.5	0.0	0.0	100
Mini LCV, Tata ACE	34.9		34.9	2.3	27.9	0.0	0.0	100
LCV	0.0		66.7	0.0	33.3	0.0	0.0	100
Two Axle Trucks	13.4		22.4	22.4	41.8	0.0	0.0	100
Km 215.000								
Car/Jeep/Van	8.6	4.7	0.0	27.0	51.8	7.9	0.0	100
Taxi	11.8	9.8	0.0	25.5	52.9	0.0	0.0	100
Pvt. Bus	0.0	60.0	0.0	20.0	20.0	0.0	0.0	100
Mini LCV, Tata ACE	0.0		0.0	45.0	55.0	0.0	0.0	100
Two Axle Trucks	3.6		0.0	32.1	64.3	0.0	0.0	100

We see similar trip characteristics for the passenger and goods vehicles. Major share of both passenger and goods vehicles is in the range 100-200 Km. At Km 35.000, the Maximum trips fall in 50-100 and 200-500 Km trip length range. At Km 215.000, the maximum trips in 100-200 and 200-500 Km trip length range.

3.4.3.4 Commodity groups and analysis

The different commodities recorded during the O – D survey have been classified in 20 categories as presented in Table Due consideration has been given to include all possible commodities and to categorize them into homogeneous groups.

Table 3.15.Commodity Type

Code	Commodity
1	Empty
2	Food Grains (Rice, Wheat,Gur, sugarcane etc.,)
3	Vegetables / Fruits
4	Milk/ Milk products / Fish/Meat
5	Consumer Item
6	Iron / Steel
7	Petroleum / Oil / Gas/ Lubricants
8	Chemicals
9	Timber / Wood
10	Bricks
11	Aggregate, boulders, stone , giti
12	Sand, Cement, mitti
13	Manufactured Goods (Electronic items, Vehicles, Leather, Tobacco, Rubber/ Tyres, Plastics, etc.)
14	Wood
15	Minerals (chromium, Iron ore etc.)
16	Paper
17	Animal / Animal Fodder
18	Parcels / Containers
19	Textiles, fibre
20	Scrap

The commodity movement pattern along the corridor is analysed and presented in **Table 3.16.** The percentage of each commodity is shown mode wise at each survey location.

Table 3.16.Distribution of Goods

Commodity Type	Km - 35.000		Km – 215.000	
	LMV	2Axle	LMV	2Axle
Empty	11.9	17.4	25.0	14.6
Food Grains (Rice, Wheat, Gur, sugarcane etc.,)	0.0	8.7	6.7	22.0
Vegetables / Fruits	14.3	18.8	15.0	14.6

Commodity Type	Km - 35.000		Km – 215.000	
	LMV	2Axle	LMV	2Axle
Milk/ Milk products / Fish/Meat	0.0	0.0	0.0	0.0
Consumer Item	0.0	0.0	20.0	0.0
Iron / Steel	7.1	4.3	0.0	7.3
Petroleum / Oil / Gas/ Lubricants	31.0	17.4	18.3	14.6
Chemicals	0.0	0.0	0.0	0.0
Timber / Wood	0.0	0.0	0.0	0.0
Bricks	0.0	0.0	0.0	0.0
Aggregate, boulders, stone, Giti	7.1	4.3	8.3	7.3
Sand, Cement, Mitti	4.8	10.1	0.0	4.9
Manufactured Goods	21.4	15.9	0.0	12.2
Wood	0.0	0.0	0.0	0.0
Minerals (chromium, Iron ore etc.)	0.0	0.0	0.0	0.0
Paper	2.4	2.9	0.0	2.4
Animal / Animal Fodder	0.0	0.0	6.7	0.0
Parcels / Containers	0.0	0.0	0.0	0.0
Textiles, fibre	0.0	0.0	0.0	0.0
Scrap	0.0	0.0	0.0	0.0
Total	100	100	100	100

The commodities carried by the light commercial vehicles and 2 axle trucks mainly include the food grains, fruits and vegetables, petroleum products and manufactured goods.

3.4.4 Analysis of Pedestrians Count Survey

Pedestrian-vehicular conflict can be effectively studied through the indicator suggested in **IRC 103-1988**, 'Guidelines for Pedestrian Facilities'. The code suggests some form of control measure at mid blocks and intersections where the indicator PV^2 is greater than or equal to 2 x 10^8. Where 'P' is the peak hour pedestrian volume and 'V' is the number of vehicles in that peak hour. The analysis was undertaken separately for each of the intersection where traffic surveys were conducted. A summary of the peak values for PV^2 and the hour in which the same is observed is presented in **Table 3.17**.

Table 3.17.Pedestrian-Vehicular Conflict

Sl. No.	Location	Chainage (Km)	Hour	P	V	$PV^2/10^8$
1	Panikhar	km 60.000	8:00-9:00	**66**	**6**	**0.000**
2	Padum	km 215.000	9:00-10:00	**74**	**59**	**0.003**

It can be seen that the at all the location, indicator PV^2 is less than 2, therefore no control measures are required at above locations for pedestrian safety.

3.4.5 Speed Delay survey

The purpose of this survey was to identify the critical locations or bottlenecks and to assess the existing level of service of traffic operations. Information collected from this survey included journey time, journey speed, vehicular delay, Causes of Delay etc.

The survey data was analysed to assess the journey and running speeds on the project road. The results are presented in **Table 3.18**.

Table 3.18.Observed Speed along the project Road

S. No.	Direction	Journey speed (Kmph)	Running Speed (Kmph)
1	Kargil - Zanskar	23.60	23.78
2	Zanskar - Kargil	22.41	22.56

The journey speed and running speed of the vehicles along the corridor is in the range of 22-25 kmph.

3.5 TRAFFIC FORECAST AND TOLL STRATEGY

3.5.1 Introduction

Investment priorities are governed by the traffic demand, assessed benefits and cost of the project. Demand plays the important role, governing which type of facility / infrastructure needs to be created. This in turn determines likely benefits and costs to develop the same. A highway project of this nature calls for significant investment. Prediction of traffic demand becomes an important task and has to be carried out near accurately. Accurate estimation of traffic has direct bearing on the viability of the project. Recognizing this, efforts need to be made to carefully assess all the parameters that help in predicting the traffic demand in future, which necessitates realistic estimation of traffic growth rates. Traffic growth on a road facility is generally estimated on the basis of historical trends. In the present case, traffic growth rates have been estimated using elasticity method as per **IRC: 108 – 1996**. Demand changes are usually because of shifts in the pattern of economic activities in the surrounding regions. Hence, future traffic estimation necessitates a preview, however imprecise, of the probable pattern of future growth of the economy.

3.5.2 Past Vehicle Registration Details

It is revealed from OD survey that the project stretch is mainly influenced by Jammu & Kashmir state. For establishing growth rates, data of Jammu & Kashmir state have been considered. The vehicle registration data of Jammu & Kashmir state have been collected and presented in **Table 3.19**.

Table 3.19.Past vehicle registration data

Year	Car / Jeeps	Two Wheelers	Bus	Commercial Vehicles
2004-05	108934	273265	20735	45464
2005-06	123023	297656	21435	50017
2006-07	138072	320754	22161	55701
2007-08	156508	341834	23149	61651
2008-09	175433	363029	24051	66464
2009-10	199611	407928	23480	78347
2010-11	237846	446791	25858	82206
2011-12	280825	480,815	25765	89894
CAGR	**14.49**	**8.41**	**3.15**	**10.23**

Source: India Stat Organization, Central Statistical Organization.

3.5.3 Past Growth of the Economy

Growth of traffic on the project road is influenced by existing development and future growth prospects of the influencing regions. The time series data of state income NSDP at constant (1999-00) prices, state population, per-capita income of PIA states and GDP as published by Central Statistical Organization have been collected and studied to assess the past performance of the influencing state economies. **Table 3.20** depicts these economic indicators.

Table 3.20.Economic Indices of States and India at Constant Prices (1999-00)

Year	Indices of J & K		GDP of India (Rs Crores)	Population of J & K
	NSDP (Rs Crores)	Per capita NSDP (in Rs)		
2004-05	8622228	37972	2971464	22707000
2005-06	9401146	40627	3253073	23140000
2006-07	10470049	44423	3564364	23569000
2007-08	11289592	47046	3896636	23997000
2008-09	12158839	49780	4158676	24425000
2009-10	13677999	55044	4516071	24849000
2010-11	14605347	57797	4918533	25270000
2011-12	15852299	61716	5247530	25686000
2012-13	16716882	64052	5482111	26099000
2013-14	17830719	67260	5741791	26510000
CAGR	**8.41**	**6.56**	**7.59**	**1.74**

Source: of www.indiastat.com, Office of the Registrar General & Census Commissioner, ministry of statistics and programme implementation and various websites of state governments

3.5.4 TRANSPORT DEMAND ELASTICITY

As discussed earlier, the elasticity approach has been used for determining growth rates of future traffic. Since time series traffic data on project road is not available, traffic growth rates and elasticity values are established by using registered vehicles as the dependent variable.

Description of Regression Analysis

The Regression Analysis tool performs linear regression analysis by using the "least squares" method to fit a line through a set of observations. We can analyze how a single dependent variable is affected by the values of one or more independent variables. In the present case, registered vehicles by type are the dependent variables whereas the economic parameters are independent variables. Once the relation is established by regression, the measures explained below are used to accept or reject the same.

t-statistic

The t-statistic is a measure of how strongly a particular independent variable explains variations in the dependent variable. The larger the t-statistic, the better is the independent variable's explanatory power.

R Square

R Square is another measure of the explanatory power of the model. In theory, R square compares the amount of error explained by the model as compared to the amount of error explained by averages. The higher the R-Square, the better it is.Regression analysis is carried out by creating econometric models which are suggested in IR**C: 108 - 1996** using past vehicle registration data of and economic indicators, like, Population and PCI for passenger vehicles and NSDP for freight vehicles. All India registered trucks are also regressed with GDP (Gross Domestic Product) to estimate national level elasticity value for trucks and its growth rate. The elasticity values obtained for each class of vehicle are given in **Table 3.21.**

Table 3.21.Elasticity Values Derived based on Regression Analysis

Mode	Variable	Elasticity	R-square	T-STAT	CAGR(GR)
Car	Population	8.19	0.990	-0.114	53.41
	Per-capita Income	-0.17		1.382	
	Per-capita Income	1.89	0.986	20.34	15.89
	Population	7.52	0.990	23.93	13.04
2-Wheelers	Population	1.06	0.993	0.37	8.47
	Per-capita Income	0.89		1.23	
	Population	4.57	0.991	26.36	7.93
	Per-capita Income	1.15	0.993	29.68	7.55
Buses	Population	7.35	0.971	3.02	36.42
	Per-capita Income	-1.40		-2.28	
	Population	1.81	0.941	9.81	3.13
	Per-capita Income	0.45	0.919	8.24	2.95
	NSDP	0.00	0.000	0.00	0.00
Trucks (J&K)	NSDP	1.14	1.00	53.770	9.58
Trucks (All India) 10 Year data	GDP	1.19	0.99	26.31	9.03

Projected transport demand elasticity

Considering the Project Influence Area (PIA) and economic indicators of Jammu & Kashmir, the projected elasticity values for various vehicle types are presented in **Table 3.22** which is used to estimate the growth rates of each vehicle type.

Transport demand elasticity by vehicle type, over a period of time, tends to decline and approach unity or even less. As the economy and its various sectors grow, every region tends to become self-sufficient. Moreover, much of the past growth has been associated with the country's transition from a largely rural subsistence economy to cash-based urban economy, dominated by regional and national linkages. As the transition proceeds, its impact on transport pattern can be expected to become less dominant. Therefore, the demand for different type of vehicles falls over time, despite greater economic development. In other words, the values of elasticity tend to decrease with economic development in future years due to changes in the structure of economy, with higher contribution from service sector and higher value of industrial outputs. The same is also clear from the relationships of the economy and transport demand elasticity over time, both nationally and internationally.

Table 3.22.Projected Transport Demand Elasticity Values

Vehicle Type	Indicator	2016-20	2021-25	2026-30	Beyond 2030
Cars	Population	6.09	5.48	4.93	4.44
Two-wheeler	PCI	0.93	0.84	0.76	0.68
Bus	Population	1.46	1.32	1.18	1.07
Trucks (J&K)	NSDP	0.92	0.83	0.75	0.67
Truck (All India)	GDP	1.07	1.02	0.97	0.92

3.6 FUTURE ECONOMIC GROWTH: STATE AND NATIONAL ECONOMIES

Against the discussed background, any agenda for future growth of the state economies has to take into account past trends, future prospects, and the emerging challenges. The growth prospects for the state have been developed taking into consideration the past performance of the state economies and the economic growth envisaged for the future. The pace with which the regional economies grow with the envisaged growth of the state is a major contributing factor in growth of traffic.

Based on the present NSDP growth of Jammu & Kashmir and future policies of the government, the projected NSDP, Population and PCI growth rates estimated and presented in Table 7.5. The growth of NSDP of Jammu & Kashmir has been 7.31 per cent (Analysis by Time Series Data). Therefore, considering the present economic scenario, a realistic growth of 7.31%, to 5.33% is assumed for the four periods for Jammu & Kashmir.

Considering the present GDP growth and its future targets, a realistic growth rate of 6.5% to 5.0% has been assumed. The perspective economy growth rates considered are presented in **Table 3.23**.

For traffic projection various methods and tools are there in practice. The methods suggested by **IRC: 108 – 1996**, "Guidelines for traffic prediction on rural highways" and as they account for economic performances and other social parameters.

Table 3.23.Projected growth rates of Economic indicators

Indicator	2016-20	2021-25	2026-30	Beyond 2030
NSDP (J & K)	7.31	6.58	5.92	5.33
PCI (J & K)	5.93	5.40	4.84	4.36
GDP	6.5	6	5.5	5
Population (J & K)	1.38	1.18	1.08	0.97

From the above discussions the projected growth rates of GDP, NSDP, Population and Per-capita income are presented in **Table 3.23**.These growth rates are used in estimating future traffic growth rates.

3.7 TRAFFIC FORCASTING METHODOLOGY

The growth rates are found using the formulae Eqn (a) & (b).

For Passenger vehicles,

$G = R_i \times E/100$ .....Eqn. (a)

Where Ri = Growth in PCI and Population index
E=Elasticity Value
For commercial vehicles,

$G = \sum[(R * E * I)State, (R * E * I)India]$ .....Eqn. (b)

Where,
R = Economic index (NSDP/GDP)
E = Elasticity Value
I = Influence factor

Influence factor is estimated from OD survey analysis

The Estimated Growth rates arrived based on multiplying Elasticity values and growth in Economic factors is tabulated in the **Table 3.24**.

The share of goods traffic (Influence factor) in Jammu & Kashmir and from rest of India is applied in estimating growth rate of goods traffic.

Normally, the growth potential of passenger traffic in a zone depends on its population and economic growth rates. Therefore, both these parameters have been incorporated in forecasting of passenger traffic. Further, taking into account the fact that the different modes of passenger traffic grow at different rates, the elasticity (as discussed earlier) with respect to population and income growth rates is graded differently by different modes, incorporating the same for both the states.

Growth potential of goods traffic is different from passenger traffic. This is more directly related to zone's economic activity and production levels than its population and income growth, although the latter may strongly correlate with the former, especially the income growth.

Considering Most Likely scenario of the above discussed points, the growth rates were conceived using methods discussed earlier and have been modified accordingly. The basic growth factors are considered to be realistic rates. The final recommended growth rates are given in **Table 3.24**.

Table 3.24.Estimated and Recommended Traffic Growth Rates

Vehicle type	2016-20	2021-25	2026-30	Beyond 2030
Most likely Scenario				
Car	8.40	6.47	5.33	4.31
Bus	2.02	1.55	1.28	1.04
LCV	9.94	10.46	8.42	6.92
2AT	6.63	5.25	4.21	3.37
3Axle	5.0	5.0	5.0	5.0
MAV	5.0	5.0	5.0	5.0

The forecasted traffic for one scenario at homogenous sections is presented in **Appendix J** to this report.

3.7.1 Traffic Forecast for Non–Motorised Traffic

The slow-moving vehicles essentially cater to short haul traffic, meeting localised demand for transportation of individual passenger and goods to market centres and urban centres. Non–motorised traffic, especially pedal cycles, will be gradually being replaced by motorised vehicles. Therefore, it is assumed that animal drawn vehicles' and pedal cycles' volume are expected to decline by a negative growth of 2 per annum because of economic improvement. The growth rates of tractors have been however considered as 3 per annum.

3.8 DIVERTED, INDUCED AND GENERATED TRAFFIC

Normal Traffic: The normal traffic which is presently plying on the project road.

Generated Traffic: Traffic which will come on project road, due to its up gradation

Diverted Traffic: Traffic that may divert to the alternative route due to toll imposed on the project road and due to resultant

Total Traffic: The total Traffic will include generated traffic- diverted traffic (from/to the project road)

Generated/Induced Traffic: It is expected that once the project road is upgraded to 2-lane standards, there will be an addition of generated traffic from tourists visiting Kargil region in summer seasons. Secondary data has been collected from the office of the Assistant Director Tourism, Kargil for tourist arrivals, from 2006 to 2015 and it has been projected till 2019 to arrive at the additional tourist traffic. The tourist arrivals data is as presented in table below:

Table 3.25.Tourist Arrival Data

Year	International Tourist arrivals	Domestic Tourist arrivals	Total
2006	3460	9767	**13227**
2007	3240	7889	**11129**
2008	3648	13543	**17191**
2009	3179	16968	**20147**
2010	2984	25772	**28756**
2011	2692	54392	**57084**
2012	3155	57603	**60758**
2013	1634	46614	**48248**
2014	2204	47174	**49378**
2015	2393	59790	**62183**

Since the project road remains open to traffic only for 6 months, i.e. from March to August, it has been considered that the peak month would be catering to 30% of the total tourists arrivals. Following assumptions have been made to arrive at the passenger traffic due to tourist arrivals.

The percentage composition of cars has been taken as 90% while for buses it has been considered 10%/ The occupancy of cars is considered as 4 while for buses it has been taken as 20. The total tourist details are given in **Table 3.26**

Table 3.26.Generated Traffic

Particulars	Cars	Buses
Tourist per Day	720*	
Percentage share	90%	10%
Occupancy	4	20
Number of vehicles per day	259	6
PCU	1	3

**Source: Office of the Assist. Director Tourism, Kargil*

Diverted Traffic: There will be no diverted traffic as there is no alternate road exists.

3.9 PROPOSED TOLL PLAZA LOCATIONS

The project stretch is divided into four sections for Toll revenue estimation purpose. First toll plaza is proposed near km 35.000 for first section (From km 0.000 to 80.000), second toll plaza is proposed near km 120.000 for section (from km 80.000 to km 160.000) and Third toll plaza is proposed near km 215.000 for section (from km 160.000 to km 234.000) after considering the guidelines for locating toll plazas and optimization of toll revenue. **Table 3.27** below depicts the locations of toll plazas.

Table 3.27.Toll Plaza Locations

Toll plaza	Existing Chainage	Village / location	Tollable section	Tollable length (km)	Tollable PCU in 2015-16
TP-1	km 35.000	Nr. Lankerchen	km 0.000 to km 60.000	**60.0***	669
TP-2	Km 120.000	Nr. Rangdum	km 60.000 to km 125.000	**65.0**	71
TP-3	Km 185.000	Nr. Abran	Km 125.000 to km 190.000	**65.0**	100
TP-4	Km 215.000	Nr. Padum	Km 190.000 to km 234.000	**44.0**	638

**including the length of Kargil Bypass(3.4km).*

In addition to the above fee shall be levied and collected for the following bypass forming part of the Project Highway having cost of more than Rs. 10.0 crore as specified below shall be due and payable for following Plaza(s) are listed in the **Table 3.28**:

Table 3.28.Details of Bypass

S.No.	Toll plaza	Name of Bypass	Length (Km)
1	TP-1	Kargil Bypass	3.302

3.10 SCHEDULE OF USER FEE

As per Rule 3 of National Highways Fee (Determination of Rates and Collection) Rules, 2008, of concession agreement for the Project, the per km base fee/toll rates as applicable from 2007-08 are given in Table 7-10. The escalated for 2015-16 rates are also given in **Table 3.29**.

Table 3.29.Toll Rates Adopted (in Rs)

S. No.	Category of Vehicle	Capping Rate of base fee per vehicle per one-way trip For 2007-08 (in rupees per km)	Capping Rate of base fee per vehicle per one-way trip For FY-16 (in rupees per km)*
1	Car, Jeep, Van	0.39	0.60
2	Light Commercial Vehicle or Mini Bus	0.63	0.97
	Bus or Truck (2 Axle)	1.32	2.03
3	3 Axle Truck	1.44	2.22
4	HCM, EME, MAV (4-6 Axle)	2.07	3.19
5	Oversized Vehicle (>7 Axle)	2.52	3.88

3.11 TOLL TRAFFIC

3.11.1 Discounts

There are certain discounts allowed for local traffic / frequent users as per the Concession Agreement. The executing authority or the concessionaire, as the case may be, shall upon request provide a pass for multiple journeys to cross a toll plaza within the specified period at the rates specified.

Tollable traffic will have various components based on number of trips and trip distances. Table 7.30 below gives percentages of various types of tickets they go for.

Certain vehicles who prefer monthly passes will also be returning on the same day. Similarly, some of through vehicles who take daily ticket will go for return ticket also. That means same vehicles will be crossing toll plaza more than once. But, in the volume count they will be counted separately, as many times as they pass the count locations. Buses will be crossing the count location / toll plaza many times in a day.

The O – D survey provides us with valuable information in this regard. The percentages of each type are derived from the number of appearance of vehicles in the data. The frequency of each type is calculated by considering the multiple entries. Subsequent reductions have been done to arrive at exact component of each type, so that they are not considered as tollable traffic repeatedly. The AADT figures can be directly multiplied by the respective component (%) values in the table to arrive at tollable traffic. The varying travel characteristics of vehicles such as more than 2 trips a day, 2 – 3 trips in a week etc are also depicted for quick reference.

