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NATIONAL HIGHWAYS & INFRASTRUCTURE DEVELOPMENT CORPORATION LTD. (NHIDCL)

Ministry of Road, Transport & Highways

Government of India

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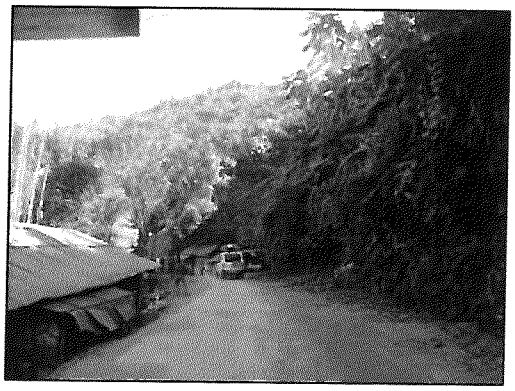
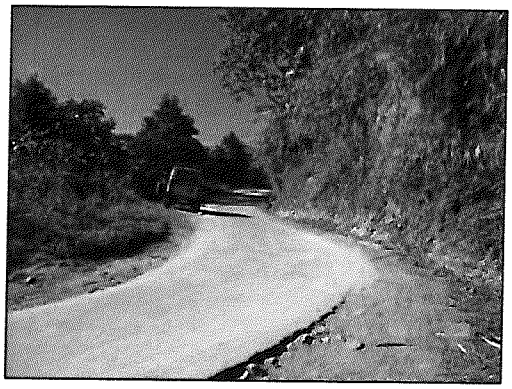

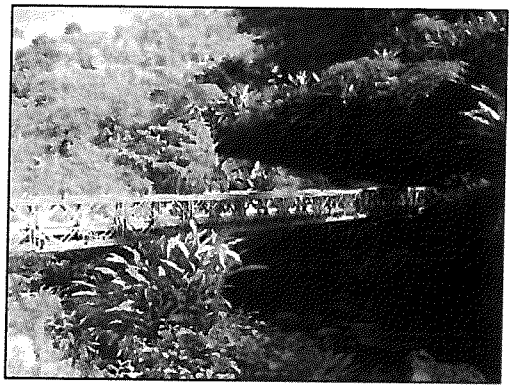

Consultancy Services for preparation of Feasibility Study and Detailed Project Report for Two laning of Joram - Koloriang Road (NH-713) from Km. 20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 Km) in the State of Arunachal Pradesh on EPC mode

DETAILED PROJECT REPORT

Volume I -Main Report

Revision : R0, September 2016

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EXECUTIVE SUMMERY

0.1 Objective

The President of India acting through the Ministry of Road Transport & Highways (MoRT&H), Government of India, represented by the Director General (Road Development) & Special Secretary is engaged in the development of National Highways and as part of this endeavour, MoRT&H has decided to undertake 2laning with paved shoulder and/or strengthening of the various sections of National Highways and it has entrusted NHIDCL for the execution of the DPR. National Highways and Infrastructure Development Corporation is a fully owned company of the Ministry of Road Transport & Highways, Government of India. National Highways & Infrastructure Development Corporation Limited (NHIDCL), Government of India has decided to implement the Two Laning of Joram – Koloriang Road (NH-713) from Km 20.00 to Km 70.00 & Km 138.00 to Km 158.000 (total length 70km) in the state of Arunachal Pradesh on EPC mode. Accordingly, NHIDCL intends to take up the preparation of the feasibility and detailed project report for same.

Joram to Koloriang section (length about 70km) of NH- 713 is a part of such National Highways, project preparation for 2laning with paved shoulder which is taken by MoRTH on priority basis.

In order to access the financial and technical feasibility **M/s Voyants Solutions Private Limited** have been entrusted by MoRT&H the task of carrying out the Joram to Koloriang section (length about 70km) of NH- 713 as a part of such National Highways, project preparation for 2 laning/2laning with paved shoulder which is taken by MoRTH on priority basis.

0.2 Project Road Description

The project road takes off from NH-229 at Joram Junction very near to Joram church. Joram is about 14 km south of the location Ziro in the district of Lower Subansiri. However, the first 20 km (From km 0.00 to km 20.000) is being implemented by the BRO and outside the scope of this project and comes under the district of Lower Subansiri. Km 20.00 to km 70.00 is the first stage of this subject project and under districts of Lower Subasiri as well as Kra Daadi. New Palin town is the last point of this project. Then again km 70.00 to km 138.00 is under the scope of a different agency, being under project preparation stage through MORTH and falls in the district of Kurung Kumey. The last stage under this contract begins at km 138.00 and end at km 158.00 at Koloriang which is the district Head Quarter of Kurung Kumey district.