Table 3.30.Tollable Component of each Mode of Vehicle

Mode of vehicle	Categories	TP-1 (km 35.000)	TP-2 (km 120.000)	TP-3 (km 185.000)	TP-4 (km 215.000)	Frequency
Car/Jeep /Van	Travel < 20km	2.2	2.2	3.9	3.9	2.00
	Monthly pass	2.3	2.3	2.2	2.2	1.66
	Through daily (one entry)	78.1	78.1	84.4	84.4	1.00
	Through daily (re entry)	17.4	17.4	9.5	9.5	2.00
Taxi	Monthly pass	0.2	0.2	2.4	2.4	1.66
	Through daily (one entry)	86.3	86.3	80.7	80.7	1.00
	Through daily (re entry)	13.5	13.5	16.9	16.9	2.00
Minibus	Monthly pass	7.0	7.0	0.0	0.0	1.66
	Through daily (one entry)	21.0	21.0	100.0	100.0	1.00
	Through daily (re entry)	72.0	72.0	0.0	0.0	2.00
Std. Bus	Monthly pass	0.0	0.0	0.0	0.0	1.66
	Through daily (one entry)	50.0	50.0	24.0	24.0	1.00
	Through daily (re entry)	50.0	50.0	76.0	76.0	2.00
Goods Pickup	Monthly pass	10.5	10.5	0.0	0.0	1.66
	Through daily (one entry)	54.6	54.6	100.0	100.0	1.00
	Through daily (re entry)	34.9	34.9	0.0	0.0	2.00
LCV	Monthly pass	0.0	0.0	0.0	0.0	1.66
	Through daily (one entry)	66.7	66.7	100.0	100.0	1.00
	Through daily (re entry)	33.3	33.3	0.0	0.0	2.00
2-Axle truck	Monthly pass	4.0	4.0	1.1	1.1	1.66
	Through daily (one entry)	64.2	64.2	80.3	80.3	1.00
	Through daily (re entry)	31.8	31.8	18.6	18.6	2.00
3-Axle truck	Monthly pass	0.0	0.0	0.0	0.0	1.66
	Through daily (one entry)	100.0	100.0	100.0	100.0	1.00
	Through daily (re entry)	0.0	0.0	0.0	0.0	2.00
MAV	Monthly pass	0.0	0.0	0.0	0.0	1.66
	Through daily (one entry)	100.0	100.0	100.0	100.0	1.00
	Through daily (re entry)	0.0	0.0	0.0	0.0	2.00

Tollable traffic Projection

The Projected tollable traffic under different toll paying categories from FY 2015-16 to FY 2049-50 has been given in **Table 3.31, Table 3.32 & 3.33.**

Table 3.31.Projected Tollable Traffic at km 35.000

Financial Year	Car/ Jeep/Van	Taxi	Mini bus	Std. Bus	Goods Pickup	LCV	2-Axles	Total	
								Nos	PCU
FY 2015-16	244	118	20	8	44	3	68	505	669
FY 2016-17	264	128	20	8	48	3	72	543	715
FY 2017-18	287	139	21	8	53	4	77	589	772
FY 2018-19	311	150	21	8	58	4	82	634	827
FY 2019-20	507	163	26	9	64	4	88	861	1070
FY 2020-21	549	177	26	9	71	5	94	931	1153
FY 2021-22	585	188	27	9	78	5	99	991	1223
FY 2022-23	623	200	27	9	86	6	104	1055	1298
FY 2023-24	664	213	27	9	95	6	109	1123	1376
FY 2024-25	707	227	28	9	105	7	115	1198	1464
FY 2025-26	753	242	28	10	116	8	121	1278	1558
FY 2026-27	793	255	29	10	126	9	126	1348	1639
FY 2027-28	835	268	29	10	137	9	132	1420	1723
FY 2028-29	879	283	29	10	148	10	137	1496	1810
FY 2029-30	926	298	30	10	160	11	143	1578	1905
FY 2030-31	975	313	30	10	174	12	149	1663	2002
FY 2031-32	1017	327	31	10	186	13	154	1738	2088
FY 2032-33	1060	341	31	10	199	14	159	1814	2175
FY 2033-34	1106	355	31	11	212	14	165	1894	2269
FY 2034-35	1153	371	31	11	227	15	170	1978	2363
FY 2035-36	1203	387	32	11	243	17	176	2069	2468
FY 2036-37	1255	403	32	11	260	18	182	2161	2572
FY 2037-38	1309	421	32	11	277	19	188	2257	2681
FY 2038-39	1365	439	33	11	297	20	195	2360	2799
FY 2039-40	1424	458	33	11	317	22	201	2466	2918
FY 2040-41	1485	477	33	11	339	23	208	2576	3042
FY 2041-42	1549	498	34	11	362	25	215	2694	3176
FY 2042-43	1615	519	34	11	387	26	222	2814	3310
FY 2043-44	1685	542	34	12	414	28	230	2945	3460
FY 2044-45	1757	565	35	12	443	30	238	3080	3613
FY 2045-46	1833	589	35	12	473	32	246	3220	3770
FY 2046-47	1912	614	35	12	506	34	254	3367	3934
FY 2047-48	1994	641	36	12	541	37	263	3524	4111
FY 2048-49	2080	668	36	12	578	39	272	3685	4291
FY 2049-50	2169	697	36	12	618	42	281	3855	4480

Table 3.32.Projected Tollable Traffic at km 120.000

Financial Year	Car/ Jeep/ Van	Taxi	Mini bus	Std. Bus	Goods Pickup	LCV	2-Axles	Total	
								Nos	PCU
FY 2015-16	18	15	4	4	5	0	5	51	71
FY 2016-17	20	16	4	4	5	0	5	54	74
FY 2017-18	21	18	4	4	6	0	6	59	81
FY 2018-19	23	19	4	4	7	0	6	63	85
FY 2019-20	195	21	8	4	7	0	6	241	265
FY 2020-21	211	22	8	4	8	0	7	260	286
FY 2021-22	225	24	9	4	9	0	7	278	305
FY 2022-23	240	25	9	5	10	0	8	297	328
FY 2023-24	255	27	9	5	11	0	8	315	346
FY 2024-25	272	29	9	5	12	0	8	335	366
FY 2025-26	289	31	9	5	13	0	9	356	389
FY 2026-27	305	32	9	5	14	0	9	374	407
FY 2027-28	321	34	9	5	16	0	10	395	430
FY 2028-29	338	36	10	5	17	0	10	416	451
FY 2029-30	356	38	10	5	18	0	11	438	475
FY 2030-31	375	40	10	5	20	0	11	461	498
FY 2031-32	391	42	10	5	21	0	11	480	517
FY 2032-33	408	43	10	5	23	0	12	501	540
FY 2033-34	425	45	10	5	24	0	12	521	560
FY 2034-35	443	47	10	5	26	0	13	544	585
FY 2035-36	462	49	10	5	28	0	13	567	608
FY 2036-37	482	51	10	5	29	0	13	590	631
FY 2037-38	503	53	11	5	32	0	14	618	662
FY 2038-39	525	56	11	6	34	0	14	646	692
FY 2039-40	547	58	11	6	36	0	15	673	721
FY 2040-41	571	61	11	6	39	0	15	703	751
FY 2041-42	595	63	11	6	41	0	16	732	782
FY 2042-43	621	66	11	6	44	0	16	764	814
FY 2043-44	648	69	11	6	47	0	17	798	850
FY 2044-45	675	72	11	6	50	0	17	831	883
FY 2045-46	705	75	11	6	54	0	18	869	923
FY 2046-47	735	78	12	6	57	0	19	907	963
FY 2047-48	766	81	12	6	61	0	19	945	1001
FY 2048-49	799	85	12	6	66	0	20	988	1046
FY 2049-50	834	89	12	6	70	0	21	1032	1092

Table 3.33.Projected Tollable Traffic at km 185.000

Financial Year	Car/ Jeep/ Van	Taxi	Mini bus	Std. Bus	Goods Pickup	LCV	2-Axle trucks	3-Axle trucks	Total	
									Nos	PCU
FY 2015-16	12	11	5	2	6	6	15	1	58	100
FY 2016-17	13	12	5	2	7	6	16	1	62	106
FY 2017-18	14	13	5	2	7	7	17	1	66	112
FY 2018-19	15	14	5	2	8	8	18	1	71	120
FY 2019-20	187	15	9	2	9	8	19	1	250	303
FY 2020-21	202	16	10	2	10	10	21	1	272	330
FY 2021-22	215	18	10	2	11	11	22	1	290	351
FY 2022-23	229	19	10	2	12	12	23	1	308	371
FY 2023-24	244	20	10	2	13	13	24	1	327	393
FY 2024-25	260	21	10	2	14	14	25	2	348	418
FY 2025-26	277	23	10	2	16	16	27	2	373	448
FY 2026-27	292	24	11	2	17	17	28	2	393	471
FY 2027-28	307	25	11	2	19	19	29	2	414	495
FY 2028-29	324	26	11	2	20	20	30	2	435	519
FY 2029-30	341	28	11	3	22	22	32	2	461	552
FY 2030-31	359	29	11	3	24	24	33	2	485	579
FY 2031-32	374	30	11	3	25	25	34	2	504	600
FY 2032-33	390	32	11	3	27	28	35	2	528	628
FY 2033-34	407	33	11	3	29	29	36	2	550	652
FY 2034-35	425	35	12	3	31	31	38	3	578	688
FY 2035-36	443	36	12	3	33	34	39	3	603	716
FY 2036-37	462	38	12	3	35	35	40	3	628	744
FY 2037-38	482	39	12	3	38	38	41	3	656	775
FY 2038-39	502	41	12	3	40	41	43	3	685	810
FY 2039-40	524	43	12	3	43	43	44	3	715	843
FY 2040-41	547	44	12	3	46	47	46	3	748	882
FY 2041-42	570	46	12	3	49	49	47	4	780	919
FY 2042-43	595	48	12	3	53	53	49	4	817	962
FY 2043-44	620	50	13	3	56	56	51	4	853	1004
FY 2044-45	647	53	13	3	60	60	52	4	892	1047
FY 2045-46	675	55	13	3	65	65	54	4	934	1095
FY 2046-47	704	57	13	3	69	68	56	5	975	1144
FY 2047-48	734	60	13	3	74	73	58	5	1020	1195
FY 2048-49	765	62	13	3	79	79	60	5	1066	1248
FY 2049-50	798	65	13	3	84	84	62	5	1114	1303

Table 3.34.Projected Tollable Traffic at km 215.000

Financial Year	Car/ Jeep/Van	Taxi	Mini bus	Std. Bus	Goods Pickup	LCV	2-Axles	Total	
								Nos	PCU
FY 2015-16	429	51	0	5	59	0	28	572	638
FY 2016-17	465	55	0	5	65	0	30	620	690
FY 2017-18	504	60	0	5	71	0	32	672	746
FY 2018-19	546	65	0	5	78	0	34	728	806
FY 2019-20	762	70	4	5	86	0	36	963	1047
FY 2020-21	826	76	4	5	95	0	39	1045	1135
FY 2021-22	880	81	4	5	105	0	41	1116	1210
FY 2022-23	937	87	4	6	115	0	43	1192	1292
FY 2023-24	998	92	4	6	128	0	45	1273	1377
FY 2024-25	1063	98	4	6	141	0	47	1359	1467
FY 2025-26	1132	105	4	6	156	0	50	1453	1567
FY 2026-27	1192	110	4	6	169	0	52	1533	1651
FY 2027-28	1255	116	5	6	183	0	54	1619	1742
FY 2028-29	1322	122	5	6	198	0	56	1709	1836
FY 2029-30	1392	129	5	6	215	0	59	1806	1939
FY 2030-31	1466	135	5	6	233	0	61	1906	2043
FY 2031-32	1529	141	5	6	249	0	63	1993	2134
FY 2032-33	1595	147	5	6	267	0	66	2086	2233
FY 2033-34	1663	154	5	6	285	0	68	2181	2332
FY 2034-35	1735	160	5	6	305	0	70	2281	2436
FY 2035-36	1809	167	5	6	326	0	72	2385	2544
FY 2036-37	1887	174	5	6	348	0	75	2495	2660
FY 2037-38	1968	182	5	6	372	0	77	2610	2779
FY 2038-39	2053	190	5	7	398	0	80	2733	2910
FY 2039-40	2141	198	5	7	425	0	83	2859	3042
FY 2040-41	2233	206	5	7	455	0	86	2992	3181
FY 2041-42	2329	215	5	7	486	0	89	3131	3326
FY 2042-43	2429	224	5	7	519	0	92	3276	3477
FY 2043-44	2534	234	5	7	555	0	95	3430	3637
FY 2044-45	2643	244	5	7	594	0	98	3591	3804
FY 2045-46	2756	255	5	7	635	0	101	3759	3978
FY 2046-47	2875	266	6	7	678	0	105	3937	4164
FY 2047-48	2998	277	6	8	725	0	108	4122	4357
FY 2048-49	3127	289	6	8	775	0	112	4317	4560
FY 2049-50	3262	301	6	8	829	0	116	4522	4773

3.12 TOLL REVENUE

The summary of toll revenue estimate for most likely scenario is presented in **Table 3.35**:

Table 3.35.Revenue Summary(Crores)

Year		Revenue from Toll plaza @ km TP-1	Revenue from Toll plaza @ km TP-2	Revenue from Toll plaza @ km TP-3	Revenue from Toll plaza @ km TP-4	Total
Apr-18	Mar-19	0.85	0.10	0.14	0.57	1.65
Apr-19	Mar-20	0.98	0.10	0.16	0.71	1.96
Apr-20	Mar-21	1.09	0.12	0.19	0.78	2.18
Apr-21	Mar-22	1.28	0.13	0.20	0.85	2.46
Apr-22	Mar-23	1.69	0.45	0.53	1.26	3.92
Apr-23	Mar-24	1.97	0.48	0.59	1.37	4.41
Apr-24	Mar-25	2.14	0.56	0.68	1.49	4.87
Apr-25	Mar-26	2.46	0.62	0.73	1.78	5.58
Apr-26	Mar-27	2.66	0.70	0.83	1.91	6.10
Apr-27	Mar-28	3.04	0.80	0.94	2.07	6.85
Apr-28	Mar-29	3.48	0.86	1.05	2.45	7.84
Apr-29	Mar-30	3.73	0.96	1.17	2.61	8.48
Apr-30	Mar-31	4.19	1.09	1.32	3.03	9.63
Apr-31	Mar-32	4.68	1.22	1.46	3.49	10.85
Apr-32	Mar-33	5.23	1.32	1.60	3.72	11.87
Apr-33	Mar-34	5.86	1.46	1.75	4.26	13.33
Apr-34	Mar-35	6.22	1.60	1.94	4.50	14.25
Apr-35	Mar-36	6.88	1.76	2.13	5.07	15.85
Apr-36	Mar-37	7.78	2.00	2.41	5.68	17.88
Apr-37	Mar-38	8.55	2.19	2.71	6.35	19.79
Apr-38	Mar-39	9.40	2.38	2.94	7.06	21.78
Apr-39	Mar-40	10.28	2.59	3.20	7.85	23.92
Apr-40	Mar-41	11.56	2.92	3.58	8.27	26.34
Apr-41	Mar-42	12.62	3.19	3.92	9.62	29.36
Apr-42	Mar-43	14.06	3.57	4.35	10.60	32.58
Apr-43	Mar-44	15.34	3.95	4.85	11.65	35.80
Apr-44	Mar-45	17.02	4.39	5.37	12.79	39.57

3.13 CAPACITY ANALYSIS

Capacity analysis for project road has been carried out in order to define the Level of Service (LoS) offered by road sections under the prevailing roadway and traffic conditions.

3.13.1 Capacity and level of service guidelines

Capacity and design service volumes for various lane configurations specified by **IRC: 64 – 1990**: 'Capacity of Roads in Rural Areas' has been adopted for determining the Level of Service offered by the road sections during design period.

3.13.2 Projected Total (Normal + Generated) Traffic

The projected total traffic is presented in **Table 3.36** and to estimate the generated traffic for the Kargil region's tourist data is available till 2015 and the mode wise projected traffic is presented in **Appendix J**.

Table 3.36.Projected Tostal Traffic AADT (Nos)

Year	CVC_km 35.000_ Shankoo	CVC_km 45.000_ Sangra	CVC_km 60.000_ Panikhar	CVC_km 120.000_ Rangdum	CVC_km 185.000_ Abran	CVC_km 208.000_ Phe	CVC_km 215.000_ Padum
2015 – 16	570	213	90	76	59	122	824
2016 - 17	613	229	96	81	63	131	886
2017 - 18	660	247	102	86	68	141	953
2018 - 19	710	266	108	91	73	151	1025
2019 - 20	939	461	289	271	253	336	1277
2020 - 21	1012	498	311	291	273	363	1376
2021 - 22	1077	530	330	309	291	386	1463
2022 - 23	1146	564	350	328	309	411	1557
2023 - 24	1219	601	371	348	330	438	1656
2024 - 25	1298	640	393	370	351	467	1763
2025 - 26	1382	682	418	392	374	498	1876
2026 - 27	1455	718	439	412	394	525	1976
2027 - 28	1533	756	461	433	415	553	2082
2028 - 29	1614	797	485	456	438	583	2194
2029 - 30	1701	840	509	479	461	615	2312
2030 - 31	1792	885	535	504	486	649	2437
2031 - 32	1872	924	558	525	507	678	2547
2032 - 33	1955	965	581	547	530	709	2661
2033 - 34	2041	1008	606	570	553	741	2781
2034 - 35	2132	1053	632	595	578	774	2907
2035 - 36	2228	1100	658	620	603	810	3038
2036 - 37	2327	1149	686	646	630	847	3176
2037 - 38	2432	1200	716	674	659	885	3320
2038 - 39	2541	1254	746	703	688	926	3471
2039 - 40	2656	1310	778	733	719	969	3630
2040 - 41	2776	1369	811	765	751	1013	3796
2041 - 42	2902	1431	846	797	785	1060	3969
2042 - 43	3033	1495	883	832	820	1109	4152
2043 - 44	3172	1563	920	868	858	1161	4343
2044 - 45	3316	1634	960	905	896	1215	4543
2045 - 46	3468	1708	1002	944	937	1272	4753
2046 - 47	3627	1785	1045	985	980	1332	4973
2047 - 48	3794	1867	1090	1028	1025	1394	5204
2048 - 49	3968	1952	1137	1073	1072	1460	5446
2049 - 50	4152	2041	1187	1120	1121	1529	5700

Table 3.37.Projected Total Traffic AADT (PCU)

Year	CVC_km 35.000_ Shankoo	CVC_km 45.000_ Sangra	CVC_km 60.000_ Panikhar	CVC_km 120.000_ Rangdum	CVC_km 185.000_ Abran	CVC_km 208.000_ Phe	CVC_km 215.000_ Padum	Ave rage
2015 - 16	755	261	196	164	100	218	1004	755
2016 - 17	809	280	205	172	107	232	1069	809
2017 - 18	866	301	214	180	114	247	1139	866
2018 - 19	929	324	224	188	122	263	1214	929
2019 - 20	1172	525	411	374	307	456	1472	1172
2020 - 21	1258	566	437	398	330	489	1575	1258
2021 - 22	1334	601	460	419	351	519	1666	1334
2022 - 23	1415	639	484	441	373	550	1763	1415
2023 - 24	1501	680	510	465	396	583	1866	1501
2024 - 25	1592	723	537	490	421	619	1976	1592
2025 - 26	1690	769	566	517	448	656	2094	1690
2026 - 27	1775	809	591	541	471	690	2197	1775
2027 - 28	1864	851	618	566	496	724	2306	1864
2028 - 29	1958	895	646	592	521	761	2422	1958
2029 - 30	2058	942	676	619	549	800	2543	2058
2030 - 31	2163	991	707	648	577	841	2672	2163
2031 - 32	2253	1033	735	674	602	876	2784	2253
2032 - 33	2348	1077	763	700	628	913	2901	2348
2033 - 34	2446	1124	793	728	655	952	3024	2446
2034 - 35	2549	1172	824	757	683	993	3152	2549
2035 - 36	2657	1222	857	787	713	1035	3287	2657
2036 - 37	2770	1275	891	818	744	1079	3427	2770
2037 - 38	2888	1330	926	851	776	1126	3574	2888
2038 - 39	3011	1388	962	885	810	1174	3729	3011
2039 - 40	3140	1448	1001	920	846	1225	3890	3140
2040 - 41	3275	1511	1040	957	883	1278	4059	3275
2041 - 42	3415	1577	1082	996	922	1334	4236	3415
2042 - 43	3563	1646	1125	1036	963	1392	4422	3563
2043 - 44	3717	1718	1170	1078	1005	1453	4616	3717
2044 - 45	3878	1794	1217	1121	1050	1517	4819	3878
2045 - 46	4047	1873	1266	1167	1097	1583	5033	4047
2046 - 47	4224	1955	1318	1214	1146	1653	5256	4224
2047 - 48	4408	2042	1371	1264	1197	1727	5490	4408
2048 - 49	4602	2132	1426	1316	1251	1803	5735	4602
2049 - 50	4805	2227	1484	1370	1308	1884	5992	4805

Capacity and design service volumes for various lane configurations are specified in **IRC: 64 – 1990**, 'Capacity of Roads in Rural Areas', **IRC-SP:73-2015** 'Manual of Specifications and Standards for Two-laning of Highways with paved shoulders. The project stretches pass through hill terrain predominantly. The design service volume standards for LoS B and LoS C considered as per guidelines are given in **Table 3.38** below.

Table 3.38.Design service volume standards

Road	Shoulder Type	Plain Terrain	Rolling Terrain	Hilly Terrain
Single Lane	Earthen shoulders	2000	1800	1600
Intermediate lane	Earthen shoulders	6000	5700	5200
2 Lane	Earthen shoulders	15000	11000	7000
	Paved shoulders	18000	13000	9000

The traffic projections on the project road do not demand for the 2-laning in the near future. However, Ministry vide Circular no NH-14019/6/2012-P&M dated 5th October, 2012 had decided that, henceforth, whenever new projects of widening/bypass/realignment are taken up, the width of the carriageway shall be at least two lane with paved shoulders irrespective of the traffic thereon.

As per Ministry vide circular No. NH-15017/28/2018-P&M dated 15th December, 2020, For roads in hilly and mountainous terrain which act as feeder roads to the Indo-China border or are of strategic importance for national security, the carriageway width should be 7m with 1.5m paved shoulder on either side.

Further, as per meeting held at NHIDCL, HQ regarding Kargil – Zanskar road on 24/12/2020, It is recommended to upgrade the entire project road to 2 lane with paved shoulder facilities.

3.14 BLACK SPOTS AND MITIGATION MEASURES

Highway from Kargil – Zanskar section of NH-301 has been taken up with the following objectives:

- To identify the black spots along the project road from existing km 0.000 to km 234.000.
- To carry out the investigations for frequent accidents on the selected stretch.
- To prioritize the black spots in a scientific manner and to suggest remedial measures.

3.14.1 Road Accidents in Jammu and Kashmir

People have been dying on the roads in Jammu and Kashmir almost everyday. The scale of casualties and injuries caused by road accidents is alarming. Nearly 1,000 persons have been losing their lives in road mishaps each year and the number of victims getting maimed is much larger. The state due to its terrain is prone to road accidents. According to the report release by the Chief Minister in 2012, during the years 2009, 2010 and 2011, 18, 786 accidents took place as a result of which 3,288 persons were killed and 27,165 received injuries. Of these, 1,126 persons were killed and 8,348 injured in 6,006 accidents in 2009, 1,042 were killed, 8,709 were injured in 6,136 accidents in 2010 and 1,120 were killed, 10,108 injured in 6,644 accidents in 2011. Appropriate incident command system to deal with road accidents has to be developed taking into account the nature of the roads, terrain and frequency of accidents happening in the roads of the state. The number of road accidents was 6,700 in 2012. The figure was 6,457 in 2013. Statistics provided

by various official sources point out that deaths and injuries caused by road accidents have been continuing unabated. In Jammu and Kashmir, 63.5 per cent of the total unnatural deaths had been caused by road accidents compared to the all-India figure of 36.4 per cent. It suggested that the Transport Department should identify accident prone areas in the state, which were 50 at present, and take necessary steps. Hilly roads especially in Doda, Ramban, Udhampur, Rajouri, Reasi, Poonch, Kishtwar, Ramban, Baramulla, Anantnag, Pulwama, Budgam, Jammu, Kathua, Zojila, Kargil, Leh etc. are prone to road accidents.

3.14.2 DATA COLLECTION

The data available with the local police station was collected for analysis. Based on the accident data (FIRs), the relevant details were acquired for all the data points.The following issues were observed during the collection of data:

- Availability and Accuracy of data: The locations could not be pinpointed due to lack of details regarding its location in the FIRs.
- Under-Reporting of accidents: In case of minor accidents, due to the fear of authority and judicial action, people tend to settle the matter between themselves leaving the official authorities clueless about the accident.
- Possibility of biased account of details: As the data was collected from FIRs, there was a possibility that information, given by person filing the complaint can be incomplete.

3.14.3 BLACK SPOTS ON PROJECT HIGHWAY

As preventive measures identification and study of black spots was carried-out and mitigation measures have been proposed in the development of Project Highway according to specific reasons of the accidents of that particular black spot. Existing Project Highway was developed and maintained under PMGSY Scheme and it is predominantly 2 lane with paved shoulder highway with carriageway from km 0.000 to km 87.000 and from km 196.250 to km.230.020. After that is unpaved carriageway. Average speed of vehicles plying on existing road is not more that 25 kmph because of very poor condition of the pavement. Therefore, number of road accidents on the existing Project Highway is not alarming. Therefore, despite of our all the efforts including consultations with local people of several road side villages and only existing Police Station on Project Highway in Kargil we could not get any authentic details through which we can designate any spot under the category of Black Spot. Details of the one of the road accident occurred on the existing Project Highway in the past is given below.

At least 11 people were killed, and 38 others injured when a bus fell into a gorge in Kargil district on November 04, 2011.

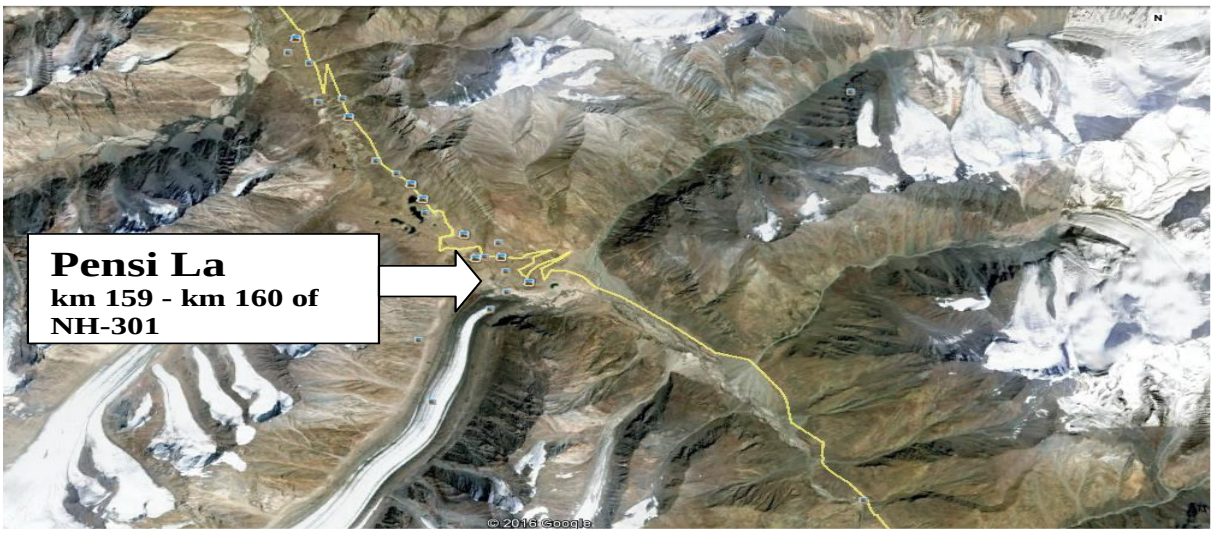
The bus, JK01B/3880, carrying 49 passengers was on its way to Kargil town from Padum when it skidded off the road and rolled into the gorge near Panzilla (or Pensi La) at 5:30pm.

Luckily a police truck and a private Sumo was on the way whose passengers informed the administration at Zanskar and Kargil. A police party and medical team from Zanskar headed by SDM reached the spot and launched the rescue operation in -10-degree temperature. The injured were rescued by the local people, police and army personnel.

While 34 injured were taken to hospitals in Padum and Kargil, four critically injured shifted to hospitals in Srinagar and Leh.

Drang Drung Glacier Viewpoint

Drang Drung Glacier



Satellite Image of Pensi Las – Road Accident Site near Drang Drung Glacier Between km 159 and km 160 of existing NH-301

3.14.4 PREVENTIVE MITIGATION MEASURES

All the required road safety measures have been proposed as per "IRC: SP - 48 – 1998 Hill Road Manual" and "IRC: SP – 88 – 2010 Road Safety Audit Manual" for development of Project Highway. Some of the preventive mitigation measures proposed are as below:

a) Fixed speed limit proposed to install signage and construct speed breakers and provision of parking lane in all the urban areas.
b) Provision for installation of caution boards and speed breakers in accident prone areas, particularly at sharp curves and hair-pin bend locations.
c) Proposals for repairing of damaged railing and W-beam type crash barriers and construction of additional railings, parapet walls and W-beam type crash carriers in areas where it is necessary.
d) Marking of a centerline and edge lines along the highway as per specifications.
e) Installation of "No Overtaking" signboards before the start of the curve.
f) Clearing the obstructions near the Project Highway.
g) Chevron alignment markers (CAM's) such as reflective signs are proposed to delineate non-standard curves. They provide added delineation (over and above edge lines and guideposts) for those few curves that are considered to be in need of additional delineation. These include curves at the end of long straights; sharp reverse curves and compound curves where it is necessary to guide drivers/riders through the decreasing radius curve. Guideposts and edge lines etc.
h) Discussed the preferred bus stop locations with village representatives during public consultations and seal each bus stop area.
i) Proposal for construction of two suitable shelters for waiting bus passengers with bus-bays as per standards for all the villages along the Project Highway.

4 DESIGN PROPOSALS

4.1 GEOMTRIC DESIGNS

The basic aim of highway design is to identify technically sound, environment-friendly and economically feasible highway alignment. The ensuing sections deals with obligatory points, which control highway alignment, design of cross-section, highway geometric design & methodology, design of miscellaneous items.

One Bypass has been proposed for Kargil Town.

4.1.1 Kargil Bypass: It starts from Km 0.000 (Design) to Km 3.302 (Design)

After detailed studies of available secondary data and information as well reconnaissance and discussion with clients we have proposed requirement of bypass for Kargil. We have carried out "Alignment Options Study" and developed three Alternative Alignments for the Kargil Bypass.

Three alternative alignments were evolved, and comparative statement has been prepared based on:

1. Study of Secondary Data available so far,
2. Study of available topographical maps of SoI and detailed study of area on Google Earth,
3. Reconnaissance survey,
4. Preliminary discussions with stakeholders,
5. Our recent experience of similar type of projects in similar type of terrain, etc.

The identified alignement options are given as **Figure 4.1, Figure 4.2 & Figure 4.3.**

Figure 4.1:Proposed Kargil Bypass Alternative-I

Figure 4.2:Proposed Kargil Bypass-Alternative-II

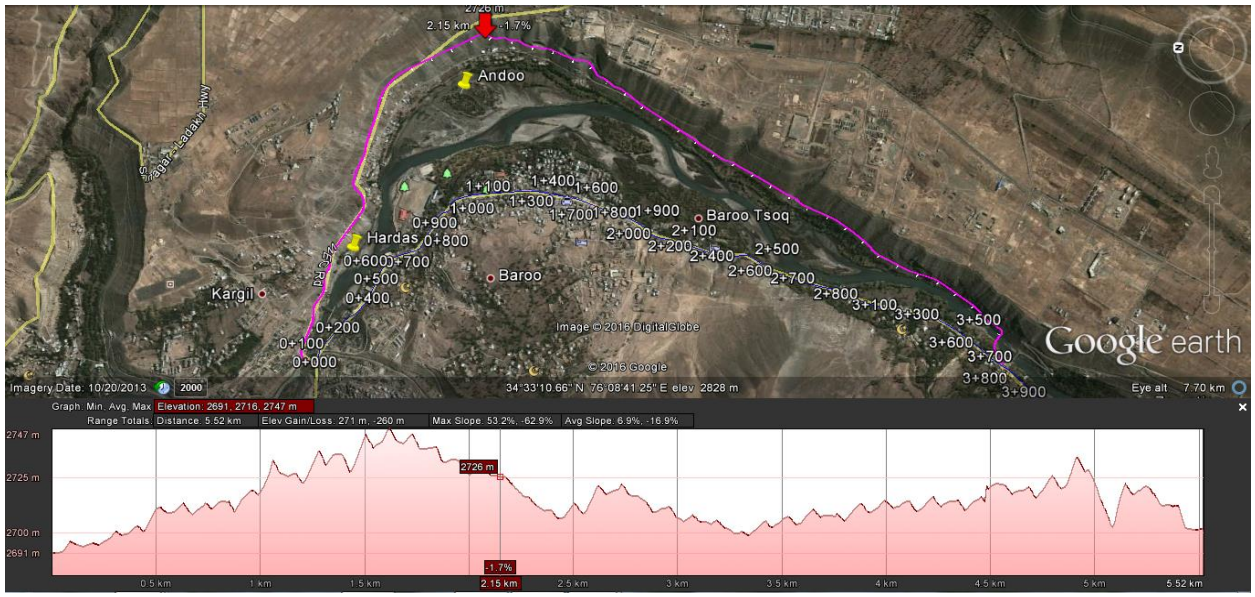


Figure 4.3:Proposed Kargil Bypass-Alternative-III

4.2 CROSS SECTIONAL ELEMENTS

Cross sectional elements are based on design standards and specifications. This includes specifications of lane width, width of paved shoulder, earthen shoulder, median, edge strips etc. These cross-sectional elements are discussed below:

4.2.1 Carriageway Width

The entire project road is proposed as 2-Lane with paved shoulder with 10m carriageway width from Ch. 0.000 to Ch. 87.000 and from km.196.250 to 230.020.

4.2.2 Earthen Shoulder

The proposed earthen shoulder is 1.0 m wide either on bothsides or single side based on the typical section used in the below sections.

Ch 0.000 to Ch 87.000 and
Ch 196.250 to Ch 230.020

4.2.3 Right of way

The proposed right of way is 18 m throughout the length of the proposed alignment.

4.2.4 Cross fall/Camber

The normal cross fall (camber) of the main carriageway un-paved/ earthen shoulders it is kept 3.0%. At curves designed superelevation governs the cross slopes of the pavement and shoulder.

4.2.5 Cross Sections

The typical cross-sections adopted for the project road are given in TCS drawings.

4.3 PAVEMENT DESIGN PROPOSALS

The purpose of pavement design and option study is to make analysis of different pavement alternatives to provide a basis for selection of the most advantageous solution, considering all costs occurring during the life of the pavement viz. construction cost, road user cost and maintenance cost. Traffic surveys were conducted on the Project Highway to know the future traffic flow pattern. Traffic projection over the design period has been done using present traffic and secondary data. Detailed pavement investigations viz. inventory, visual condition survey, roughness survey, structural evaluation and soil surveys were also conducted.

Axle Load Survey was conducted for the Project Highway, in order to estimate Vehicle Damage Factor (VDF), for use in pavement design. Soil samples were collected at subgrade level of existing pavement and tested to find the properties necessary for pavement design. Borrow areas were identified along the Project Highway and the samples were tested to ascertain the properties of soil to be used for the construction of sub grade for new pavement.

Pavement design has been carried out for the following options and recommended the best suitable design for the project road.

1) Flexbile Pavement Design with Granular Base and Subbases
2) Flexbile Pavement Design with Cement Treated Sub-base
3) Flexbile Pavement Design with Cement Treated Sub-base
4) Rigid Pavement Design

4.3.1 Flexible Pavement Design

Flexible pavement has been proposed for widening of main carriageway, proposed bypass and junctions except from Ch. 88.500 to Ch. 98.500, which is proposed with rigid pavement.

The type and pavement structural layers proposed are as under:

The proposed flexible pavement for widening portion, new bypass/realignment sections and proposed service roads, consists of various layers such as Granular Subbase (GSB), Wet Mix Macadam (WMM), Bituminous Surfacing comprising Dense Bituminous Macadam (DBM) and Bituminous Concrete (BC). Rigid pavement is proposed from Km 88.500 to Km 98,500 considsts of various layers like Pavement Quality Concrete (PQC), Dry Lean Concrete (DLC) and Granular Subbase (GSB).

Strengthening / improving riding quality of existing flexible pavement is to be achieved by providing an overlay which may consist of Dense Bituminous Macadam and/or Bituminous Concrete (BC) layer.

The design of Flexible pavement for widening of main carriageway, Junctions and proposed bypass sections have been carried out in accordance with IRC: 37-2018.

4.3.2 Flexible Pavement Design with Granular Base & SUbbases

The IRC method for pavement design is based on limiting the vertical compressive strain on top of sub-grade which results in permanent deformation of the pavement and the horizontal tensile strain at the bottom of the bituminous layer which results in cracking of the pavement. The relationships governing the above two pavement failure criteria are expressed as:

Rutting Model: The model considers the vertical strain in sub-grade as the only variable for rutting, which is a measure of bearing capacity of the sub-grade.

$N = 4.1656 \times 10^{-8} (1/\varepsilon_v)^{4.5337}$ - (80% Reliability Level)

$N = 1.41 \times 10^{-8} (1/\varepsilon_v)^{4.5337}$ - (For 90% Reliability Level)

Where,

N - Number of cumulative standard axles, and
ε_v - Vertical strain in the sub-grade

Fatigue Model: With every load repetition, the tensile strain developed at the bottom of the bituminous layer develops micro cracks, which go on widening and expanding till the load repetitions are large enough for the cracks to propagate to the surface over an area of the surface that is unacceptable from the long term serviceability point of view of the pavement. The phenomenon is called fatigue of the bituminous layer and the number of load repetitions in terms of standard axles that because fatigue denotes the fatigue life of the pavement. The two equations for the conventional bituminous mixes designed are given below:

$N_f = 1.6064*C*10^{-4} (1/\varepsilon_t)^{3.89}*(1/M_{Rm})^{0.854}$ (for 80% Reliability)

N_f = $0.5161*C*10^{-4}(1/\varepsilon_t)^{3.89}*(1/M_{Rm})^{0.854}$ (for 90% Reliability)

Where,

C = 10M, and $M=4.84(V_b/(V_a+V_b)-0.69)$

V_a = % volume of air void in the mix used in the bottom bituminous layer

V_b = % volume of effective bitumen in the mix used in the bottom bituminous layer

N_f = Fatigue life of bituminous layer in number of standard axles

ε_t = Maximum tensile strain at the bottom of the bituminous layer (DBM) calculated using liner elastic layered theory by applying standard axle load at the surface the selected pavement system., and

M_{Rm} = Resilient modulus (MPa) of the bituminous mix used in the bottom bituminous layer, selected as per the recommendations made in these guidelines.

As per Clause 12.3 of IRC 37-2018, the mix volumetric parameters of V_a, V_b & C factor considered for the pavement design are 4.5%, 10.5% & 1.12 for the design of conventional flexible pavement.

The new 2-lane with paved shoulder lane and widening /upgradation sections are designed for minimum traffic of 20MSA.The proposed crust thickness for flexible pavement is given in ***Table 4.1.***

Table 4.1.Proposed Flexible pavement design for Reconstruction,

Design Chainage (km)		Design Traffic (MSA)	CBR (%)	Proposed Flexible Pavement Thickness (mm)				Total (mm)
From	To			BC	DBM	WMM	GSB	
0.000	230.020	20	5	40	115	250	200	605

4.3.3 Rigid Pavement Design

Rigid pavement design has been proposed done by considering future maintenance problem and performance period. Rigid Pavement with tied concrete shoulder has been considered. The pavement has been designed based on IRC: 58-2015 *Design of Rigid Pavement* and for design life of 30 years.

Rigid pavement is recommended from Km 88.500 to Km 98.500 (Design). Rigid Pavement Design calculations are given as **Appendix L.** The proposed rigid pavement design is given as **Table 4.2**

Table 4.2.Rigid pavement design for Reconstruction, New Construction and Widening

Design Chainage (km)		CBR (%)	Proposed Pavement Thickness (mm)			Total (mm)
From	To		PQC	DLC	GSB	
0.000	230.020	5	280	150	150	580
Plain Dowel Bar Details		36 mm Dia. @ 300 mm c/c, 450 mm long				
Deformed Tie Bar Details		12mm Dia. @ 720 mm c/c, 640 mm long				

4.1.1.1 Strengthening of Existing Pavement

Detailed pavement condition survey and pavement investigations have been carried out to assess the strength of the existing flexible pavement. Based on the observations from pavement condition/investigations, strengthening measures have been finalised.

Fresh BBD Survey has been carried out at as per the methodology discussed in chapter 3. Proposed overlay thickness is calculated by considering 20 years as design life Recommended overlay design is given in **Table 4.3** and the detailed BBD analysis is given in **Appendix-D.**

Table 4.3.Proposed Overlay thickness

Existing Chainage (Km)		Design Chainage (Km)		Design Length (Km)	MSA	Recommended Overlay Thickness (mm)		Remarks
From	To	From	To			BC	DBM	
3+358	3+688	3+450	3+780	0.330	20	40	115	
6+822	8+946	6+910	9+030	2.120	20	40	115	
9+421	9+751	9+500	9+830	0.330	20	40	115	
9+940	11+468	10020	11+550	1.530	20	40	115	
17+594	19+941	17+660	20+000	2.340	20	40	115	
20+252	22+124	20+310	22+180	1.870	20	40	115	
37+172	39+842	37+130	39+780	2.650	20	40	115	
40+191	40+811	40+130	40+750	0.620	20	40	115	
230+499	234+000	229+540	230+735	1.195	20	40	115	Padum

4.2 DESIGN OF STRCTURES

Refer Chapter 5 of the Design Reprot (Volume-II) for detailed structurals for the project road.

5 COST ESTIMATES

5.1 INTRODUCTION AND ASSUMPTIONS

Cost estimation is important for the feasibility study as it provides vital input to the economic and financial evaluation of the project. The cost estimates have been prepared for the Project Highway considering the recommended alignment. The estimate has been prepared for Upgradation & Widening the existing stretches to 2-lane carriageway with paved shoulder including strengthening of the existing pavement, strengthening / widening/reconstruction of existing structures, new bridges.

5.2 QUANTIFICATION (General Outline of Items and Unit of Quantities)

The main items that have been covered in cost estimation are as following:

S. No	DESCRIPTION OF WORK	ITEMS OF WORK
1.	SITE CLEARANCE	CLEARING & GRUBBING
2.	EARTH WORK	EARTH WORK EXCAVATION FOR ORDINARY SOIL/ SOFT ROCK/ HARD ROCK CONSTRUCTIONS OF EMBANKMENT WITH BORROW MATERIAL FROM APPROVED SOURCE. CONSTRUCTION OF EMBANKMENT WITH USEFUL MATERIAL OBTAINED FROM ROADWAY EXCAVATION. CONSTRUCTION OF SUB-GRADE AND SHOULDER WITH SELECTED SOIL. EXCAVATION AND DISPOSAL OF UNSUITABLE MATERIALS
3.	NON-BITUMINOUS BASE & SUB-BASE COURSES	GRANULAR SUB BASE WET MIX MACADAM
4.	BITUMINOUS COURSE	PRIME COAT TACK COAT DENSE BITUMINOUS MACADAM BITUMINOUS CONCRETE
5.	BRIDGES, FLYOVER UNDERPASSES AND ROB'S	NEW/RE- CONSTRUCTION OF BRIDGE
6.	TRAFFIC SIGNS MARKING AND OTHER APPURTENANCE	PAVEMENT MARKINGS ROAD SIGNAGE 5^{TH} KM, ORDINARY KM AND HECTOMETER STONES GANTRY/OVERHEAD CANTILEVER SIGN BOARD
7.	RE WALL	

The quantities for various items of work have been computed as detailed below:

- The quantities for sub grade, subbase, base and bituminous/rigid courses have been computed as per TCS

- The quantities for earthwork (earthwork excavation and embankment construction) have been computed as per corresponding TCS
- The quantities for structures like bridges, Culverts, etc., have been calculated based on the preliminary GAD's and design calculations.

5.3 ADOPTION OF UNIT RATES

The unit rates for each construction items have been arrived by using the "**Jammu & Kashmir Schedule of Rates (SOR): 2020**".

The input rates of Bitumen, Emulsion, Cement, Steel,have been taken from market rates and Plant, Machinery, Labour and other materials like Metal, Sand etc. have been taken from "Jammu & Kashmir SOR 2020". For items where rates are not available in SOR, the rates have been adopted as per previous experience of the consultant or on the present market rates.

5.4 BILL OF QUANTITIES FOR CIVIL WORKS

The bill of quantities for civil works has been prepared on the basis of detailed designs.

5.5 COSTING FOR SAFETY DEVICES

Provision for adequate numbers of road signage and pavement markings have been considered as a safety measures while making costing for road safety to give proper information to the road users to avoid accident on the Project Highway.

5.6 TOTAL COST ESTIMATE

The detailed cost estimate is given as Volume VII separately**.** The summary of project cost has been worked out and given in **Table 5.1.**

Table 5.1.Summary of Project Cost

S. No	Description	Total Amount (Rs. in Cr.) Pkg -I
	Length(in Km.)	**30.04**
1	Road works incl. e/w, site clearance, sub-base, bituminous courses & junctions	92,56,82,700
2	Drainage Works	28,12,68,877
3	Cross Drainage works (culverts)	10,33,78,265
4	Bridges	11,26,39,365
5	Traffic signs, road markings and other road appurtenanaces	10,60,12,905
6	Miscellaneous works including Truck lay bye, Bus Shelter and rest area.	1,88,62,760
7	Protection work (Breast Wall, Gabion Wall, Retaining Wall)	70,14,99,330

8	Special slope stabilization of works (Wire mesh, soil nail, filter media)	1,31,00,000
9	Avalanche Protection Structures (Snow Gallery, Snow Net for prevention of avalanche)	-
A	**Civil Cost**	**2,26,24,44,202**
B	**Utility Shifting Cost (Excl. GST & Supervision Charges)**	10,71,92,710
C	**Estimated Project Cost (Excl. GST)**	**2,36,96,36,912**
D	Contingencies @ 2.8% of A	6,33,48,438
E	Maintenance cost for 5 years during DLP (0+0.5+0.5+0.5+1.0=2.5% of A)	5,65,61,105
F	Escalation @2.5% for 2 nd year on A	5,65,61,105
G	Supervision Charges @ 3% of A	6,78,73,326
H	Agency Charges @ 3% of A	6,78,73,326
I	GST @12% of A	27,14,93,304
J	Supervision Charges @10% of B to be paid to the utility owing department incl. 18% GST	1,26,48,740
K	Cost towards Pre-construction Activities (LA,R&R/EMP etc.)	87,64,00,000
M	**Total Project Cost (C+D+E+F+G+H+I+J+k)**	**3,84,23,96,256**
	Civil cost per km	7.53
	Total project cost per km	12.79

6 ENVIRONMENTAL SCREENING AND PRELIMINARY ENVIRONMENTAL ASSESSMENT

6.1 PRELIMINARY ENVIRONMENTAL ASSESSMENT

6.1.1 Introduction

Road projects are meant for improving the quality of life of people and developing the country's economy. For all positive impacts of the road projects, there may also be some significant detrimental impact on nearby communities and natural environment. There may be impact on properties of people, their livelihood and other social components. Similarly there can be direct or indirect impact on flora, fauna, water resources, land use etc. To account for all these issues, environmental and social impact assessment is utmost necessary. These concerns for environmental and social issues in road projects have also become a part of legal requirements and requirements for obtaining financial support. Environmental assessment is therefore of prime importance in road projects.

Findings of the initial environmental assessment are presented in this chapter. Further details will be taken up during subsequent stages of the project preparation. This chapter has been prepared based mainly on field survey and collection of secondary data. In this stage, existing environmental set-up of the study corridor in general i.e., the Corridor of Impact (CoI) and the existing Right of Way (RoW) in particular were studied and is described in subsequent sections.

6.1.2 PROJECT ROAD

The Project Road starts in Kargil at Km 0.000 and ends near Zanskar at Km 234.020 (design Chainage), section of NH-301 in the state of Jammu & Kashmir. The whole road lies with the administrative boundary of Kargil district.

The main objective of the consultancy service is to establish the technical feasibility of the project and prepare detailed project reports for rehabilitation and upgrading of the existing Intermediate and Single Lane road to 2-lane with paved shoulder configuration with provision of capacity augmentation.

Some of the villages/towns present along the road are Minjigum, Salaskot, Lankacherry, Sanku, Purtikche, Panikhar, Thangol, Parkachik, Zhuldo, Rangdum, Chibra, Skygam, Phe, Tungri, Sani, Padum, and Zankar.

The location of the road is shown in Figure below

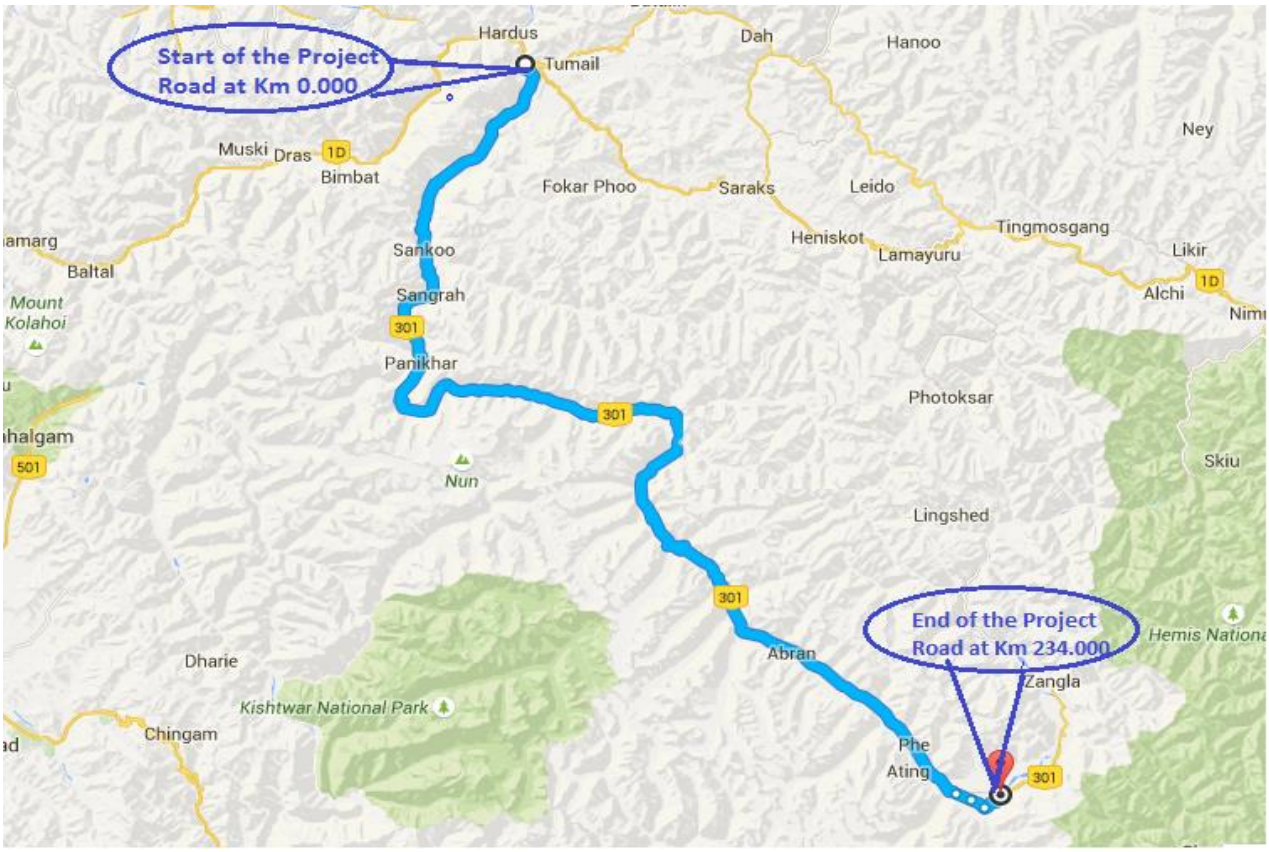


Figure 6.1: Location of Project Road

6.1.3 Project Area

The project road section passes through Kargil District of J&K State. The neighbouring districts are Baramulla, Pulwama, Anantnag& Doda in West and Leh in East.