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The existing length of the project road is 70 kms and it traverses through the districts of Lower Subansiri, Kra Daadi and Kurung Kumey.

The project road is not continuous. The first part is of length 50.0km (from km 20.00 to km 70.00 near New Palin town) and the second part is of length 20.00km (from km 138.00 to km 158.00).

0.3 Abutting Land Use Pattern

A considerable part of the corridor passes through forest stretches. The existing abutting land use pattern for the balance reaches is predominantly agricultural. Besides, at few stretches it is found built up and open/hilly in nature.

0.4 Terrain

Terrain is generally mountainous and steep.

0.5 Important Settlements

There are two important towns along the alignment. These are (1) New Palin near km 69.00, (2) Koloriang near km 158.00. The other settlements in general are villages with scattered kutcha houses. These are (1) New Pania near km 24.00, (2) Neelum near km 32.00, (3) Deed near km 35.200, (4) Daam near km 42.00, (5) Shakti near km 58.00.

0.6 Right of Way

The road land boundary pillars are not found along the road as dense forests abut either side of the existing road. According to site observations, the width from the road shoulder edge adjoining the valley side to the shoulder edge along the hill face varies from 9m to 12m. The proposed ROW is taken as 18m to 35m, in general, except at built up areas where 14m total ROW has been considered. Total quantum of LA, is 41.00Ha for km 138.00 to km 158.00/km 154.036 and 105.00ha for km 20.00 to km 70.00/km 59.363.

0.7 Traffic

To establish the traffic characteristics along the project road, Consultants have carried out 7 days Classified Traffic Volume Counts at a couple of locations.
The Average Annual Daily Traffic (AADT) in the base year 2016 for the two packages is presented in **Table 0.1**.

Table 0.1: The AADT in the Year 2016 on the Two Packages

Homogeneous Section	From (km)	To (km)	Length (km)	AADT (No)	AADT (PCU)
KM 20.000 TO KM 58.716	20.000	70.00/59.363	39.363	560	595
KM 138.000 TO KM 154.036	138.000	158.00/154.036	16.036	528	607

The adopted traffic growth rates are presented in **Table 0.2**.

Table 0.2: The Adopted Traffic Growth Rates

Vehicle Type	Final Traffic Growth Rates (%)			
	2016-2020	2021-2025	2026-2030	Beyond 2030
Cars	5.0	5.0	5.0	5.0
Two Wheelers	5.0	5.0	5.0	5.0
Buses	5.0	5.0	5.0	5.0
LCV	5.0	5.0	5.0	5.0
2-Axle Trucks	5.0	5.0	5.0	5.0
3-Axle Trucks	5.0	5.0	5.0	5.0
MAV	5.0	5.0	5.0	5.0

Projected traffic are given in **Table 0.3** for two homogeneous section.

Table 0.3: Projected Traffic

Year	At km 67+500		At km 155+200	
	Nos	PCU	Nos	PCU
2016	560	595	527	575
2017	588	624	553	603
2018	617	656	581	633
2019	788	951	743	965
2020	827	998	781	1013
2021	869	1048	820	1063
2022	912	1100	861	1117
2023	958	1155	904	1172
2024	1006	1213	949	1231
2025	1056	1274	996	1293
2026	1109	1338	1046	1357
2027	1164	1404	1098	1425
2028	1222	1475	1153	1496

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Year	At km 67+500		At km 155+200	
	Nos	PCU	Nos	PCU
2029	1283	1548	1211	1571
2030	1348	1626	1271	1650
2031	1415	1707	1335	1732
2032	1486	1793	1402	1819
2033	1560	1882	1472	1910
2034	1638	1976	1545	2005
2035	1720	2075	1623	2105
2036	1806	2179	1704	2211
2037	1896	2288	1789	2321
2038	1991	2402	1878	2437
2039	2091	2522	1972	2559
2040	2195	2648	2071	2687
2041	2305	2781	2175	2821
2042	2420	2920	2283	2963
2043	2541	3066	2397	3111
2044	2668	3219	2517	3266
2045	2802	3380	2643	3429
2046	2942	3549	2775	3601
2047	3089	3726	2914	3781
2048	3243	3913	3060	3970
2049	3405	4108	3213	4169
2050	3576	4314	3373	4377
2051	3754	4530	3542	4596
2052	3942	4756	3719	4826
2053	4139	4994	3905	5067
2054	4346	5244	4100	5320
2055	4563	5506	4305	5586
2056	4792	5781	4521	5866
2057	5031	6070	4747	6159
2058	5283	6374	4984	6467
2059	5547	6692	5233	6790

From the projected traffic it is thus recommended to provide 2-lane wide carriageway with paved shoulders.