6.1.4 Project Proponent

District Superintending Engineer, PWD Circle, Kargil acting on behalf of Director General (RD) & SS, Ministry of Road Transport & Highways (MoRTH)

- Need of the Project and Benefits Associated
- Will provide easy access to commuters
- Will cater the traffic growth on the road
- Project road also caters for transportation of agricultural productions

Project Road would bring about all-round development activities in the region, such as movement of people and goods, agriculture, commerce, education, health and social welfare, or even maintenance of law and order and security

6.2 SCOPE OF ENVIRONMENT ASSESSMENT

Environmental Assessment has been carried out to identify critical issues and areas that would be studied in detail for detailed EIA study. Further details will be taken up during subsequent stages of the project preparation, if required. The entire study was carried

out within existing policy, legal and administrative framework considering the applicable environmental legislation, regulations and guidelines. The Environmental Impact Assessment covers the following:

(a) Project Description
(b) Need & benefit of the project
(c) Legal Framework
(d) Baseline Environment
(e) Probable Environmental Impact
(f) Mitigation Measures
(g) Environment Management Plan

This chapter deals with preliminary environmental assessment for the feasibility report for the project.

6.3 METHODOLOGY

Environmental Impact Assessment is a detailed process, which starts from the conception of the project and continues till the operation phases. The steps for environmental impact assessment are therefore different at different phases. The present study is for identifying major environmental issues and their mitigation to be included in the design of the project. This report deals with preliminary environmental assessment for the feasibility report for the project.

6.3.1 Approaches to Study

For the present study, the scope of work in brief is:

Co-ordination of preliminary environmental assessment with the feasibility study; Legal and policy framework and applicability analysis; Important environmental features along the road alignment; Identification of potential impacts; and Mitigation measures

6.3.2 Steps in Study Process

Study process mainly consists of the following types of activities:

Study of Background information

Study of Project Documents: Project documents have been studied to have the understanding of the project objectives, its main components, its boundaries etc.

Study of Laws and regulations: Laws and regulations enacted by Government of India and Karnataka state relevant to road construction and environment were studied.

Study of Guidelines, Standards etc.: Various documents and publications of the Ministry of Environment and Forest (MoEF) and Indian Road Congress were studied

6.3.3 Reconnaissance / Onsite Study

Environment expert carried out reconnaissance survey of the project road. Important environmental components including hills, water bodies, forests, public utilities, community resources, cultural sites, high pollution zone, accident-prone areas etc. along

the corridor of impact zone were identified. The important environment components are given in Table below.

Table 6.1.Important Environment Components

Sl. No.	Environmental Attributes	Environmental Components
1	Topography	Terrain
2	Land use	Agriculture, settlements, forest, industrial areas etc.
3	Water resources	Rivers, canals and ponds in study area
4	Forests & Wildlife	Designated Protected Areas like Biosphere Reserves, National Parks and Sanctuaries etc.) within 10 Km from the proposed project location boundary Presence of RF, PF other forests within study area
5	Roadside Plantations	Green Tunnels, Strip Plantation
6	Settlements	Towns and villages abutting the road corridor
7	Sensitive Receptors	Sensitive receptors such as educational and health facilities
8	Drinking water sources	Wells, hand pumps, community water points / taps etc.
10	Religious Structures	Temples, shrines, mosque, church, gurudwara etc.
11	Cultural Properties	Protected / unprotected archaeological monuments
12	Common Property Resources	Seating areas of the community; cremation / burial grounds etc.

6.3.4 Analysis of Data

The data collected through the above steps were compiled to develop the environmental scenario of the project area and the sensitive components within that. The full road length was put under screening to identify the hot spot zones. The identification of hot spots inproject area would help in further detailed study and preparation of Environmental Impact Assessment report and Environmental Management Plan for the project at later phase.

Field Study / Monitoring / Laboratory Analysis for Generation of Primary Data

Field study / monitoring shall be carried out to generate and collect primary data in the study corridor, which shall involve:

Water quality monitoring at identified ground water and surface water locations

Air quality monitoring at identified locations

Ambient noise level monitoring at identified locations

6.4 PROJECT DESCRIPTION

6.4.1 Existing Feature of Road

Alignment

The existing road of the Project Highway NH 301 has intermediate lane and single lane carriageway with earthen shoulder configuration, except in Kargil (1.6 Km) where it is 2-Lane with paved shoulder carriageway configuration.
The existing pavement type is flexible pavement (34%) and gravel pavement (66%).

The overall condition of the flexible pavement that is of 79.20 Km out of 234 Km pavement has been analyzed and it varies between Good to Very Poor condition. Out of 79.20 kms from Kargil to Zanskar on NH-301, 84.09% of road is in excellent to good condition, 0.38% of road is in good to fair condition, 1.70% of road is in fair to Poor condition, 3.60% of road is in poor condition and 10.29% of road is in very poor condition. The width of earthen shoulder varies between 1.0 m to 2.0m on both sides and condition of the earthen shoulders is fair to poor.

Detailed raod inventory and pavement condtion are given in Appendix A and Appendix B Respectively.

Table 6.2.Existing Cross Section details

Carriageway Width (m)	Earthen Shoulder Width (m)	Embankment Height (m)
7.5-3.0	1.0-2.0	Hill/Valley

Source: Road Inventory Appendix A

Right of Way

Existing ROW pillars are not available along the project road, hence measured from fixed boundaries. The available ROW varies from 12 m to 18 m (approximately) but in built up sections except few locations where it seems on lesser side.

Road Inventory

The existing road inventory has been presented in below table.

Table 6.3.Existing Road Inventory

Major Intersection	Minor intersection	Major bridges	Minor bridges	Culverts
1	31	Nil	28	935

Source: Raod Inventory Appendix A

Design Aspects

The design of Flexible pavement for main carriageway has been done in accordance with IRC: 37-2012 for design traffic estimated from traffic surveys. The Design of Rigid Pavement has been done in accordance with IRC: 58-2015. The design of overlays on the existing carriageway shall be in accordance with IRC: 81-1997 using the BBD deflections.

All geometric design aspects have been carried out as per the IRC: SP: 73-2015 and MoRT&H standards and specifications. Adequate warnings have been provided or maintaining continuity has been emphasised in the design

The existing profile has been maintained all throughout the project road

The design speed has been kept quite consistent, and speed difference between two consecutive curves is not exceeded.

Bypass

1 bypass at Kargil is proposed.

Right of Way

Proposed ROW is 18 m.

Traffic Control and Road Safety Features

All junctions have been studied thoroughly with respect to traffic volume and geometric design. The important junctions leading to settlements have been identified and proper junction layouts (including road marking, and traffic signs) shall be applied as per IRC-SP: 73-2015.

Cross Drainage Structures

The details of proposed Cross Drainage structures are given below

Table 6.4.Proposed Structures

Major bridges	Minor bridges	Culverts
Nil	4	659

Source: Design Report

Enhancement of Inventories

The project also proposes enhancements such as 26 bus-bays/shelters in the settlement areas.

6.5 LEGISLATIVE FRAMEWORK

Environment Legislation - India

The Government of India has formulated various policy guidelines; acts and regulations aimed at protection and enhancement of environmental resources. The following table surmises the existing legislations pertaining to the project, the various clearances required for the project and the status as on date. The summary of environment laws and their applicability is given in Table below.

Table 6.5.Environment Laws and their Applicability

S. No.	Law / Regulation / Guidelines	Relevance	Applicability (Yes / No)	Reason for Application	Implementing / Responsible Agency
1	The Environmental (Protection) Act. 1986, and the Environmental (Protection) Rules, 1987-2002 (various amendments)	Umbrella Act. Protection and improvement of the environment. Establishes the standards for emission of noise in the atmosphere.	Yes	All environmental notifications, rules and schedules are issued under the act	MoEF, State Department of Environment & Forest, CPCB and SPCB
2	The EIA Notification, 14th September 2006 &2009 subsequent amendments	Identifies expansion of National highways projects greater than 100 Km involving additional ROW and land acquisition greater than 40m on existing alignments on 60m on re-alignments or by-passes and All new state highway projects & SH expansion projects in hilly terrain (above 1000 MSL) and or ecological sensitive areas (item 7 (f) of schedule) as one of the projects requiring prior clearance.	No	Project Highway is neither a new national highway nor a NH expansion project with land acquisition of greater than 40m on existing alignments and 60m on re-alignments or by-passes	MoEF / SEIAA
		Opening of New Borrow Area	Yes	Prior Environmental Clearance to be taken by Contractor if there is any need for opening of new borrow area	
		Opening of new Quarry Area (Excavation of River bed)	Yes	Prior Environmental Clearance to be taken by Contractor if	

S. No.	Law / Regulation / Guidelines	Relevance	Applicability (Yes / No)	Reason for Application	Implementing / Responsible Agency
				there is any need for opening of quarry area	
3	The Water (Prevention and Control of Pollution) Act, 1974 and is subsequent amendments	Central and State Pollution Control Board to establish / enforce water quality and effluent standards, monitor water quality, prosecute offenders, and issue licenses for construction / operation of certain facilities.	Yes	Consent required for not polluting ground and surface water during construction	State Pollution Control Board
4	The Air (Prevention and Control of Pollution) Act. 1981 and is subsequent amendments	Empowers SPCB to set and monitor air quality standards and to prosecute offenders, excluding vehicular air and noise emission.	Yes	Consent required for establishing and operation of batching plants and crushers	State Pollution Control Board
5	Noise Pollution (Regulation And Control) Act, 1990 and is subsequent amendments	Standards for noise emission for various land uses	Yes	Construction machineries and vehicles to conform to the standards for construction	State Pollution Control Board
6	Jammu and Kashmir Forest Act, 1987 (1930 A.D.) and its subsequent amendment.	Conservation and definition of forest areas. Diversion of forest land follows the process as laid by the Forest conservation Act.	Yes	Diversion of forest land shall be required Subjected to joint verification of forest department and District revenue department.	State Forest Department, MoEF and Local community
7	Jammu and Kashmir Wild Life (Protection) Act, 1978 and its subsequent	Protection of wild life in sanctuaries and National Park	No	Puliebadze WLS located within 5 km of project area	NBWL, SBWL & Chief Wild Life Warden

S. No.	Law / Regulation / Guidelines	Relevance	Applicability (Yes / No)	Reason for Application	Implementing / Responsible Agency
	amendment.				
8	Public Liability And Insurance Act,1991 and is subsequent amendments	Protection to the general public from accidents due to hazardous materials	Yes	Hazardous materials like Bitumen shall be used for road construction	State Pollution Control Board
9	Hazardous Wastes (Management and Handling) Rules, 1989 and is subsequent amendments	Protection to the general public against improper handling and disposal of hazardous wastes	Yes	Hazardous wastes shall be generated due to activities like of maintenance and repair work on vehicles	State Pollution Control Board

The PAPs will be compensated against land acquisition as per prevailing Norms in J&K State.

6.6 BASELINE ENVIRONMENT SCENARIO

6.6.1 Study Area

Details of affected structure and trees were collected for 10m on either side from the centre line of the road. Details of sensitive receptors, those are located beyond 10m were also collected as the noise and air pollution may take place beyond direct area of impact.

6.6.2 Data Collection

Efforts have been made to collect the latest information both at regional as well as local level especially along the project roads alignment.

6.6.3 Secondary Data

Data collection from the secondary sources has been done from various authentic and published sources. Following are some important information available from secondary sources.

Project objectives, technical information on existing road features from Contract Document Climatic condition & long-term meteorological data from Indian Meteorological Department and governmentwebsites

Geology, seismicity, soil and topography from government websites & district groundwater brochure of CGWB

Land Use from Google Earth and observation during surveys
Survey of India Topo-sheet, Google Earth & field observation

6.6.4 Primary Data

Field study / monitoring are being carried out to generate and collect primary data in the study corridor, which involves:

Inventory of road features like drinking water source, water bodies, community structures, environmentally sensitive locations areas, congested locations etc. from physical surveys

Enumeration of roadside trees
Environment Monitoring
Natural Environment

Environmental monitoring location of baseline data generation is given as:

S. No	Locations	Address
S1	Titi Chumik	Opposite Distt. Tuberculosis & Chest Diseases Hospital Kargil
S2	Near Achambur (Achumbore)	Mr. Gulam Hedar Village : AchumburePO. Panikhar
S3	Rangdum	Near Rangdum PWD Guest House
S4	Abran Village	Mr. Sultan Village – Abran, PO – Padum
S5	Phey Village	TSC Tundup, Phey Zanskar PO. Padum
S6	Padum (Zanskar)	Helipad Padum (Zanskar)

6.6.5 Climate and Meteorology

The climate of the region is cold and temperate. Kargil lies on the rain shadow side of the Himalayan where dry monsoon winds reaches Kargil after being robbed of its moisture in plains and the Himalayan mountain. The district combines the condition of both arctic and desert climate. Rainfall in the area is negligible. Heavy snowfall is experienced in winter. The average snowfall is about 2 to 5m in neaby villages. The average annual temperature in Kargil is 8.6°C. About 318 mm of precipitation falls annually. The driest month is November with 6 mm. Most precipitation falls in March, with an average of 82 mm.

The warmest month of the year is July with an average temperature of 23.3 °C. In January, the average temperature is -8.8 °C. It is the lowest average temperature of the whole year. The difference in precipitation between the driest month and the wettest month is 76 mm.The average temperatures vary during the year by 32.1 °C.

Meteorological Data were collected at Afzal Guest House, Opposite Omini Van Taxi Stand Kargil – 194103, State Jammu and Kashmir, meteorological data of June 2016 month was collected to assess the long-term meteorological scenario of the area.. The data collected shows almost similar nature of atmospheric scenario due to geo-graphic equality of the stations.

Table 6.6: Micro meteorology of the study area

Months	Temperature (°C)			Relative Humidity (%)			Average Wind Speed (kmph)	Rainfall (mm)
	Max	Min	Avg.	Max	Min	Avg.		
June - 2016	21.6	11.2	15.9	76.2	15.3	42.9	4.1	0

6.7 LAND

6.7.1 Terrain & Land Use

The terrain on the projects stretch is 100% maountaineous terrain. The land use pattern along the project road is Agricultural, Barren and Built-up in which predominant land use pattern is Barren. Maountaineous view is the dominanat feature present along the road. However, some settlements in small patches are also present along the road. The details of Land Use along the Project stretch are shown in Table below.

Table 6.6.Terrain Along the Project Stretches

S. No.	Land use Pattern	Length (km)	% of Land Use	Length (km)	% of Land Use
		LHS		RHS	
1	Agricultural	8.4	3.6	20.0	8.5
2	Built up	44.2	18.9	31.2	13.3
3	Barren	181.4	77.5	182.8	78.1

Source: Design Report

6.7.2 Geomorphology

Kargil district is a mountainous desert. The topography of the district is mountainous with little or no vegetation. The mountains are of sedimentary rocks and are in process of disintegration due to weathering. This district is separated from the rest of the State by high mountains which are crossed through passes at various points. The District is divided into four high level natural Valleys namely the Suru Valley, the Drass Valley, the Indus Valley and the Upper Sindh Valley of Kanji Nallah Valley. Zojila and Fotulla passes situated at the height of 3567 and 4192 meters above the sea level are called gateways for Kashmir Valley and Leh District for entry in Kargil District. High peaks of Namikala and Penzila are called the sky pillars of the District. The terrain being hilly, available land for agriculture is meagre. General elevation ranges between 5934 meters to 8510 m AMSL. In Zanskar ranges, permanent glacial body is existing because of higher elevation of these ranges. Deep gorges and valleys are being formed due to rapid flows of rivers in the district. Almost all the rivers are flowing through deep valleys. The important major rivers draining the Kargil district are Drass, Suru, Zanskar and Indus. Width of these valleys range between less than a kilometer to around one kilometer around Salskot. Suru valley constitutes a major part of the Kargil district, which is surrounded by hills of soft mixture of clay and sand stone. Suru valley has comparatively at lower altitude and most of the villages are located in this valley only. This valley is comparatively warmer and favorable for cultivation. The summer being short, only one crop of local gram or wheat is grown. The soil of the district is sandy to loamy in nature and deficient in organic

matter and availability of phosphorus and potashes low and mixed with stones and gravels. It is shallow in formation, weak friable and being sandy it is vulnerable to all types of erosion. Soils developed on river terraces highly porous and coarse grained in nature. Fertility of the soil varies from place to place and growing season is very short. The district has some deposits of chromed at Drass and around it. Copper is also found in Lungnak valley, Zanskar and Tai-Suru. Besides, deposits like lime stone, marble and building material also exist. However, these mineral resources are yet to be exploited.

6.7.3 Seismicity

The project road lies in the high unstable seismic zone. According to GSHAP data, the state of Jammu & Kashmir falls in a region of high to very high seismic hazard. As per the 2002 Bureau of Indian Standards (BIS) map, this state also falls in Zones IV & V. Historically, parts of this state have experienced seismic activity in the M6.0-7.0 range. The project road NH-301 is falls in the Zone IV.

6.7.4 Geology

Geology of Kargil district is complicated due to its severe collision of Indian plate with Eurasia plate resulting into elimination of most of the geological records. Undifferentiated Central Crystalline rocks (Lioned / Kilar formations) are the oldest rocks exposed in the district. These are mainly Garnetiferous mica-schists, Kyanite schists with thin bands of quartzite and marble. These crystalline rocks are overlain by a thick belt of sedimentary rocks designated as Phe formation of upper proterozoic age. They comprised of silt stone/arenite, black pyritous and carbonaceous shale with limestone bands. The Phe formation is directly overlapped by a thin strip of basic volcanic rocks of lower permean age designated as Ralakung volcanics which are homotaxially correlatable with Panjal volcanics of Kashmir. Lilang group of rocks of Perma-triassic age comprising grey splintery shales and thick sequence of interbedded ferruginous limestones with Cephalopods overlie the Ralakung volcanic formations. Cretaceous volcanics known as Drass volcanics are intrusive ultrabasic rocks consisting of succession of volcanic, pyroclastic, volcano-clastic sediments with Gabbro and Doleite dykes. Isolated serpentinite lenses are also present. It is thrust over the molasses or the Indus formations in the northern part. Along its southern contact Drass formation thrusts over, by the different units, which include Mesozoics of the Zanskar, super group. Drass formation is well developed around Drass, Fashkyum and surrounding areas without crops reaching upto 15.5km.

The Indus Suture Zone which forms northern part of the district is characterized by the presence of ophiolite mélange tectonically mixed with other rocks which are highly deformed marine sediments of Cretaceous-Eocene age. North of Indus suture zone is exposed by the rocks of Indus formation which is a sedimentary belt of a thickness of over 5000 mtrs extending NW-SE for more than 5000 km located between the Ladakh Plutonic complex in the North and the ophiolite melange in the South. Indus formation consists of a thickly inter-bedded succession of predominantly conglomerate sandstone, siltstone and shale together with sub-ordinate calcareous shale and limestone.

- The Kashmir valley comprises of sedimentary, metamorphic and igneous rocks ranging in age from Salkhala (Precombrian) to Recent.
- Indus valley (Ladakh) Comprises Crystalline complex of rocks ranging in composition from sedimentary igneous and metamorphic in characteristics.

6.7.5 Soil

The soil of the District is sandy to loamy in nature and deficient in organic matter and availability of phosphorus and potashes low and mixed with stones and gravels. It is shallow information, weak friable and vulnerable to all types of erosion. Fertility of the soil varies from place to place and growing season is very short. The district has some deposits of chromed at Drass and around it. Copper is also found in Lungnak valley, Zanskar and Tai-Suru. Besides, deposits like limestone, marble and building material are alsoexist. However, these mineral resources are yet to be exploited.

6.7.6 Air Quality

The air quality in the project area is less polluted. The 98th percentile value of PM 10 was maximum 92.42 mg/m^3 at Titi Chumik and minimum 60.18 mg/m^3 at AbranVillage. The 98th percentile value of PM 2.5 maximum 40.77 mg/m^3 at Titi Chumik and minimum 23.14 mg/m^3 at Abran Village. The concentration of SO_2 maximum 8.15 mg/m^3 at Titi Chumik and minimum 5.52 mg/m^3 at Rangdum. The concentration of maximum 14.96 mg/m^3 at Achambur and minimum 10.67 mg/m^3 at Abran village.

Among all six selected location maximum dust concentration present on Titi Chumik (AAQ 1) because it is near to Kargil city, due to this the vehicle movement are dense in this location area, it is the major source of dust generation. The higher concentration of PM 2.5 at Titi Chumik (AAQ 1) is close proximity of the city area. Emission of SO_2 and NOx in this project area was slightly observed only due to burning of fossil fuelsProposed improvement in the road condition will remove the road generated dust up to acceptable level.

6.7.7 Noise

Noise monitoring has been carried out once during the entire study period (over a period of twenty-four hours to obtain L_{eq} values at uniform time intervals of 1 hour. For each location, day and nighttime L_{eq} values have then been computed from the hourly L_{eq} values such that comparison could be made with the national ambient noise standards. Day & nighttime L_{eq} has been computed from the hourly L_{eq} values as per standards L_{eq} is varies from 38 dB(A) to 59 dB(A).

6.7.8 Water Scenario of the project area

The district is underlain by consolidated formation in maximum part. Ground water in these formations occur in fissures and fractures developed due to repeated tectonic activities. The unconsolidated formations like alluvium, scree and talus formations present along the river valleys play vital role in terms of occurrence and movement of ground water. Ground water resources of these formations can also be developed on sustainable basis These moraine formations (Talus and scree formations) consists of boulders and clasts in a matrix of sand, silt, clay and gravel. The aquifer is made up of boulders and clastic material in clay, silt and sand matrix. Depth to water levels in moraine formations is very deep and varies between 60 to 75 m bgl. The valley fill deposits are mainly boulders and gravel mixed with silt and sand material. This is mainly transported material lying un-sorted in the recent river valleys. Ground water occurs as un-confined condition in this formation. Depth to ground water is in continuous with river water table and is very shallow to as deep as about 25 m bgl.

The district is predominantly hilly terrain, ground water resources cannot be estimated and quantified. Ground water development through construction of tube wells and hand pumps is very much possible in this district.

As per CGWB Report, ground water in the area is fresh and potable with electrical conductivity (EC) generally less than 700 µS/cm at 25°C. Studies for Iodine have been carried out which shows that the concentration of iodine is much less than the permissible limits. The range of concentration of various parameters as monitored by CGWB is given in Table below.

Table 6.7.Forest Cover in the Project District & Project State

S. No.	Paramater	Unit	Range	
			Minimum	Maximum
1	pH	-	7.15	7.47
2	Conductivity (at 25°C)	µS/cm	175	700
3	Alkalinity (as HCO3-)	mg/l	79	201
4	Chloride (as Cl-)	mg/l	3.5	11
5	Nitrate (as NO3-)	mg/l	Tr	9.61
6	Fluoride (as F-)	mg/l	Tr	0.23
7	Calcium (as Ca+)	mg/l	26	80
8	Magnessium (as Mg+)	mg/l	2.4	34
9	Sodium (as Na+)	mg/l	0.7	14
10	Potassium (as K+)	mg/l	0.1	3.8
11	Total Hardness (as CaCO3)	mg/l	90	340
12	Iodine	micro grams/l	0.275	1.22

Source: Ground Water Information Booklet of Kargil District Jammu & Kashmir State, CGWBSurface Water

Zanskar, Indus, Sur, Shiggar, etc. are the major river in the district. Springs are the major source of water supply for drinking and irrigational requirements. The detailed study of origin and discharges of 33 springs were studied. Out of 33 springs 17 nos. were structural controlled originating from the fractures and joints existing in the lithology of various geological formation and remaining were either from contact of two rock units or gravity. Discharge of water yielded by these springs ranges between 0.06lps in Chhutumel village and highest of 7.5lps in Kargil (1 km of Kargil). By and large spring situated on hard rock granatoid shows an average discharge of 4.4lps and which situated on volcanic rocks (Drass Volcanics) shows average discharge 1.939lps whereas sedimentary rocks (Kargil formation) exhibit an average of 0.8490lps. The springs which are perennial in nature are generally snow fed, and their recharge area lies in higher reaches of mountain.

Ground Water:

The project area falls in hilly area. The sources of ground water are limited. Some of the hand pumps found at the valley near river in the settlement area of the road.2 ground water samples were collected to assess the ground water quality along the project corridor. The samples were collected in the month of June 2016. Ground water samples were analysed in lines with IS 3025 and APHA 22nd edition 2012. TDS of the sample GW-1 is 176 mg/l and GW-2 is 68mg/l. The water quality was found well within the permissible limits as per IS: 10500 drinking water quality standards.

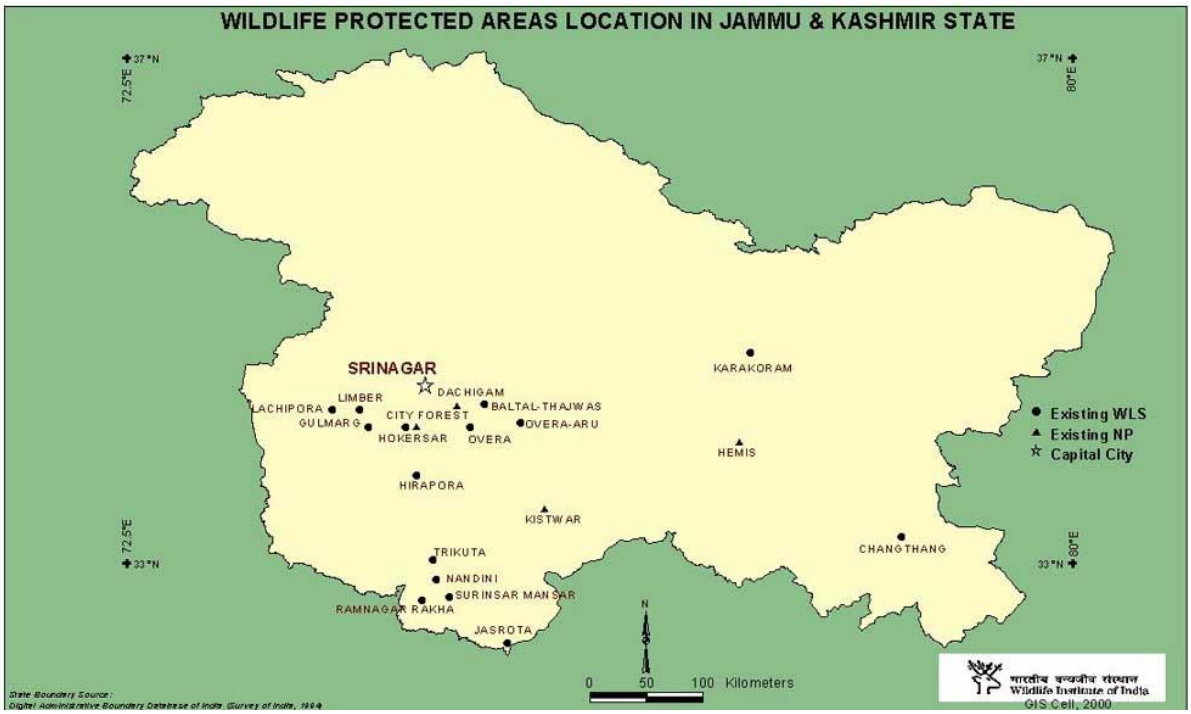
Surface Water:

There are many perennial River and stream found along the project road which may be used for the drinking as well as construction purpose. People along the road use the stream water for drinking purpose after conventional treatment. Four surface water sample was collected in the month of June 2016. Samples were analysed for the parameters as desired for assessment of surface water quality. The results were compared against the Class C water (Water for fish culture and wild life propagation) quality standards as per IS 2296.

6.8 BIOLOGICAL ENVIRONMENT

6.8.1 Protected Areas

Kanji Conservation Reserve located within project area. The area is notified for the protection of snow leopard andother rare / endangered species.



Source: ENVIS Centre on Wildlife & Protected Areas

Figure 6.2: Wildlife Protected Areas of J&K State

6.8.2 Presence of Forest

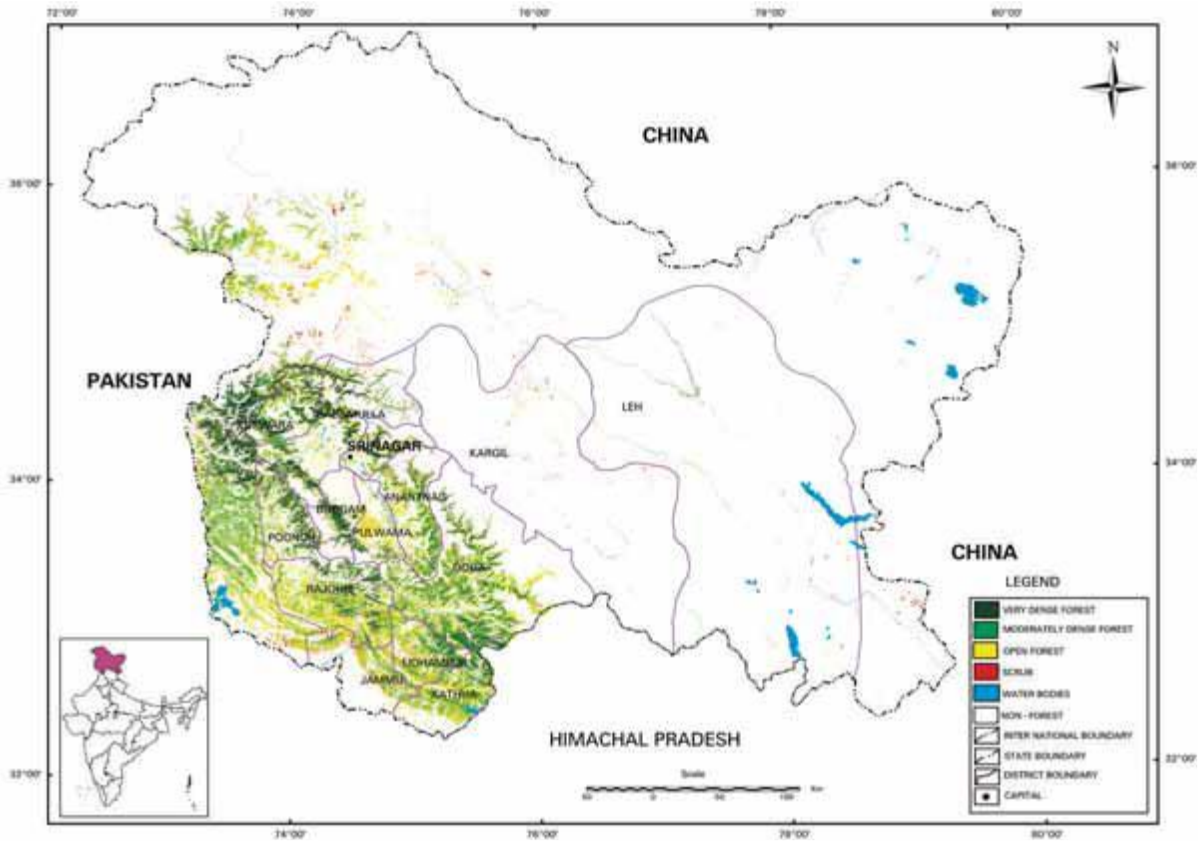
According to India State of Forest Report, 2015, the recorded forest area of Jammu & Kashmir State is 22988 km2 which constitute 10.34% of State geographical area. The comparative Forest Cover details of the project District and Project State has been presented in table below. It is observed that the percentage of forest cover out of total geographical area for project district is quite less than the state's overall percentage. Comparative details between the Project District & State forest Cover have been presented in below table. & below figure presents the Forest Cover Map of Project State

state.

Table 6.8.Forest Cover in the Project District & Project State

District/State	Area in Km2					% of Geographical Area
	Geographical Area	Very Dense Forest	Moderately Dense Forest	Open Forest	Total	
Kargil	14,037	0	2	37	39	0.28
Jammu & Kashmir	222,236	4,061	8,815	10,112	22,988	10.34

Source: India State of Forest Report, 2011



Source: India State of Forest Report, 2011

Figure 6.3: Forest Cover in the Project State

6.8.3 Flora & Fauna

Kanji Conservation Reserve located within project area. Much of vegetation is found in the irrigated villages, and on the upper slopes which receive more precipitation and where it consists of alpine and tundra species. Most impressive are the meadows covered with thousands of edelweiss. At the foot of the Gumburanjon mountain blue poppies can be found. Crops including barley, lentils, and potatoes are grown by farmers at the lower elevations. Domesticated animals such as the yak, dzo, sheep, horse, and dog are found in the region.

Among the wildlife that can be found in Kargil are the marmot, bear, wolf, snow leopard, kiang, bharal, alpine ibex, wild sheep and goats, and the lammergeier.

1. Riverian

The riverian vegetation includes the stream side flora which is confined to the main nallahs and their tributaries. The main constituent of this biotope is the broad-leaved shrub of genera *Salix app., Hippophae spp., Myricaria spp*. And at some places *Betula utilis* and *Juniperous Shrubs*.Shrubs of *Lonicera, Rosa webbiana* and *Ephedra spp*. In scattered patches also occur in the river bed hence these plants are recommended in the river bed of the project road sile.

2. Savana cover

The coarse grass patches dominate most of the area with frequent association of *Caraana* spp. At high altitudes and *Ephedra* and *Rosa webbena* a lower elevation.

a. ***Caragana* Scrub:** Dominates the low altitudes over mountain groves and pastures where it is interspersed with *rosa webbaina* and *Ephedra* spp.
b. **Rock Savanna:** Occurs mostly at the mouths on both sides of the nallahs and on the neighboring ridges of Kanji vally. Coarse grasses and bushes of *Juniperous*, *Rosa webbiana* sparsely occupy the rocky cliffs.
c. **Betula Sands**: Mainly occur in the deep gorges east and north-east of the Kanji vally.

Founa

Data from the secondary source shows that about 16 species of Birds and 8 species of mammals found in the Project area

The detailed assessment for presence of forest area and wildlife along the project stretch shall be elaborated in detailed EIA Report

6.9 SOCIAL AND CULTURAL FEATURE

6.9.1 Settlements alongthe Project Road Section

There are a total of 47 settlements varying in size and populations along the project corridor. The settlements are given in the following table.

Table 6.9.Settlements along Project Road

SL No	Chainage (Km)		Length Km	Name of Village/Town
	From	To		
1	0.000	0.800	0.800	Kargil
2	0.800	2.000	1.200	Baroo
3	2.000	5.000	3.000	Titi Chumik Village
4	5.000	7.000	2.000	Remospar
5	7.500	9.000	1.500	Chuttuk
6	9.000	10.000	1.000	Minjee

SL No	Chainage (Km)		Length Km	Name of Village/Town
	From	To		
7	12.000	14.000	2.000	Gramthang
8	18.200	20.000	1.800	Aliabad Trespone Village
9	22.000	24.000	2.000	Salishkote
10	26.000	27.400	1.400	Khumbathang
11	27.400	30.000	2.600	Faroona

Source: Primary Study

6.9.2 Census

The project highway passes through Kargil district of Jammu & Kashmir State. As per the 2011 census, Jammu & Kashmir has a total population of 1,25,41,302 and the total male and female population of the state is 66,40,662 and 59,00,640 respectively. The population density per sq km is 56. The total number of literates of the state is 70,67,233 while the sex ratio is 889. The demographic profile of Project District and Project State is presented in table below.

Table 6.10.Demographic Features of Project State and Project Districts

State / District	Total Population			Sex Ratio	Population density (/Km2)	No of Literate Population		
	Persons	Males	Females			Persons	Males	Females
Kargil	140802	77785	63017	810	10	86236	56301	29935
J&K	12541302	6640662	5900640	889	56	7067233	4264671	2802562

Source: Indian Census, 2011

6.9.3 Cultural/Archaeological Resources

Religious structures have been observed along the project road, most of them are Mosques. The summary of observed religious structures along the project road is given in Final DPR Report.

6.10 STAKEHOLDER CONSULTATION

6.10.1 Process and Methodlogy

As a part of the project preparation and to ensure that the community support is obtained and the project supports the felt needs of the people; stakeholder consultations are carried out as an integral component. Individual interviews, field level observations, community consultations & meetings are used to collect stakeholders input on the project. Meetings with community are conducted in both ways i.e. formal as well as informal.

Areas / Issues that are of Concern to the Stakeholders

- Compensation for structures and land at market rate
- Land & Resettlement issues
- Drainage system & drinking water facilities issues
- Provision of new bus shelters in lieu of demolished shelters
- Provision of public toilet facility
- Employment to local people during construction work
- Provision of footpath in settlement area

6.11 POTENTIAL ENVIRONMENTAL IMPACTS

This section provides the potential impacts likely on the various environmental components along the project corridor based on the field visits and the primary surveys. Most of the impacts on the various environmental components shall be perceived during construction and operation phase. The key environmental, health, safety and social issues that were identified to have a major impact due to the various proposed interventions are as below:
Air, water, soil & noise quality

Water pollution, drinking water sources, water scarcity in non-monsoon months and construction water requirements

Roadside trees, tree plantation, forest diversion

Employment opportunity during civil works

The Table below shows the general impact on the environmental components due to the project.

Table 6.11.General Impacts on Environment in Project Road

Env. Component Affected	Construction Phase				Road Operation	Indirect effects of Operation or Induced Development
	Project Activity					
	Removal of trees and Vegetation	Earth works	Laying of Pavement	Vehicle & Machine Operation	Vehicle operation	-
Air	Air pollution, Hotter, drier microclimate	Dust generation	Asphalt odour	Dust pollution		Air pollution due to increase in vehicle
Land	Erosion and loss of topsoil	Erosion and loss of topsoil, disposal of earth material	Contamination of land	Contamination by fuel & lubricants compaction	Spill from accidents	-
Water	Siltation	Alteration of drainage	-	Contamination by fuel & lubricants compaction	Spill Contamination by fuel & lubricants &	Increased contamination of ground water

Env. Component Affected	Construction Phase				Road Operation	Indirect effects of Operation or Induced Development
	Project Activity					
	Removal of trees and Vegetation	Earth works	Laying of Pavement	Vehicle & Machine Operation	Vehicle operation	-
Noise	Noise pollution					
Flora	Felling of trees & trimming of branches of some trees that might cause safety hazard or affected due to raising of embankment & widening work	-	-	-	Impact of pollution on vegetation	-
Fauna	Disturbance due to habitat loss	Disturbance	-	Disturbance	Collision with traffic	Distorted habitat
Agricultural land	-	Loss of standing crops	-	-	-	Conversion of agricultural land into other land use
People and community	Loss of shade and community trees, loss of fuel wood and fodder, loss of income	Dust nuisance	Noise & air pollution	Odour and dust	Noise pollution, Risk of accidents	Induced pollution
Cultural assets	Displacement of structures	Loss of sacred trees (if	-	Noise vibration may cause	Damage from vibration	-

Env. Component Affected	Construction Phase				Road Operation	Indirect effects of Operation or Induced Development
	Project Activity					
	Removal of trees and Vegetation	Earth works	Laying of Pavement	Vehicle & Machine Operation	Vehicle operation	-
	from Row	any)		structural damage	and air pollution	
Labour's health & safety	Increase of stagnant water and diseases			Asphalt odour and dust	-	-

6.12 MITIGATION AND ENHANCEMENT MEASURES

6.12.1 General

The negative impacts of road projects can be reduced or minimised only if proper safeguards are put in place during the design and construction stage itself. These can include reducing pollutant discharge from the harmful activities at source or protecting the sensitive receptor. An effective mitigation strategy will utilise a combination of both options to arrive at practically implementable measures. Conscious efforts shall be worked out to minimise any adverse impacts on the various environmental and social components. Where the impacts on various environmental components shall be unavoidable, suitable mitigation designs shall be worked out.

Table 6.12.Summary of Mitigation

Sl. No	Potential impact	Mitigation / Enhancement
1.	Change in Geology	Blasting to be done as per requirement and with proper safegaurds is envisaged. Quarry Development Plan need to be enforced.
2.	Change in Seismology	All structures to be checked and complied with the seismological settings of the region (Zone)
3.	Loss of land	Land acquisition minimised Design restricted to within 24m of ROW in Rural Area and 20m in Urban Area
4.	Generation of Debris	Disposed properly to avoid contamination.
5.	Soil Erosion	Embankment protection through stone pitching, Turfing & , retaining walls Residual spoil need to be disposed properly Silt Fencing need to be provided Quarries need to be reclaimed
6.	Contamination of Soil	Hazardous Wastes (Management and Handling) Rules, 1989 to be enforced.

Sl. No	Potential impact	Mitigation / Enhancement
		Oil Interceptor will be provided for accidental spill of oil and diesel Rejected material will be laid as directed by engineer. Septic tank will be constructed for waste disposal.
7.	Soil quality monitoring	Measures will be revised & improved to mitigate / enhance environment due to any unforeseen impact.
8.	Scarified Bituminous Wastes	No scarification involved. In case concessionaire decides to scarify then the material to be reused in the GSB layer. Non reusable Bituminous wastes to be dumped in 30cm thick clay lined pits with the top 30cm layer covered with good earth for supporting vegetation growth over a period only after obtaining permission of Independent Consultant.
9.	Scarified Non Bituminous Material	Used in the normal GSB layer (not the drainage layer)
10.	Cut material	Reused as embankment, median & shoulder fill materials Excess material to be used for filling up of borrow areas identified by the concessionaire and approved by the Independent Consultant
11.	Construction debris generated from dismantling of structures	Guidelines for Identification of Debris Disposal Sites& Precautions and Guidelines for Rehabilitation of Dumpsites, Quarries and Borrow Areas shall be framed
12.	Soil Contamination due to accident spills	An emergency response team to be created. The team shall contain members of the district and police administration and also have specialist in remediation. Responsibility of Concessionaire to inform the team to take actions. The roles and responsibility of the members of the ram shall be framed in conjunction with all the parties to address the situation arising out of the accidental spills resulting in situation like water and soil contamination, health hazards in the vicinity of the accident spot, fire and explosions etc. During construction, the contractor and the concessionaire's described previously. Fuel storage will be in proper bunded areas. All spills and collected petroleum products to be disposed off in accordance with MoEF and SPCB guidelines and as per the directions of the Emergency Response team. Fuel storage and fuelling areas will be located at least 300m from all cross drainage structures and significant water bodies.
13	Runoff and drainage	Improvements of design shall lead to less accidents and hence less spillage of oil and grease Silt fencing to be provided Recharge well to be provided to compensate the loss of pervious surface

Sl. No	Potential impact	Mitigation / Enhancement
14.	Operation of residential facilities for labour camps, Vehicle parking areas	Vehicle parking area will be made impervious using 75 mm thick P.C.C. bed over 150 mm thick rammed brick bats. The ground will be uniformly sloped towards to adjacent edges towards the road. A drain will take all the spilled material to the oil interceptor
15.	Meteorological factors and climate	Comprehensive afforestation Avenue plantation Shrub plantation in the median / island
16.	Dust generation	Sprinkling of Water Fine materials to be completely covered, during transport and stocking. Plant to be installed in down wind direction from nearby settlement.
17.	Gaseous pollutants	Air pollution Norms will be enforced. Labourers will be provided mask. Local people will be educated on safety and precaution on access roads, newly constructed embankment etc.
18.	Air quality emissions	Compliance with future statuary regulatory requirements
19.	Air quality monitoring	Measures will be revised & improved to mitigate enhance
20.	Alteration of Cross Drainage	Widening & construction of bridges, there will be an improvement in the drainage characteristics of the project area.
21.	Water requirement for project	Contractor needs to obtain approvals for taking adequate quantities of water from surface and ground water sources. This is required to avoid depletion of water sources. Water harvesting structures to be provided.
22.	Increased sedimentation	Silt fencing to be provided Guidelines for Sediment Control to be framed
23.	Contamination of Water	Hazardous wastes (Management and Handling) Rules, 1989 to be enforced. Oil Interceptor will be provided for accidental spill of oil and diesel. Rejected material will be laid as directed by IC. Septic tank will be construction for waste disposal.
24.	Water quality monitoring	Measures will be revised and improved to mitigate / enhance environment due to any unforeseen impact.
25.	Noise mitigation for Sensitive receptors	Options for Noise barriers to be analysed No Horn Zone sign Post.
26.	Noise Pollution (Pre-Construction Stage)	Machinery to be checked and complied with noise pollution regulations. Camps to be setup away from the settlements, in the down wind direction
27.	Noise Pollution (Construction Stage)	Camps to be setup away from the settlements, in the down wind direction. Noise pollution regulation to be monitored and enforced.

Sl. No	Potential impact	Mitigation / Enhancement
		Temporary as the work zones will be changing with completion of construction.
28.	Noise Pollution (Operation Stage)	Will be compensated with the uninterrupted movement of vehicles
29.	Noise Pollution Monitoring	Measures will be revised and improved to mitigate / enhance environment due to any unforeseen impact.
30.	Forest area	Minimum acquisition of land Permission for acquisition from forest department as per Forest Act Plantation of trees as per Forest Department
31.	Trees Cutting	Compulsory tree plantation in the ratio of 1:2. Option of compensatory afforestation through Forest Department. Identification of incidental spaces for plantation along corridor, where ever possible
32.	Vegetation	Clearing and grubbing will be minimised Exposed surface like embankment slopes will be protected with stone pitching and turfing. Open land in and around plant will be vegetated.

The following mitigation measures shall be considered at the detailed design stage:

- Up gradation of existing approach roads to the highway
- Adequate drainage facilities along the road
- Appropriate noise barriers at sensitive locations
- Development of strip plantation on both sides and median shrubs
- Regular monitoring of ambient air quality, noise level and water quality during construction
- Grade separation at interchanges
- Construction Related Activities

Most of the direct impacts of a road project occur during the construction stage. This stage is also important since the people living near the sites are inconvenienced without the collateral benefits of a functional road. Moreover, construction related activities are confined within an identifiable boundary and so is the affected population. It is also the stage of the project when the PWD, can exercise maximum control to ensure that the environmental impacts are minimised.

Most of the mitigation measures can be incorporated as good engineering practice during the design phase itself thus ensuring the mainstreaming of environmental concerns early in the project. Adherence to design drawing and specifications will reduce the adverse impacts during construction to within acceptable levels. Moreover, continuous supervision of construction activity can also work as a deterrent to errant behaviour. Therefore, incorporating environmental provisions within the construction contracts becomes vital to ensure effective implementation of mitigation measures during construction stage of the project itself.

6.12.2 Land Acquisition

Based on the preliminary survey conducted and information on RoW obtained so far, the land required for widening of the existing road and acquisition for the project shall include agricultural, barren / fallow lands, forest & governmental lands. Care shall be taken to minimise land acquisition. In order to mitigate the ensuing negative impacts of the land acquisition a Resettlement and Rehabilitation (R&R) Policy shall be prepared based on the applicable R&R policy. The salient features of the mitigation measures are:

Wherever possible, displacement shall be reduced or avoided altogether by sensitive design of civil works (e.g. alternative designs or modification to the design)

Where displacement is unavoidable, those displaced will have their living standard improved
PAPs will be compensated, at replacement cost, for assets lost. Adequate social and physical infrastructure will be provided

PAPs and lost community would be encouraged to participate in the implementation of RAP
An entitlement policy shall be worked out as part of the RAP and will deliver a comprehensive package of compensation and assistance to entitled persons, families groups suffering losses as a result of the project

6.12.3 Safety

The project shall take care of safety measures for road users including pedestrians as per IRC guidelines. Safety of pedestrians as well as of the vehicles plying on the road shall be given highest importance and adequate measures shall be incorporated in the design of the alignment. Advance warning signboards, flagmen are proposed during the construction period. Care shall be taken during construction with habitation areas and especially near Schools. All the signboards giving caution and barricades for diverting the traffic shall be as per IRC specifications. Some trees might need to be felled / branches trimmed since these might become potential safety hazards due to their existing locations or due to rising of embankment height. However care shall be taken to save as many trees as possible from felling.

6.13 ENVIRONMENTAL ENHANCEMENT

Enhancements specifically refer to these positive actions to be taken up during the implementation of the project for the benefit of the road users and the communities living close to project road alignment. Enhancements are carried out with the following objectives:

- To enhance the appeal and environmental quality of the project road to the users;
- To enhance visual quality along the highway; and
- To generate goodwill amongst the local community towards the project, by the enhancement of common property resources

It is planned to enhance the environment in 3 major areas and the the details shall be explored at later stage report:

Enhancement of selected water bodies nearby the road as per design, drawings and direction of the Environmental Specialist. This shall be also be utilisd for Water storage capacity for settlements

Enhancement of cultural properties including seating arrangements where ever feasible and guided by the Project Proponent

Enhancement & increase of height of boundary walls of government schools by planting of creepers on the exterior wall and planting of 1 row of flowering, shade, medicinal, ornamental & fruit bearing trees inside the boundary at a distance of 3m c/c and as per directions of the Environmental Specialist

6.14 LANDSCAPING AND ARBORICULTURE

A proper landscape shall be provided along the highway alignment to fit in with the surroundings for pleasing appearance reduce headlight glare and adverse environmental effects such as air pollution, noise pollution and visual intrusion. The proposal for future landscaping shall include the following:

Treatment of embankment slopes as per IRC: 56 – 1974, depending upon soil type involved
Turfing of slopes of high embankment for controlling rain and wind erosion
Planting of low height shrubs on medians for reducing glare effect and visual intrusion
Planting of trees along ROW as part of compensatory afforestation

Grading of ground between the embankment toe and ROW and provision of surface drain along the ROW. This will help in physical delineation of the ROW and avoid encroachment at later date

6.15 ENVIRONMENTAL MANAGEMENT PLAN

Environmental impacts could be positive or negative, direct or indirect, local or regional and also reversible or irreversible. The impacts generated during construction and operational phase of the roads along with management plan for these impacts has been discussed in Environmental Management Plan. Environmental management considerations in the form of EMP shall be designed for project activities during the Detailed EIA. The EMP shall provide guidelines & help in implementing and incorporating environmental management practices to reduce negative environmental impacts of the project. Enhancement measures shall also be proposed in order to provide good environmental practices and improve the aesthetics.

6.16 ENVIRONMENTAL BUDGET

The tentative budget for the Environment Monitoring Plan is given in Table below. The monitoring plan is prepared considering 2 year construction and 5 years operation and maintenance period.

Table 6.13.Environment Monitoring Plan

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Crores
1	**MITIGATION / ENHANCEMENT COST**						
1.1	**Pre-construction Stage**						
1.1.1	Water	Relocation of affected hand pumps, wells etc.	Covered in Utility Shifting Budget			0.00	0.000
1.1.2	Forest	Net Present Value of Forest Land	Not Applicable			-	0.000
1.2	**Construction Stage**						
1.2.1	Horticulture	Compensatory Re-plantation to offset the loss of trees due to widening of the project corridor in accordance to the relevant forest laws (Minimum of 2 trees planted for every tree cut) including Plantation and maintenance at locations & as per directions of the forest department or administrative department	No.	85100	2,000.00	17,02,00,000.00	17.020
		Avenue Plantation along the Road on both side 200 Trees/Km in a single Row (including maintenance cost)	No.	0	2,000.00	-	0.000
		circular tree guard & /other for protection of plantation	No	85100	1,200.00	10,21,20,000.00	10.212
1.2.2	Soil	Providing Oil Interceptors at vehicle parking /washing areas/Fuel Storage	Nos.	4	30,000.00	1,20,000.00	0.012
1.2.3	Air	Dust Management with sprinkling of water	Covered in Engineering Cost				0.000
1.2.4	Noise	Construction of compund wall at Noise Sensitive Locations using brick masonry work upto a height of total 2m above ground level	running m	540	8,000.00	43,20,000.00	0.432
1.2.5	Water Quality	Provision for Silt fencing along waterbodies	running m	500	1,250.00	6,25,000.00	0.063
1.2.6	Solid Waste Disposal	Disposal of Sewage and other wastes in the construction yard and labour camps as per directions of the Environmental Specialist of CSC	Month	30	15,000.00	450000.00	0.045
1.2.7	Cultural properties	Relocation of cultural properties	Covered in RAP Budget				0.000
1.2.8	Environmental Enhancements	Enhancement of Local Enviornment at 2 Locations	No (LS)	2	2,50,000.00	5,00,000.00	0.050
TOTAL MITIGATION / ENHANCEMENT COST						**27,83,35,000.00**	**27.834**
2	**MONITORING COST**						
2.1	**Construction Stage (30 Months)**						
2.1.1	Air	Monitoring ambient Air Quality as per CPCB Standard Procedures at 15 locations as per the Monitoring Plan given in EMP by NABL / MoEF approved Laboratory	No. of Samples	810	5,000.00	40,50,000.00	0.405

Item No.	Component	Description	Unit	Quantity	Unit cost (INR)	Total cost (INR)	
						Detail Cost	Cost in Crores
2.1.2	Water Quality	Sampling & Analysis of water quality as per the monitoring plan at 15 locations by NABL/ MoEF approved Laboratory	No. of Samples	90	6,000.00	5,40,000.00	0.054
2.1.3	Noise	Monitoring Noise level at as per CPCB Standard Procedures at 15 locations as per the Monitoring Plan given in EMP by NABL / MoEF approved Laboratory	Nos.	90	2,000.00	1,80,000.00	0.018
2.1.4	Soil	Monitoring Soil at 15 locations as per the Monitoring Plan given in EMP by NABL /MoEF approved Laboratory	Nos.	90	3,000.00	2,70,000.00	0.027
2.2	**Operation Stage (4 Years)**						
2.2.1	Air Quality	Monitoring ambient Air Quality as per CPCB Standard Procedures at 15 locations as per the Monitoring Plan given in EMP by NABL/ MoEF approved Laboratory	No. of Samples	648	5,000.00	32,40,000.00	0.324
2.2.2	Water Quality	Sampling & Analysis of water quality as per the monitoring plan at 15 Locations by NABL/ MoEF approved Laboratory	No. of Samples	24	6,000.00	1,44,000.00	0.014
2.2.3	Noise	Monitoring Noise level at as per CPCB Standard Procedures at 15 locations as per the Monitoring Plan given in EMP by NABL / MoEF approved Laboratory	Nos.	24	2,000.00	48,000.00	0.005
2.2.4	Soil	Monitoring Soil at 15 locations as per the Monitoring Plan given in EMP by NABL / MoEF approved Laboratory	Nos.	24	3,000.00	72,000.00	0.007
TOTAL MONITORING COST						**85,44,000.00**	**0.854**
3	**MISCELLANEOUS COST**						
3.1	Training	Training	L.S.	-	2,50,000.00	2,50,000.00	0.025
3.2	Administrative Charges including logistics	Maintenance of vehicle with the Environment Cell, Data processing, administrative support, stationery etc.	Months	30	35,000.00	10,50,000.00	0.105
TOTAL MISCELLANEOUS COST						**13,00,000.00**	**0.130**
TOTAL COST						**28,81,79,000.00**	**28.818**
Contingency @ 5% on Total Environmental Cost						**14408950.00**	**1.441**
GRAND TOTAL						**302587950.00**	**30.259**
Rate per kilometer						**1311607.93**	**0.13**

6.17 CONCLUSION

The preliminary Environment Assessment is a step towards preparation of environmental impact assessment report. The Preliminary Environment Assessment process as described in previous sections has primarily tried to focus on the potential impacts due to the proposed project, identification of the hotspots and to propose mitigation measures at different phases of the project. Based on the findings during the Preliminary Environment Assessment some measures have to be considered from the inception of the project, which will reduce the detrimental effects of project appreciably. These are:

The project is an expansion of existing National Highway not involving LA more than 40m in existing and 60m in realignment / bypasses, the project doesn't qualify as a category A project as per EIA notification of Sept 2006 and its subsequent amendments. Hence no Prior Environmental Clearance is required under EIA Notification of 2006 & its amendments

The project may require Forest Clearance for diversion of forest land and the Project Proponent shall apply for forest clearance

Trees are also needed to be felled due to road widening. Permissions to be obtained from Forest Authorities before felling

The project road is along the proposed Kanji Conservation Reserve. Hence, Wild life Reccomendation should be required

No notified archaeological feature within 500m from the project road stretch. Thus no archaeological clearances / permissions to be obtained

Property & Livelihood will be affected due to the project and their rehabilitation shall be taken up as per SIA

7 INITIAL SOCIAL ASSESSMENT AND PRELIMINANRY LAND ACQUISITION PLAN

7.1 INITIAL SOCIAL ASSESSMENT

7.1.1 General

Jammu and Kashmir is the state in northernIndia. It is located mostly in the Himalayan Mountains, and shares a border with the states of Himachal Pradesh and Punjab to the south. Jammu and Kashmir (J&K) has an international border with China in the north and east, and the Line of Control separates it from the Pakistani-occupied territories of Kashmir and Gilgit–Baltistan in the west and northwest respectively.

Jammu and Kashmir consists of three regions: Jammu, the Kashmir Valley and Ladakh. Srinagar is the summer capital, and Jammu is the winter capital. The Kashmir valley is famous for its beautiful mountainous landscape, and Jammu's numerous shrines attract thousands of Hindu pilgrims every year. Ladakh, also known as "Little Tibet", is renowned for its remote mountain beauty and Buddhist culture. It is the only state in India with a Muslim majority population.

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 Kms wide and 15,520.3 Km^2 in area. The Himalayas divide the Kashmir valley from Ladakh while the Pir Panjal range, which encloses the valley from the west and the south, separates it from the Great Plains of northern India. Along the northeastern flank of the Valley runs the main range of the Himalayas. This densely settled and beautiful valley has an average height of 1,850m above sea-level but the surrounding Pir Panjal range has an average elevation of 5,000m.

The Jhelum River is the only major Himalayan River which flows through the Kashmir valley. 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 5,753m above sea-level, the Siachen Glacier is 76 km long making it the longest Himalayan glacier.

The climate of Jammu and Kashmir varies greatly owing to its rugged topography. In the south around Jammu, the climate is typically monsoonal, though the region is sufficiently far west to average 40 to 50 mm of rain per month between January and March. 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 mm. In September, rainfall declines, and by October conditions are hot but extremely dry, with minimal rainfall and temperatures of around 29°C.

In Jammu, Hindus constitute 66% of the population, Muslims 30% and Sikhs 4%; In Ladakh (comprises Buddhists-dominated Leh and Muslim-dominated Kargil), Muslims constitute about 47% of the population, the remaining being Buddhists (46%) and Hindus (6%). The people of Ladakh are of Indo-Tibetan origin, while the southern area of Jammu includes many communities tracing their ancestry to the nearby Indian states of Haryana and Punjab, as well as the city of Delhi. In totality, the Muslims constitute 67% of the population, the Hindus about 30%, the Buddhists 1%, and the Sikhs 2% of the population.

The total area of state is 2,22,236 sq. kms. But the area under actual control is 1,01,387 sq. kms only, as the great chunk of the territory is under illegal occupation of Pakistan and China.

It consists of three distinct regions – Kashmir valley, Jammu, and Ladakh. The area and population of the three regions is:

Table 7.1.Population of the State

Region	Areas (Sq. Miles)	Population (2011 census) (Provisional)
Kashmir Valley	8,639	5,35,0811
Jammu Region	12,378	69,07,623
Ladakh Region	33,554	2,90,492
Total	**54,571**	**1,25,48,926**

Whereas, in 2011, Kargil had population of 140,802 of which male and female were 77,785 and 63,017 respectively. In 2001 census, Kargil had a population of 119,307 of which males were 64,955 and remaining 54,352 were females. Kargil District population constituted 1.12 percent of total Maharashtra population. In 2001 census, this figure for Kargil District was at 1.18 percent of Maharashtra population.

There was change of 18.02 percent in the population compared to population as per 2001. In the previous census of India 2001, Kargil District recorded increase of 33.55 percent to its population compared to 1991.

7.1.2 Basic demographic profile of Kargil district

Basic demographic profile of Kargil district is presented in **Table 7.2**.

Table 7.2.Basic Demographic Profile of Kargil District

Description	2011	2001
Actual Population	1,40,802	1,19,307
Male	77,785	64,955
Female	63,017	54,352
Population Growth	18.02%	33.55%
Area Sq. Km	14,036	14,036
Density/km2	10	9
Proportion to Jammu and Kashmir Population	1.12%	1.18%
Sex Ratio (Per 1000)	810	837
Child Sex Ratio (0-6 Age)	977	977
Average Literacy	71.34	60.85
Male Literacy	83.15	75.83
Female Literacy	56.3	42.38
Total Child Population (0-6 Age)	19,928	19,928
Male Population (0-6 Age)	10,078	10,078
Female Population (0-6 Age)	9,850	9,850
Literates	86,236	0
Male Literates	56,301	0
Female Literates	29,935	0

Description	2011	2001
Child Proportion (0-6 Age)	14.15%	16.70%
Boys Proportion (0-6 Age)	12.96%	15.52%
Girls Proportion (0-6 Age)	15.63%	18.12%

7.1.3 Socio-Economic conditions

According to Census of India 2011, the J&K state accommodates a population of 1.25 crore (12,548,926), registering a population density of 124 persons per sq.km and sex ratio of 883. A decrease in the decadal population growth rate of the region has been observed during 1991-2001 (29.4 percent) and 2001-2011 (23.7 percent).

Jammu & Kashmir is basically an agrarian state. Agriculture occupies an important place in the economy of the state. The share of agriculture and allied sectors in the Gross state Domestic Product (at 1999-2000 prices) for the year 2010-11 as per preliminary estimates stands at 20.59%. On the other nearly 70% of the population in the state derives its livelihood directly or indirectly from agricultural sector. Agriculture is the main stay of the state's economy.

The state of is predominantly a mono cropped and rain fed with about 40% of the area in Jammu division and 60% in Kashmir Division having assured means of irrigation. Irrigation is crucial input for development of agriculture in the state. The major area in the state falls under the command of canal irrigation.

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.

Table 7.3.Census of the state

Socio-Economic profile of J&K Description	As per Census, 2011
Population	12541302
Population size (Males)	6640662
Population size (Females)	5900640
Population size (Rural)	9108060
Population size (Urban)	3433242
Population size (Rural Males)	4774477
Population size (Rural Females)	4333583
Population size (Urban Males)	1866185
Population size (Urban Females)	1567057
Population density (Total, Persons per sq km)	124
Sex ratio (Females per 1000 males)	889
Sex ratio (Rural)	908
Sex ratio (Urban)	840
Percentage of Literacy	68.74%
GDP at constant (2004-05) prices	17.10% (2012-13)

7.1.4 The District

The entire project road is falls under Kargil district in the state of Jammu and Kashmir.

Kargil is a district of Ladakh, which is located in Jammu and Kashmir. It lies close to the Line of Control and it faces Gilgit - Baltistan to the west and Kashmir valley to the south. Kargil has been the center of conflict between India and Pakistan in the year 1999 and it was declared as a separate district in the year 1979. It has been considered as the least populous district of Jammu and Kashmir.

Kargil district is nestled in the Himalayas, giving it a cool, temperate climate. Summers are warm with cool nights, while winters are long and cold with temperatures often dropping to −40°C with recorded temperatures of −60°C in the tiny town of Dras, situated some 56 km from the Kargil town. The Zanskar plateau is even colder, making it thus a near-uninhabitable place for humans, except for the hardy Khampas.

According to the 2011 census Kargil district has a population of 143,388. This gives it a ranking of 603rd in India (out of a total of 640). The district has a population density of 10 inhabitants per square kilometre. Its population growth rate over the decade 2001-2011 was 20.18%. Kargil has a sex ratio of 775 females per every 1000 males, and a literacy rate of 74.49%.

Ladakh is a part of Jammu & Kashmir State situated in North of India consisting of two districts Leh and Kargil. It is a mountainous desert. This region is separated from the rest of the State by high mountains which are crossed through passes at various points. The lowest pass to Ladakh is Zojila which is at 11,500'. It has an area of 4036 Sq.Km. It is situated between 30 to 35-degree North latitude and 75 to 77 degree East West longitude. It is surrounded by Baramullah, Srinagar and Doda Districts in the South-West, Leh District in the East, Himachal Pradesh in the South and Pakistan in the North-West. The District is divided into four high level natural Valleys namely the Suru Valley, the Drass Valley, the Indus Valley and the Upper Sindh Valley of Kanji Nallah Valley.

The whole District is of high Rocky Mountains, desert arid, snow bound and devoid of natural vegetation. It occupies unique position because of its high altitude area in the country which ranges from 8000 to 23000 ft. above the sea level.

The topography of the region is mountainous with little or no vegetation. The mountains are of sedimentary rocks and are in process of disintegration due to weathering. The terrain being hilly, available land for agriculture is meagre. The summer being short, only one crop of local grim or wheat is grown.

The District Headquarter is situated at a distance of 205 Kms from Srinagar and 230 Kms from Leh. Kargil district comprises of Kargil town and 127 inhabited villages and 2 un-inhabited villages.

Out of total population, 80% are Muslim, most of the district's Muslims are found in the north (Kargil town, Drass, and the lower Suru valley). Another 15% of the total population practise Tibetan Buddhism and Bon, mostly found in Zanskar with small populations in the upper Suru valley (Rangdum) and around Shergol and Mulbekh. Remaining 5% of the native population follow Hinduism and Sikhism.

The mainly Muslim Dards inhabit the valley of Drass and speak Shina, a small number of Buddhist Dard, known as Brokpa, inhabit the Dha-Hanu region near the Lamayuru monastery. Some Arghons and Shina are also settled in Kargil Town.

The Purik language is being spoken by about 78 percent population of Kargil while 10 percent speak Dard group of languages and about 3 per cent speak Balti language. Balti is a dialect of Tibetan and is spoken by the inhabitants of Askardu (Baltistan) and Turtuk in the Nubra valley of Leh district. The Buddhists of Zanskar speak Bhotia or Ladakhi language. The Kashmiri language is also spoken by about 50 per cent of the inhabitants of the village Malayan, which lies near the entrance to Kargil district, after crossing the Zojila pass. However, in Drass, most of the people speaks three languages, firstly Purik and Shina, which are the regional languages and then Kashmiri.

The average annual temperature in Kargil is 8.6°C. About 318 mm of precipitation falls annually. The driest month is November with 6 mm. Most precipitation falls in March, with an average of 82 mm. The warmest month of the year is July with an average temperature of 23.3°C. In January, the average temperature is -8.8°C. It is the lowest average temperature of the whole year. The difference in precipitation between the driest month and the wettest month is 76 mm. The average temperatures vary during the year by 32.1°C.

7.1.5 Site Appreciation and Reconnaissance Details

7.1.5.1 General

In order to be able to appreciate the site conditions and project requirements, our team had a joint site visit with representatives of the client and inspected the project Road.

7.1.5.2 Road Alignment

The Project Road starts at Boro Kargil at Km 0.000 and ends near Zanskar at Km 234.000 in the state of Jammu and Kashmir. The entire Project road passes through the district of Kargil, and passing through important Villages/towns like Minjigum, Salaskot, Lankacherry, Sanku, Purtikche, Pssanikhar, Thangol, Parkachik, Zhuldo, Rangdum, Chibra, Skygam, Phe, Tungri, Sani, Padum, and Zankar. The Total length of the project road is 234.000 Kms. Some exhibits of the project road are shown below.




7.1.5.3 Terrain

The projects road falls under Mountainous Terrain. The terrain details along the Project stretches is shown in **Table 7.4.**

Table 7.4.Terrain Details along the Project Road

Sr. No.	Terrain	% of Terrain
1	Mountainous	100.00
2	Plain	-
3	Rolling	-

Some exhibits of the mountainous terrain are shown below:


Exhibits Showing Mountainous Terrain

7.1.5.4 Land Use

The land use pattern along the project road is Agricultural, Barren and Urban/Built-up. Few major towns and villages have been observed along the project road.

Some exhibits of the land use pattern along the project road are shown below;

Agricultural Land at Km 60.000

Built-up section at Km 40.000 (Sanku Village)

Barren area at Km 54.000

7.1.5.5 Right of Way

There are no existing ROW pillars along the project road, hence measured from the fixed boundaries. The observed ROW varies between 5.00m to 10.00m.

7.1.5.6 Land Acquisition

It is seen that in almost entire stretch of the corridor, additional land will be required to achieve the required ROW for the road construction. However, the project would entail land acquisition as private properties are found in all the corridors. The details of land acquisition required are provided in **Table 7.5**

Table 7.5.Extent of Land Acquisition

Design Chainge (Km)		Area in Sqmtr	
From	To	LHS	RHS
11+700	12+000	1594.352	1832.048
12+000	13+000	4755.442	4733.078
13+000	14+000	4918.584	4529.494
14+000	15+000	4082.023	5484.818
15+000	16+000	4758.169	4726.296
16+000	17+000	4925.359	4566.8
17+000	18+000	5239.002	4217.176
18+000	19+000	5651.188	4098.163
19+000	20+000	5304.588	4434.654
20+000	21+000	4438.522	5053.364
21+000	22+000	5155.107	4332.658
22+000	23+000	4639.739	4856.428
23+000	24+000	4582.356	4912.981
24+000	25+000	4566.622	4939.051
25+000	26+000	4887.638	4580.441
26+000	27+000	5788.397	3813.732
27+000	28+000	4411.579	5091.78
28+000	29+000	5129.755	4355.439
29+000	30+000	5322.948	4206.249
30+000	31+000	5131.815	4354.687
31+000	32+000	4246.009	5225.696
32+000	33+000	4560.224	4877.49
33+000	34+000	6118.76	3704.531
34+000	35+000	5540.103	3952.234
35+000	36+000	4303	5065.526
36+000	37+000	4227.267	5716.649
37+000	38+000	7009.587	3791.114
38+000	39+000	4869.44	4623.429
39+000	40+000	5366.346	4128.112
40+000	41+000	5778.189	6839.977
41+000	42+000	3989.503	5643.132
42+000	43+000	6909.947	3771.461
43+000	44+000	7308.763	2813.108
44+000	45+000	8397.144	8620.787
45+000	46+000	8999.159	8999.159
46+000	47+000	8997.892	8997.892
47+000	48+000	8999.228	8999.228
48+000	49+000	8999.799	8999.799
49+000	50+000	6827.446	7805.345

Design Chainge (Km)		Area in Sqmtr	
From	To	LHS	RHS
50+000	51+000	1714.366	8666.52
51+000	52+000	3075.224	6586.735
52+000	53+000	3967.374	6451.319
53+000	54+000	5805.885	4287.879
54+000	55+000	3724.039	5737.406
55+000	56+000	4397.472	5068.713
56+000	57+000	4870.007	4624.734
57+000	58+000	5040.75	6021.109
58+000	59+000	6309.392	6245.601
59+000	60+000	5844.006	6636.889
60+000	61+000	5278.823	7424.261
61+000	62+000	5071.316	8871.892
62+000	63+000	6586.077	5882.898
63+000	64+000	6146.401	6327.03
64+000	65+000	6216.501	6441.716
65+000	66+000	5635.419	6928.294
66+000	67+000	6172.105	6326.105
67+000	68+000	6022.196	6459.17
68+000	69+000	6305.734	6184.885
69+000	70+000	5849.135	6392.997
70+000	71+000	5987.304	6792.824
71+000	72+000	4889.116	7654.223
72+000	73+000	5423.739	7148.801
73+000	74+000	6398.861	6243.654
74+000	75+000	5740.615	6740.037
75+000	76+000	7367.301	6075.018
76+000	77+000	5921.073	6558.329
77+000	78+000	5793.109	6650.522
78+000	79+000	6830.404	6416.539
79+000	80+000	6760.482	5715.766
80+000	81+000	6620.039	5854.254
81+000	82+000	6125.339	6428.593
82+000	83+000	6630.164	5847.866
83+000	84+000	6632.545	5863.558
84+000	85+000	5422.159	7835.974
85+000	86+000	5606.63	7289.828
86+000	87+000	6636.115	5850.375
87+000	88+000	6267.727	6198.715
88+000	89+000	6455.162	6019.034
89+000	90+000	6369.768	6086.923

Design Chainge (Km)		Area in Sqmtr	
From	To	LHS	RHS
90+000	91+000	6294.355	6197.025
91+000	92+000	6030.076	6428.146
92+000	93+000	6615.323	5869.194
93+000	94+000	6597.815	5897.371
94+000	95+000	6689.067	5786.443
95+000	96+000	6421.911	6047.692
96+000	97+000	6445.475	6000.637
97+000	98+000	7257.318	6843.486
98+000	99+000	7008.508	7009.059
99+000	100+000	6491.775	5949.651
100+000	101+000	6724.338	5763.109
101+000	102+000	7772.805	4720.349
102+000	103+000	6276.459	6211.255
103+000	104+000	7876.8	4615.419
104+000	105+000	6483.314	6001.435
105+000	106+000	6680.541	5799.091
106+000	107+000	6811.173	5684.834
107+000	108+000	6566.273	5913.061
108+000	109+000	6873.361	5636.855
109+000	110+000	4993.548	6109.387
110+000	111+000	6430.406	6109.387
111+000	112+000	6366.509	6125.246
112+000	113+000	7197.439	5272.267
113+000	114+000	5594.748	6919.18
114+000	115+000	6804.092	5713.635
115+000	116+000	6727.928	5754.733
116+000	117+000	7617.892	4828.267
117+000	118+000	7635.32	4871.9
118+000	119+000	6942.825	5510.733
119+000	120+000	6384.83	6079.72
120+000	121+000	8014.122	5209.487
121+000	122+000	8039.446	7811.861
122+000	123+000	5657.105	6967.389
123+000	124+000	6162.404	6338.032
124+000	125+000	6038.613	6437.941
125+000	126+000	5643.236	6935.61
126+000	127+000	5902.775	6638.314
127+000	128+000	5542.858	6985.263
128+000	129+000	6411.87	6060.276
129+000	130+000	6320.922	6166.322

Design Chainge (Km)		Area in Sqmtr	
From	To	LHS	RHS
130+000	131+000	7017.918	6066.57
131+000	132+000	9566.402	4065.282
132+000	133+000	5776.995	6718.001
133+000	134+000	6134.508	6356.315
134+000	135+000	6159.342	6336.817
135+000	136+000	5982.078	6512.66
136+000	137+000	6200.618	6276.915
137+000	138+000	5860.681	6633.064
138+000	139+000	5868.008	6597.924
139+000	140+000	6935.176	5594.446
140+000	141+000	6486.421	5993.885
141+000	142+000	6078.065	6378.894
142+000	143+000	5992.248	6488.36
143+000	144+000	4490.6	7951.135
144+000	145+000	5821.952	6646.643
145+000	146+000	5874.921	6582.993
146+000	147+000	6176.892	7012.216
147+000	148+000	5398.489	7447.242
148+000	149+000	8554.555	4376.906
149+000	150+000	4210.077	8250.011
150+000	151+000	4973.405	7461.228
151+000	152+000	4553.985	7924.502
152+000	153+000	5466.182	7018.133
153+000	154+000	6372.504	6548.985
154+000	155+000	4394.636	8277.13
155+000	156+000	7305.758	5247.341
156+000	157+000	7544.661	4995.122
157+000	158+000	8285.843	4605.952
158+000	159+000	4022.185	8495.037
159+000	160+000	8121.737	3229.526
160+000	161+000	5852.556	6596.445
161+000	162+000	5934.11	6845.383
162+000	163+000	5789.85	7590.572
163+000	164+000	6778.98	6277.839
164+000	165+000	5665.496	6833.291
165+000	166+000	5003.47	7496.762
166+000	167+000	5464.035	7679.198
167+000	168+000	4987.664	7488.8
168+000	169+000	5266.099	7219.871
169+000	170+000	5080.846	7347.057

Design Chainge (Km)		Area in Sqmtr	
From	To	LHS	RHS
170+000	171+000	4769.205	7703.981
171+000	172+000	5917.267	6635.796
172+000	173+000	4895.325	7569.724
173+000	174+000	4608.725	8092.69
174+000	175+000	5998.438	6584.68
175+000	176+000	5234.643	7251.181
176+000	177+000	4530.72	7905.841
177+000	178+000	4739.773	7753.452
178+000	179+000	5123.752	7348.935
179+000	180+000	4453.751	8313.505
180+000	181+000	4749.614	7723.928
181+000	182+000	5509.891	6988.959
182+000	183+000	6741.826	5788.133
183+000	184+000	7808.356	4764.658
184+000	185+000	6002.875	6477.622
185+000	186+000	6266.897	6228.962
186+000	187+000	5582.88	7434.726
187+000	188+000	4959.124	8072.303
188+000	189+000	5991.666	6505.936
189+000	190+000	6383.389	6199.443
190+000	191+000	7151.353	5355.764
191+000	192+000	5855.556	6854.972
192+000	193+000	6533.467	5953.336
193+000	194+000	5636.993	6858.499
194+000	195+000	7501.641	5013.395
195+000	196+000	3630.389	8868.945
196+000	197+000	7960.54	4539.626
197+000	198+000	7506.507	5471.77
198+000	199+000	5171.311	7306.136
199+000	200+000	4675.02	6812.417
200+000	201+000	5001.229	6494.897
201+000	202+000	3456.969	8042.488
202+000	203+000	3438.706	8042.095
203+000	204+000	3834.647	7653.983
204+000	205+000	3175.291	8318.331
205+000	206+000	3819.549	7667.333
206+000	207+000	3542.408	7930.36
207+000	208+000	3756.937	7729.018
208+000	209+000	4263.781	7217.795
209+000	210+000	3854.958	7605.622

Design Chainge (Km)		Area in Sqmtr	
From	To	LHS	RHS
210+000	211+000	2704.715	8789.356
211+000	212+000	2702.255	8926.091
212+000	213+000	3016.923	8480.248
213+000	214+000	3776.857	7707.726
214+000	215+000	3706.229	7779.863
215+000	216+000	2396.403	9124.449
216+000	217+000	3132.578	8369.677
217+000	218+000	3602.762	7892.483
218+000	219+000	5764.106	6324.586
219+000	220+000	3321.234	8177.647
220+000	221+000	4603.788	6890.686
221+000	222+000	5607.253	5887.01
222+000	223+000	5698.636	5792.979
223+000	224+000	7257.361	5609.246
224+000	225+000	8135.015	7888.976
225+000	226+000	5419.402	6096.991
226+000	227+000	4365.36	7131.743
227+000	228+000	5697.554	5801.149
228+000	229+000	8120.046	6827.911
229+000	230+000	4467.312	7022.415
Sub total (A)		1258193	1395032
Grand Total (A+B)		2653224.838	

Total Realignment/widening 671.19 acres LA required.

7.1.6 Objectives

The main objective of survey is to provide inputs of social concerns to be detailed in project design and to avoid or minimise the adverse social impacts with the best possible engineering solutions at minimum cost in close coordination between engineering, environmental and social experts during the entire design process. The social screening exercise is intended to assess the negative impacts (direct, indirect or cumulative) and to suggest mitigating measures to avoid or at least minimise the adverse impacts on nearby communities and natural environment, peoples and properties falling on the direct path of road development, people indirectly affected by the way of disruption of livelihood, breakage in community linkages, impacts arising from land acquisition and resettlement, on indigenous people (SC, ST etc.) and on human safety etc. To minimise and / or avoid the adverse impacts, necessary modifications are to be made at the design stage. But in cases of unavoidable negative impacts these would be mitigated through suggested appropriate measures being adopted during the construction and operational stages.

To ensure that all the Project Affected Persons (PAPs) are duly compensated, a Resettlement Action Plan (RAP) would be drawn up as an integral part of the main project proposal so that the highway improvement options under consideration are socially sound, sustainable and contribute to the development of social development goals. Moreover, the main objective of the RAP is to provide a Resettlement Policy Framework to ensure that the affected and displaced persons are appropriately resettled and

rehabilitated i.e. to improve their livelihood and standards of living or at least to restore them, in real terms. The RAP needs to be appropriately monitored also.

7.1.6.1 Preliminary Social Assessment & Baseline Scenario

One of the objectives of the report has been to assess the nature of the impacts on the communities living in the towns and villages located on the roads. With a view to help in analyzing the impacts, the present chapter attempts at analyzing the PAFs in terms of the ownership of the structures, social groups to which these properties belong to, demographic composition, the income, the education and occupational.

7.1.6.2 Settlement Section

The urban and semi urban settlements would need provision of service roads, which will have high impact on people as well as property. However, provision of service roads and development of facility for pedestrian movement across the road with necessary safety measures are desirable. Provision of service roads and barricading through traffic from the local traffic will not only reduce congestion on the project road but also will facilitate smooth movement of traffic and reduce the cases of accident.

The main settlement where in major social impacts are envisaged are suggested for bypass of Kargil towns Around 46 villages/settlements are affected along this road corridor. This Project road connects the district head quarters of Kargil, important towns like like Minjigum, Salaskot, Lankacherry, Sanku, Purtikche, Panikhar, Thangol, Parkachik, Zhuldo, Rangdum, Chibra, Skygam, Phe, Tungri, Sani, Padum, and Zankar. The detailed list of affected villages is given in the following **Table 7.6.**

Table 7.6.List of villages

Sr No.	Chainage (Km)	Village Name
1	0.000	Baroo
2	5.200	Sutop
3	7.000	Minji
4	9.800	Gramtham

Sr No.	Chainage (Km)	Village Name
5	15.900	Trespone
6	19.200	Saleskon
7	25.100	Faruna
8	27.400	Khachan
9	29.500	Skinmarchay

7.1.7 Religious structures

There are 50 religious structures as far as possible, religious structures shall be avoided by adopting suitable alternatives as these create emotive issues. Religious structures have been observed along the project road, most of them are Mosques. The summary of observed religious structures along the project road is given in Final DPR volume IV.

Mosque LHS at Km 20+866

Temple LHS at Km 201+841

Of the different type of buildings, the Govt. Buildings, school buildings, bus stands and the water structures are going to be affected by the project. Under the proposed project these CPRs will be located in such a way that it will not affect the future road interventions as well.

7.1.8 Public Consultation

7.1.8.1 Introduction

Public consultation has been taken up as an integral part of social assessment process of the project. It has been viewed as a continuous two way process, involving promotion of public understanding of the processes and mechanisms through which developmental problems and needs are investigated and solved. Consultation was used as a tool to inform and educate stakeholders about the proposed action both before and after the development decisions are made. It assisted in identification of the problems associated with the project as well as the needs of the population likely to be impacted. This participatory process helped in reducing the public resistance and enabled the participation of the local people in the decision making process. The involvement of the Public consultation has been carried out in this Project with the objectives of minimizing probable adverse impacts of the project through alternate design solutions (alignment and cross-sectional) and to achieve speedy implementation of the project through bringing in awareness among the community on the benefits of the project. Several meetings were organized at various locations, promoting public understanding of the processes and mechanisms through which developmental problems and needs are investigated and resolved.

7.1.8.2 Classification of Stakeholders

Stakeholder analysis typically classifies stakeholders or all those who have an interest in the project, into three categories:

- Primary stakeholders are those who are directly or indirectly affected by a project, such as the project beneficiaries and the people who are likely to be adversely affected by a project.
- Secondary stakeholders are those who are involved in the delivery of the project outputs, such as the government, the implementing agency (PWD), the executing agency (e.g., contractors, consultants), if any and NGOs, etc.
- External stakeholders are those who are "outside" the ambit of the project activities, but who can influence the outcome of the project, such as the media, politicians, religious leaders and other opinion leaders.

Identification of Stakeholders and their Priorities
The project has identified the following entities/institutions as stakeholders of the Project. Consultations carried out with these following entities are described in the following sub-sections.

- General public
- Authorities of the various religious properties
- Pradhan of the temple
- Women Folk, SC/ST and other vulnerable groups
- Political parties, NGOs and educational institutions

Consultation with Potentially Affected PAPs

Public consultation is a continuous process and has been carried out at all stages throughout the project road. However, in order to document the issues raised by the potential PAPs, public consultations at this stage were conducted at all sensitive locations

and with various focus groups by using structured formats. A large number of potentially affected persons (PAPs) expressed their views about the proposed project. All the consultations conducted were in focus groups such as vulnerable communities, women, shop owners and truck operators. The authorities of the religious properties were also consulted to know the significance of the structure, its establishment details and to get an idea of the people's reaction if the structure is required to be demolished / shifted to some other place. A series of discussion with Sarpanch, Govt. officials and NGOs were also conducted in the project stretch.

The general issues raised by the PAPs in most of these consultations were related to the compensation package, provision of safety measures (like providing speed breaker, proper signage etc.), employment generation schemes by the project authority to restore the livelihood of the affected households etc.

7.1.8.3 Concluding Remarks

Many developmental projects suffer setbacks due to the lack of dissemination of information and consultation with the stakeholders; the misinformation about the project leads to agitation against the projects resulting in inflating the total project cost. Consultation with the stakeholders and incorporating their views about the project at the design stage (especially the PAPs who are likely to lose their structures or any other assets) at appropriate time will help to reduce the social risks occurring due to misinformation. To avoid such situations and to involve the people in the planning process, proper care was taken to record their views on the advantages and disadvantages of the project. Public consultation was held at various places where social risks were anticipated. The consultation revealed the fact that the PAPs were aware of the project and they were more concerned about the type/amount of compensation so that they can resettle and restore their livelihood at a new place.

7.1.9 Suggested Mitigation Measures

The following considerations may be kept in view at the design stage:

- Construction and Up gradation of approach roads to the highway
- Up gradation of the existing road
- Ambulance service to transport serious cases to district hospital in case of accidents

7.1.9.1 Safety

The road safety issues were raised by the community and what issues were observed during the field survey are:

- Location of dumping sites
- Health issues, such as water borne diseases, HIV & STD
- Safety issues

The project design shall take care of safety measures for road users. Safety of pedestrians as well as of the vehicles plying on the road shall be given highest importance and adequate measures shall be incorporated in the design of the alignment. Beside the divided carriageway designed for the project, service roads are also proposed. Signboards indicating construction sites on the road and flags shall be erected. All the signboards giving caution, barricades for diverting the traffic shall be as per MoRT&H

specifications.

7.1.9.2 Enhancement Opportunities

Enhancements specifically refer to these positive actions to be taken up during the implementation of the project for the benefit of the road users and the communities living close to project road alignment. The following enhancement opportunities have been explored as part of the detailed project report:

- Day-tourism potential along roadsides
- Water storage capacity for settlements
- Bus bay and Truck lay-by
- Wayside amenities
- Road signs, illuminations and markings
- Introduction of ambulance services to transport serious accident cases

The enhancements shall be carried out with the following objectives:

- To enhance the appeal and environmental quality of the project road considers to the users;
- To enhance visual quality along the highway; and
- To generate goodwill amongst the local community towards the project, by the enhancement of common property resources

7.1.10 Proposed Action Plan

The proposed action plan for social assessment would include the following:

- A detailed Census and Socio-Economic survey of the Project Affected Persons based on the Corridor of Impact and alignments provided by the design engineers.
- Analysis of the Primary and secondary data.

7.1.11 Tentative Budget

Hence, a tentative estimate of cost for Rehabilitation & Resettlement has been worked out to **Rs. 316.895** Crores, which covers all components of compensation, assistance and entitlements. The broad break up of R & R budget is given in SIA Report.

7.1.12 Proposed Right of Way (PROW)

Proposed Right of Way for the entire Project Highway is proposed 18.00m only to minimize adverse social impact.

7.2 CONCLUSIONS

The Social Imapct Assessment Report is tried to focus on the relevant legislations, potential impacts due to the proposed project and to propose mitigation measures at different phases of the project. Based on the findings during the survey study some measures have to be considered from the inception of the project, which will reduce the detrimental effects of project appreciably.

- Alternative alignments such as eccentric or concentric widening, realignment / bypass etc shall be attempted in order to find a suitable alignment that would have minimum adverse impact on social aspects.
- The alignment for widening would be designed considering minimum land acquisition.
- The alignment widening would try to avoid schools, places of worships, public utilities and other common resources.
- An amicable solution with regard to shifting of religious structures (if required) shall be explored in consultation with community leaders, religious leaders and other prominent persons in the local area.
- It will be ensured that the likely affected common properties used by local people are suitably rehabilitated before the start of civil construction work and budgetary provision for the same shall be made in the project estimates.

With the above approach to design, construction and operation the project will be socially feasible.

8 ECONOMIC AND FINANCIAL ANALYSIS

8.1 ECONOMIC ANALYSIS

8.1.1 Investment Appraisal

Two alternatives have been considered for the economic analysis. The first is "without Project" (do minimum) where the project road between Kargil (at existing Km 0.000 and design Ch. 0.000) and Zanskar (at existing Km 234.000 and design Ch. 230.735), Section of NH-301, is considered without improvement proposals. In this case, the future traffic volume will continue to flow on the existing Intermediate/Single lane road. In the HDM model analysis, this 'Do Minimum' alternative will form the base strategy against which all other strategies will be compared. The second is 'With Project' alternative. This corresponds to the up gradation of existing project road to Four Lane with paved shoulder facilities. In order to arrive at the net benefits associated with the second strategy, it is compared with 'Do Minimum Alternative'. By comparing the above alternatives, the net agency costs and net user costs and finally net project benefits, associated with the project during its analysis period are calculated, for the improvement option in order to arrive at the Economic Internal Rate of Return (EIRR) and Economic Net Present Value (ENPV).

The project road is divided into 4 links based on the homogeneity in pavement condition, traffic volume and geometric features like curvature and rise & fall.

In brief, the following two strategies have been considered and evaluated in this study:

8.1.2 "Without Project" alternative

Strategy 1: This is the "Do Minimum Scenario". In this scenario, the agency performs routine maintenance and pothole patching every year from the starting year. It will receive functional overlay of 30 mm overlay whenever roughness exceeds 10. This would have effect of reducing the surface roughness to IRI 3.0 m/km.

This strategy has been termed "Do Minimum Scenario" where the existing road network is maintained at current levels and no improvements are envisaged. In this situation, the projected future traffic is assumed to use the existing road in a congested traffic flow condition.

Agency costs (maintenance cost), distance and time related vehicle operation costs together with travel time costs and accident costs pertaining to this alternative will form the base on which net project cost and benefit streams during the analysis period are calculated for each 'with project' alternative.

8.1.3 "With Project" alternative

Strategy 2: This is the scenario with the upgrading of the project road to a 2Lane with flexible pavement. Once the construction is complete, the agency will perform the routine and periodic maintenance of the flexible pavement.

This strategy forms a 'With Project' alternative and is compared to 'Without Project' alternative.

8.1.4 HDM Model Input Data

8.1.4.1 General

The following general input values have been considered for the HDM Model as presented in **Table 8.1** to**Table8.5**.

Table 8.1.General Inputs for HDM Model

Run Date	11-05-2018
Discount Rate (%)	12%
Analysis Period (years)	30
Calendar Year of Initial Year	2016
Output Currency Name	Indian Rupees
Input Currency Name	Indian Rupees

Table 8.2.HDM Input - Road Sections – Basic data

ID	Name	Speed Flow Type	Road Class	Climate Zone	Surface Class	Length (km)	Carriageway Width (m)	Shoulder Width (m)	AADT in nos. in 2015		Remarks
									MT	NMT	
A-01	**Section I** *from km 0.000 to km 40.000*	Intermediate	Primary	Tropical Humid	Bituminous	40.00	5.50	0.5	511	5	-
A-02	**Section II** *from km 40.000 to km 125.000*	Single Lane	Primary	Tropical Humid	Gravel	85.00	3.00	0.5	190	4	-
A-02	**Section III** *from km 125.000 to km 210.000*	Single Lane	Primary	Tropical Humid	Gravel	85.00	3.00	0.5	87	3	-
A-02	**Section IV** *from km 210.000 to km 234.000*	Single Lane	Primary	Tropical Humid	Gravel/ Bituminous	24.00	3.00	0.5	703	40	-

Table 8.3.Road Sections – Condition of Project Road

ID	Condition Year	Roughness IRI	Total Cracking	Ravelled Area (%)	Potholes	Edge Break	Rut
		(m/km)	Area (%) ACRA	ARV	(no./km)	(m^2/km)	Depth (mm)
1	2015	5.0	19.0	10	10	15	1.0
2	2015	12.0	15.0	12	7.00	15	1.0
3	2015	12.0	-	-	-	-	-
4	2015	8.0	-	-	-	-	-

Table 8.4.HDM Input: Road Sections- Geometry of Project Road

ID	Name	Speed Flow Type	Rise + Fall (m/km)	Curvature Deg/km	Horizontal Super elevation (%)	Speed Limit (kmph)
A-01	**Section I** *from km 0.000 to km 40.000*	Intermediate	40.0	150	5.0	30
A-02	**Section II** *from km 40.000 to km 125.000*	Single Lane	45.0	250	5.0	20
A-03	**Section III** *from km 125.000 to km 210.000*	Single Lane	40.0	230	5.0	20
A-04	**Section IV** *from km 210.000 to km 234.000*	Single Lane	25.0	100	5.0	30

Table 8.5.HDM Input: Road Sections – Pavement Condition of Project Road

Material Type	Current Surface Thickness (mm)	Previous Surface Thickness (mm)	Last Re-Construction/New Construction Year	Last Rehabilitation Year	Base Thickness (mm)
Asphalt Concrete (AC)	30	30	2000	2010	300

8.1.5 Traffic

The Assignable traffic likely to use the proposed project road has already been discussed in Chapter 6 and 7 of this report. For the economic analysis, fast moving motorised traffic including two wheelers and non-motorised vehicles have been considered.

8.1.5.1 Capacity of the Road

There are few suggestions with respect to maximum capacity of roads in India. IRC 64-1990 provides design service volume based on level of service B (volume to capacity ratio of 0.5) and a peak hour share of 10%. It is also suggested that the capacity will increase by 15% with 1.5m paved shoulders. The HDM model suggests even higher capacities. Both are compared in **Table 8.6**. Based on this comparison, maximum capacities as per IRC 64 are considered reasonable to use.

Table 8.6.Suggested Capacities for Plain/Rolling Terrain (PCU/Hr)

Width / Lane Configuration	Shoulders (Width & Type)	Maximum Capacities	
		IRC-64	HDM
2-Lane (7m)	Nil	1500	2800
2-Lane (7m)	2 x 1.5m – Paved	1725	-
4-Lane Dual	Nil	6400	8000
4-Lane Dual	2 x 1.5m - Paved	7360	-

8.1.5.2 Growth Rate

Traffic growth rates necessary to estimate traffic levels in future on project road are products of economic factors of the influence area and elasticity of traffic demand. Normal – most likely growth scenario has been considered for economic analysis.

Base year traffic as given in Chapter 6 and 7 of this report is considered in the econometric analysis.

8.1.6 Project Costs

8.1.6.1 Capital Costs

The capital costs of the construction / upgradation of the project road including the phasing of investment during the construction period have been calculated. The total capital costs (including road works, bridges, culverts and utilities, land acquisition, resettlement and rehabilitation, quality and project development charges at current prices with contingency costs for road works and structures have been considered.

The capital costs (financial) of the project road have been converted into economic costs by using a standard conversion factor of 0.90, to construction costs (road works and structures). The economic cost of land acquisition, R & R, quality and project development cost has been taken as the same as financial cost, without resorting to shadow pricing or assessing opportunity cost in any other alternative. The project costs, over the construction period, are shown in **Table 8.7** below.

Table 8.7.Project cost taken in analysis (in Rs.)

Total Project Cost	28,19,57,62,672
Environmental	3,83,61,40,000
LA cost	87.64 Cr
Grand Total	32,36,55,37,554

Table 8.8.Percentage Distribution of Cost

Year I	Year II	Year III
30	40	30

8.1.6.2 Routine and Periodic Maintenance

The various maintenance costs have been divided into two parts: routine and periodic maintenance. The salient features and construction policy for the both types of are mentioned below.

Routine and Periodic maintenance has been taken as given in **Table 8.9**.

Table 8.9.Annual operation and Maintenance Cost

Routine Maintenance for two Lane section for Flexible Pavement	Rs. 255000 per km
Periodic Maintenance for tow Lane section for Flexible Pavement	Rs. 2500000 per km

***Other maintenance**:* additional operational expenses associated with project such as traffic signposts, lighting etc., are considered as annual charges and included in routine maintenance costs. For annual supervision & administration charges, it has been assumed that the arrangement under 'without project' will continue for the 'with project' situation.

8.1.6.3 The Residual value

No residual value has been taken for the Project road.

8.1.6.4 Road User Costs

The economic cost inputs that are required for estimating road user costs are:

- Price of selected (popular) models, by vehicle type
- Tyre prices
- Fuel cost including oil
- Crew cost (wages of drivers / assistants)
- Time costs for :
  - Passengers
  - Freight (holding cost)

The cost of vehicles and tyres were collected from the manufacturers, and dealers. All the transfer payments such as sales tax, excise duty and octroi are deducted from the financial cost to arrive at the resource cost.

A pilot survey has been conducted to estimate the wages of drivers and their assistants. The crew cost is estimated with 2400 hours of work time per annum. With respect to maintenance and labour costs, local workshops have been contacted to assess the annual wage bill and assuming 2400 hrs of work per annum, the labour costs have been calculated per hour.

The value of passenger time has been calculated based on the average annual income of passenger collected with the assumption of 2400 hours of work time per annum. About 30 percent of the trips are assumed to be made during non-work hours. Finally, a weighted average of time value per hour has been calculated. Time saving values applicable to 1990 (IRC SP: 30 - 1993) have been adopted.

Based on the above considerations, the economic costs estimated for different VOC components are presented in **Table 8.10**.

Table 8.10.Vehicle Characteristics, Utilization Data and Economic Unit Costs

Basic Characteristics	Car (NT)	2-Wheelers	Mini Bus	Bus	LCV	2-Truck	3-Truck	MA-Truck
A. Vehicle Characteristics								
Gross Vehicle Weight (t)	1.5	0.4	5.0	10	5.0	15.7	20	30
ESAL Factor Per Vehicle	0	0	1.5	1.5	1.5	1.5	1.5	1.5
Number of Axles	2	2	2	2	2	2	3	4
Number of Tyres	4	2	4	6	4	6	10	14
Number of Passengers	3	1	20	40	0	0	0	0
B. Vehicle Utilization Data								
Service Life (Yr.)	10	10	10	10	10	10	10	10
Hours Driven per Yr.	1400	800	1600	2200	2000	2200	2400	2000
Km Drive per Yr.	30000	22000	30000	65000	75000	80000	85000	85000
Annual Interest Rate (%)	12	12	12	12	12	12	12	12
C. Economic Unit Costs								
New Vehicle Price (Rs.)	270789	35000	650000	1314530	586049	1014600	1378440	2562740
New Tire Price (Rs.)	1251	600	4373	8575	4373	8575	8575	8575
Maintenance Labour (Rs./hr.)	60	60	60	60	60	40	40	40
Crew Cost (Rs./crew-hr.)	0	0	100	150	80	100	100	100
Passenger Time	40	30	30	30	0	0	0	0

Basic Characteristics	Car (NT)	2-Wheelers	Mini Bus	Bus	LCV	2-Truck	3-Truck	MA-Truck
(Rs./pa-hr.)								
Cargo Time (Rs./veh-hr.)	0	0	0	0	60	100	60	120
Petrol Price (Rs./ kg.)	40							
Diesel Price (Rs./lt.)	30							
Lubricants Price (Rs./kg.)	120							

8.1.7 Economic Evaluation

8.1.7.1 Project Cost

The initial financial cost of construction ofRs. 28,219,951,957/- (exclusive of interest during construction cost)is taken for analysis with routine and periodic maintenance costs.

8.1.7.2 Economic Analysis

The life cycle economic benefits and costs, ENPV and EIRR are calculated considering:

VOC savings as a project benefit and
With all savings (VOC and Travel time) as a project benefit.
Agency capital costs
Agency recurrent costs

Economic analysis of the project road has been carried out and the summary of findings is attached in **Table 8.11**.

Table 8.11.Summary of NPV and EIRR of Project Road

Section	Proposed Length (km)	NPV Discounted (Rs. million)	EIRR (%)
Kargil to Zanskar	230.020	-3504.08	-2.0

8.1.7.3 Sensitivity Analysis

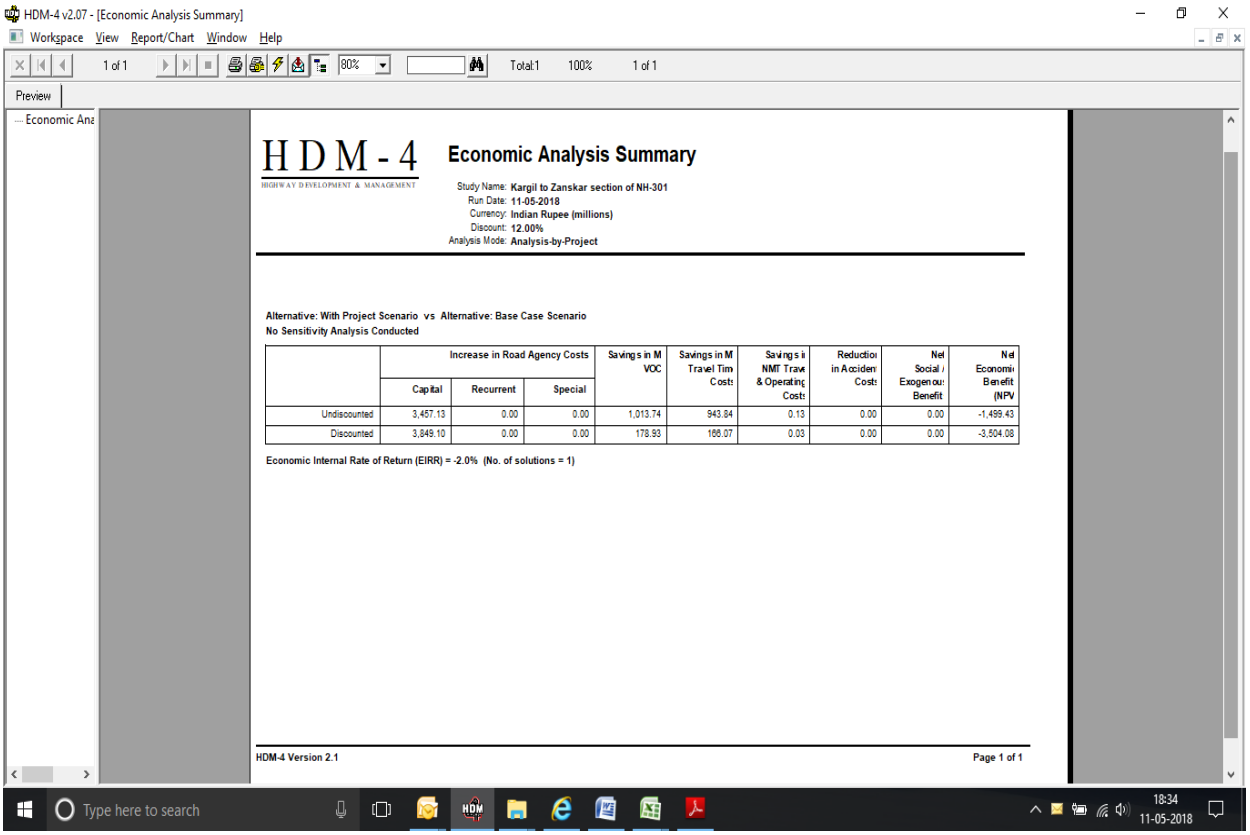
A sensitivity analysis was carried out for the project road analysis option using the following scenarios:

With base Cost and Base traffic
15% increase in Cost and base traffic – Case I
With base cost and 10% reduction in traffic – Case II
15% increase in cost and 10% reduction in traffic - Case III

The project road is not viable with base case and hence not carried out the sensitivity analysis.

8.1.7.4 Project Viability

The economic internal rate obtained is -5.60% for development of the project road with flexible pavement, which is well below the presented 12% of discounted rate. Negative value of NPV of net benefits indicates the non viability of project for the proposed improvement and hence recommended for implementation. No traffic is plying on the project road, due to the poor to very poor condition of the existing road. Once the project road developed to two lane carriageway facility and the traffic will start to use the project road and the economic activity of the region will be increased. Further, tourism also developed at Zanskar and along the project road. This will increase the traffic and which will enhance the economic growth of the people along the road. Thus, it is recommended to develop the project road with two lane capacity. The HDM output sheets are shown below;


HDM-4 v2.07 - [Economic Analysis Summary]

Workspace View Report/Chart Window Help

Preview

Economic Ana

HDM - 4
HIGHWAY DEVELOPMENT & MANAGEMENT

Economic Analysis Summary

Study Name: Kargil to Zanskar section of NH-301
Run Date: 11-05-2018
Currency: Indian Rupee (millions)
Discount: 12.00%
Analysis Mode: Analysis-by-Project

Alternative: With Project Scenario vs Alternative: Base Case Scenario
No Sensitivity Analysis Conducted

	Increase in Road Agency Costs			Savings in M VOC	Savings in M Travel Tim Cost:	Savings i NMT Trave & Operating Costs	Reductio in Acciden Cost:	Net Social / Exogenou Benefit	Net Economi Benefit (NPV
	Capital	Recurrent	Special						
Undiscounted	3,457.13	0.00	0.00	1,013.74	943.84	0.13	0.00	0.00	-1,499.43
Discounted	3,849.10	0.00	0.00	178.93	166.07	0.03	0.00	0.00	-3,504.08

Economic Internal Rate of Return (EIRR) = -2.0% (No. of solutions = 1)

HDM-4 Version 2.1 Page 1 of 1

Type here to search 18:34 11-05-2018

8.2 FINANCIAL ANALYSIS

8.2.1 Capital Cost and its Phasing

The capital cost of the project for financial analysis comprises of cost of civil works for roads, culverts, bridges, road furniture etc. The cost of land acquisition, utility shifting, environmental management, resettlement and rehabilitation etc is not included in the analysis.

8.2.2 Total Project Cost

The EPC cost of the proposed project is Rs.1990.58 Crores and Total Project Cost has been arrived at as under in **Table 8.12**.

Table 8.12.Total Project Cost Calculation (Rs. Crores)

Total Civil Cost (EPC)	**2312.71**
Financing charges including interest on debt components, contingencies, escalation during construction, financing charges, IC / IE cost etc. @ 25 % of civil cost	489.05
Total Project Cost	**2819.57**

Phasing for the cost incurrence is given in **Table 8.13** below:

Table 8.13.Percentage Distribution of Cost during Construction

Year I	Year II	Year III
35%	45%	20%

The total cost incurrence is phased over 12 quarters (3 Years) of construction period from the FY 2018 to FY 2020.

8.2.3 Cost Escalation

The base costs have been escalated at a rate of 5 percent per annum to obtain the actual costs in the year of expenditure. This is to account for increase in cost due to inflation.

8.2.4 Basic Assumptions of Financial Model

Financial viability analysis has been done on the basis of a financial model developed internally. The project highway is proposed to be open for traffic in April 2020 when toll revenue will start flowing in.

The interest rate on long-term debt is taken as 11.80 percent (all inclusive) in keeping with the current lending rates of financial institutions. Depreciation of capital items is calculated by the written down value (WDV) method. The WDV method favours income shielding and it has, therefore, been used to calculate taxes payable by the concessionaire. The rate permitted for a toll road enterprise, viz. 10 percent, is used in the present analysis.

Key Assumptions for financial analysis are listed in **Table 8.14** below:

Table 8.14.Key Assumptions incorporated in the Financial Analysis

Sl. No.	Assumption	Details
1	Project Schedule	The construction of the project highway will commence from April 2017 Actual toll collection to start from April 2020
2	Financing charges including interest on debt components, contingencies, escalation during construction, financing charges, IC / IE cost etc	25 % of civil cost
3	Tax holidays	10 years

Sl. No.	Assumption	Details
4	Moratorium period after Construction	1 year
5	Repayment period	10 years
6	Periodic maintenance	Every 6 years
7	Routine maintenance	Every year
8	Escalation in WPI	5 % per annum
9	Interest Rate	11.80%
10	Corporate Tax Rate	34.61%
11	MAT Rate	21.34%

8.2.5 Financial Viability

To assess whether the project is a profitable proposition, the return to investors is measured in terms of the equity IRR, which is estimated on discounted cash flow technique. The returns expected by investors are function of the value of equity issued in Indian stock markets, interest rates on commercial loans, the risk profile of the investment and alternative investment opportunities. The target equity IRR, for the project to be done on commercial format, has been taken as 15 percent. Summary of financial analysis is given in **Table 8.15** below.

The details of financial analysis and funds flow statement are enclosed as **Annexure-N** at the end of this chapter.

Table 8.15.Summary of Financial Analysis

Concession Period	Total Project Cost (INR)	Grant (% of TPC)	Grant (INR)	Debt (INR)	Equity (INR)	IRR Project %	IRR Equity %
29 Years	2,488.23 Crores	40%	995.29 Crores	1,045.05 Crores	447.88 Crores	Not Defined	Not Defined

Financial analysis and cash flow statement are given in Annexure-F

8.3 CONCLUSION

It is concluded that the project doesn't provide sufficient returns to equity on commercial BOT (Toll) format even with maximum permitted 40% grant for concession period of 29 years (2017-18 to 2045-46).

9 CONCLUSIONS ANDRECOMMENDATIONS

9.1 CONCLUSIONS

The study of the Project Highway comprised of Traffic Studies, Engineering Surveys and Investigations, formulation of improvement proposals, Environmental and Social Impact Assessment, Estimation of Costs and Benefits for carrying out the Economic and Financial Analyses to assess the viability of the project and to cater for the traffic demand during the project horizon period. The analyses of the data collected through various Engineering Surveys and Investigations have led to the following conclusions:

a) Traffic forecasts for the homogenous sections of the project road are as shown in **Table 9.1 and 9.2.**

Table 9.1.Traffic Forecasts (in Nos.) Homogenous Sections

Location	2015-16	2020-21	2025-26	2030-31	2035-36	2040-41
km 35.000 (Shankoo)	570	1012	1382	1792	2228	2776
km 45.000 (Sangra)	213	498	682	885	1100	1369
km 60.000 (Panikhar)	90	311	418	535	658	811
km 120.000 (Rangdum)	76	291	392	504	620	765
km 185.000 (Abran)	59	273	374	486	603	751
km 208.000 (Phe)	122	363	498	649	810	1013
km 215.000 (Padum)	824	1376	1876	2437	3038	3796

Table 9.2.Traffic forecasts (in PCU's) homogenous sections

Location	2015-16	2020-21	2025-26	2030-31	2035-36	2040-41
km 35.000 (Shankoo)	755	1258	1690	2163	2657	3275
km 45.000 (Sangra)	261	566	769	991	1222	1511
km 60.000 (Panikhar)	196	437	566	707	875	1040
km 120.000 (Rangdum)	164	398	517	648	787	957
km 185.000 (Abran)	100	330	448	577	713	883
km 208.000 (Phe)	218	489	656	841	1035	1278
km 215.000 (Padum)	1004	1575	2094	2672	3287	4059

Projected sectional PCUs were compared with design service volume. The design service volume for Project Highway is considered at the end of LOS 'B' and capacity augmentation is suggested for road sections, which carry traffic volume more than design service volume.

As per the traffic requirements the Project Highway requires capacity augmentation from Single Lane to 2 Lane with paved shoulder in the year 2020-21 and also Two Lane with paved shoulder after year 2040-41. The capacity augmentation is proposed with respect to the traffic at km 215.000.

b) Keeping various economic, social and environmental aspects in view, a bypass at Kargil town is considered essential and accordingly has been proposed in the alignment plan.

c) Summary of improvement/ development proposals of existing structures as well as proposed additional new structures, mainly minor bridges and box culverts is presented in **Table 9.3.**

Table 9.3.Details of Structure and Improvement Proposals

S. No.	Type of Structure	Existing / New	Nos.	Development/ Improvement Proposals
1	Minor Bridge	Existing	26	All proposed for reconstruction/ widening /new parallel bridges beside existing bridges
2	Minor Bridge	New	7	All proposed at new locations
3	Slab Culverts	Existing	229	201 Nos. to be replaced with New Box Culverts
				18 Nos. to be dismantled
				04 Nos. to be retained
4	Pipe Culverts	Existing	428	172 Nos. to be replaced with New Box Culverts
				152 Nos. to be dismantled 98 Nos. to be retain
5	New Box Culverts	New	718	All proposed at new locations, Starting Bypass and Sankoo Bypass
6	Causeways	Existing	24	All to be replaced with new minor bridge

9.2 ECONOMIC AND FINANCIAL VIABILITY

9.2.1 Economic Analysis

Economic analysis of the project road has been carried out and values of NPV and EIRR presented below:

Section	Proposed Length (km)	NPV Discounted (Rs. million)	EIRR (%)
Kargil to Zanskar	230.020	-3504.08	-2.0

The above analysis reveals that the EIRR for base case is less than 12%; and hence the project is economically not viable for up gradation to 2 lane with paved shoulder road.

9.2.2 Financial Viability

To assess whether the project is a profitable proposition, the return to investors is measured in terms of the equity IRR, which is estimated on discounted cash flow technique. The returns expected by investors are function of the value of equity issued in Indian stock markets, interest rates on commercial loans, the risk profile of the investment and alternative investment opportunities.

The target equity IRR for the project to be done on commercial format has been taken as 15 percent. Summary of financial analysis is presented below:

Concession Period	Total Project Cost (INR)	Grant (% of TPC)	Grant (INR)	Debt (INR)	Equity (INR)	IRR Project %	IRR Equity %
29 Years	2,488.23 Crores	40%	995.29 Crores	1,045.05 Crores	447.88 Crores	Not Defined	Not Defined

Since, the traffic is relatively very low, from the financial analysis, it has been concluded that none of the options is viable on commercial format.

9.3 RECOMMENDATIONS

As project is neither economically nor financially viable therefore, considering developments of the project influence area in future as well necessities from strategic point of view the project may be undertaken on EPC mode on priority.

10 SUGGESTED METHODS OF PROCUREMENT AND PACKAGING

10.1 TYPES OF CONTRACTS OF MoRT&H

General types of contracts of MoRT&H are:

- Item-Rate Contract,
- Engineering-Procurement-Construction (EPC) Contracts,
- Built-Operate-Transfer (BOT) on Tolling Mode; and
- Built-Operate-Transfer (BOT) on Annuity Mode

Table 10.1.Summary of Non-PPP Contracting Modes for Road and Highway Projects

Bill of Quantity/ Item Rate Contracts	Design, engineering, and quantity estimation – authority
	Contractors need to quote rates against each item
	Payments to contractors is based on quantum of work
	Tolling, if any, is done separately by the authority
Engineering Procurement Construction	Items and output specifications - authority
	Design, engineering and quantity estimation - developers
	Contractors quote lump sum amount
	Payments to contractors is based on quantum of work
	Tolling, if any, is done separately by the authority
Operation and maintenance	Contractor need to maintain road as per standard
	Payment is routine maintenance and incidental items
	Contract period generally one year
	Tolling, if any, is done separately by the authority

10.2 PPP MODE OF CONTRACTS

Traditional PPP modes of Contract are:

- Built, Operate and Transfer (BOT) (Toll) Mode,
- Built, Operate and Transfer (BOT) (Annuity) Mode; and
- Operation, Maintenance and Transfer (OMT) (Toll)

Characteristics of PPP mode of contracts are summarized in the ***Table-10.2***.

Table 10.2.Characteristics of PPP mode of contracts

BOT (Toll) mode of PPP contracting	BOT (Annuity) mode of PPP contracting	OMT mode of PPP contracting
Road alignment, location of structures, LA, environment clearance - authority	Road alignment, location of structures, LA, environment clearance - authority	Concessionaire is handed over developed road for O&M
Structural design, finance, construction, O&M – concessionaire	Structural design, finance, construction, O&M – concessionaire	No capacity augmentation
Tolling – concessionaire on the basis of GoI toll	Tolling, if any, is done separately by the authority	Tolling is done by the concessionaire as per GoI

BOT (Toll) mode of PPP contracting	BOT (Annuity) mode of PPP contracting	OMT mode of PPP contracting
policy		toll policy
Concession period depending on road capacity, subject to maximum 30 years	Concessionaire is paid fixed semi-annual annuity	Concessionaire pays annual concession fee to authority
	Concession period is generally 20/17 years	Concession period is 4-9 years

10.3 GLOBAL EXAMPLES OF FEW VARIANTS OF PPP MODEL FOR ROAD PROJECTS

Contracting Mode / Mode of Procurement	Country
Least present value of Revenue (LPVR)	Primarily Chile; occasionally UK and Spain
Design Build Operate Maintain (DBOM)	USA and Australia
Hybrid PPPs (Toll + Annuity; Grant + Annuity; Grant + Toll + Annuity)	Greece, India
Output & Performance Based Road Contracts (OPRC)	UK, USA, Australia, Norway, Finland, Sweden, Netherlands, Pilot projects in India by World Bank
Competitive Dialogue	Europe
Negotiated Procedure	Europe
Swiss Challenge	A number of countries including India

10.4 NEW PPP MODELS UNDER CONSIDERATIONS IN INDIA

Roads and Highways authorities of central and state governments of India are exploring new models of PPP contracting in order to address existing issues.
New models being considered includes:

- Modified Annuity (Grant + Annuity+ Toll)
- Hybrid PPP (Interest free loan + Toll)
- BOT model where construction is financed by authority
- BOT Toll with funded EPC for structures

Salient features of all above mode of contracts are presented in ***Tables- 10.3, 10.4, 10.5 and 10.6*** respectively.

Table 10.3.Salient Features of Modified Annuity (Grant + Annuity + Toll)

Key Features	▪ Concessionaire to partly finance, construct, toll & manage ▪ Authority to pay part of construction cost as capital grant during construction and balance as annuity payment ▪ Separate payment for O&M as a % of project cost ▪ O&M is delinked to annuity payment and subject to adherence to performance standard ▪ Recommended for stretches where BOT Toll in its traditional form is unviable due to high project cost and the absence of commensurate revenue streams
Potential Benefits	▪ Reduced funding requirement for Authority vis-à-vis EPC mode ▪ Reduced debt requirement and cost of borrowings for private sector (up to 50-75 bps) as compared to BOT-Annuity ▪ Improved quality of construction due to long-term concession tenure ▪ Improved operations and maintenance as the payments are performance linked

Table 10.4.Salient Features of Hybrid PPP (Interest Free Loan + Toll)

Key Features	▪ Concessionaire to construct, toll & manage the road ▪ Authority to pay part of the construction cost as interest free loan during construction ▪ Repayment of interest free loan after a predetermined PCU Level ▪ Bidding parameter is the amount of interest free loan
Potential Benefits	▪ Project is jointly funded by the authority and the concessionaire ▪ Repayment is after stabilization of cash flows ▪ Reduced debt requirement and cost of borrowings for private sector (up to 50-75 bps) as compared to BOT-Toll

Table 10.5.Salient Features of BOT model where construction is financed by authority

Key Features	▪ Same as BOT (Toll) model but construction is financed by authority separately as per payment terms similar to EPC projects ▪ Same concessionaire undertakes construction, O&M and tolling activity ▪ Annual concession fee is paid by the concessionaire in lieu of tolling throughout the concession period
Potential Benefits	▪ Immediate availability of ROW ▪ Project financing risk is not with the concessionaire - financing at a lower cost ▪ Balanced construction risk ▪ Timely completion of the project - Better management of cost and time overruns ▪ Reduction of residual default and abandonment risk

Table 10.6.Salient Features of BOT Toll with Funded EPC for Structures

Key Features	▪ Critical and complex project infrastructures like tunnels, bridges etc. in a BOT Toll stretch developed on EPC basis by the same developer ▪ Authority funds the critical and complex project infrastructures separately ▪ Such bundling will improve the viability of the project ▪ The EPC payment and the milestones for critical structures are predetermined
Potential Benefits	▪ Better availability of capital to finance the project and a better managed cost of finance ▪ Balanced construction risk in the complex structure ▪ Timely completion of the project - better management of cost and time overruns

10.5 SUGGESTED CONTRACTING MODE AND CONTRACT PACKAGING

Project Highway, Kargil – Zanskar NH-301 from km 0.000 (Design Chainage is Ch. 0.000) to km 234.000 (Design Chaiange is Ch. 230.735) passes entirely through very difficult hilly/ mountainous terrain.

Because of very difficult and extreme climatic conditions, particularly during winter, and very poor condition of the existing road the project influence area is very thinly and scattered populated resulting very low volume of traffic plying on the Project Highway. Project influence area has a great potential for tourism development adventures as well as religious also for the development for the various sectors like horticulture, floriculture, handicrafts etc.

Although, project is neither economically nor financially viable but considering overall socio-economic development of the project influence area in future it is essential and strongly recommended to develop better communication facilities and very good and safe road network within the project influence area.

Consultants feel the project may be considered to be undertaken on priority and may be developed on Engineering, Procurement and Construction (EPC) mode as per the latest standards and specifications.

Considering very short time available in the region for construction because of very extreme climatic conditions it is recommended to divide Civil Work Contract Agreement of the entire Project Highway in to five or six contract packages of 40kms to 50kms each. It will also give an opportunity to participate local and small contractors with work experience of similar type of terrain and climate.