0.8 Pavement Design

The pavement composition to be considered is given below:

(a) New Construction and Widening Stretches

The adopted pavement thicknesses for new and widened pavement are given in **Table 0.4**.

Table 0.4: Pavement Composition for New/Widened Pavement

Pavement Composition	Thickness (mm)
BC	40
DBM	80
WMM	250
GSB	200
Sub-grade	500

20 MSA and Sub-grade CBR of 10% (4 Days Soaked) for 15 years design period has been considered for the above pavement design as per IRC:SP:73-2015 of Paragraph 5.4.1

Life Cycle cost analysis was done to compare the financial impact between both the flexible and the rigid pavements. **Considering low traffic road, use of rigid pavement will not be economical.**

0.9 Road Junctions / Intersections

There is one major junctions (as shown in **Table 0.5**) and 61 minor Junctions along the project road.

Table 0.5 : List of Major Junctions

Sl.No	Name	Ex. Chainage (km)	Side		Type of Junction	Type of Road	Remarks
			LHS	RHS			
1	Koloriang	158.000	IB Bunglow, Kurung Kumey Town	Circuit House	4-Arm	BT	NH-713

0.10 Cross Drainage Works

There are no major bridges, and 10 minor bridges existing along the project road. Depending on the condition of bridges they are recommended for retained, widening and reconstruction.

323 culverts exist along the project road and most of them need to be reconstructed.

0.11 Cost Estimates

Unit rates were primarily estimated by using the MoRTH, Standard Data Book of Rate Analysis and PWD SOR – Arunachal Pradesh (2014) by providing the necessary cost inputs related to labour, material and equipment. Unit rates for other items of work were finalized

after considering the current market rates or from information or other major projects of similar standards.

The basic rates of machinery, materials, labour have been escalated for the current year by 5% /year.

The abstract of civil cost estimates for the entire project road has been presented in **Table 0.6 - Table 0.9**

Table 0.6: ABSTRACT OF COST : PACKAGE- I (KM 20+000 to KM 32+050)

Sl. No	Description	Percentage Weightage vis a vis overall project	Amount (in RS)	percentage Weightage vis a vis Overall Project Cost
	Design Length in Km	**12.050**		
	A- Widening and strengthening of existing road			
Road works including culverts, minor bridges, underpasses, overpasses, approaches to ROB/RUB/ Major Bridges/ Structures (but excluding service roads)	(1) Earthwork up to top of the sub-grade including excavation in soil, soft rock and hard rock including Cleaning & grubbing with required site clearance etc.	65.39%	161995996	13.10%
	(2) Granular work (sub- base, shoulders)		45503744	3.68%
	(3) Bituminous work			
	a)DBM With Prime coat & Tack coat.		50498325	4.08%
	b)BC with Tack coat.		31250459	2.53%
	B - New 2-Lane alignment			
	(1) Earthwork up to top of the sub-grade including excavation in soil, soft rock and hard rock including Cleaning & grubbing with required site clearance etc.		263673627	21.32%
	(2) Granular work (sub- base, shoulders)		63310979	5.12%
	(3) Bituminous work			
	a)DBM With Prime coat & Tack coat.		71285424	5.77%
	b)BC with Tack coat.		44006536	3.56%
	C- New culverts, minor bridges, underpasses, overpasses on existing			

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	road, realignments, bypasses:			
	(1)Box / Slab culvert		76977320	6.23%
	D-Other Engineering Works			
Other Works	Road Appurtenances	34.61%	1027926	0.08%
	Road side drain & toe wall		50753318	4.10%
	Traffic Sign		700821	0.06%
	Pavement Marking		4714076	0.38%
	Crash barrier/W metal crash barrier		15971706	1.29%
	Protection Work (Provision of Rip-Rap or similar work in valley side of the curves as special safety features)		2963200	0.24%
	Boundary stone, km Stone,5th km stone and hectometer stone		112690	0.01%
	Traffic blinker LED delineator, stud, reflective payment marker, tree reflector		2859968	0.23%
	Bus bays and Bus Shelter		1089468	0.09%
	Minor Junction		18779663	1.52%
	Overhead signboard		313047	0.03%
	Plantation (Vetiver, Hydro seeding and Mulching or similar techniques etc.) for slope protection on exposed hill slopes as slide mitigation measure.		40669800	3.29%
	Road side drain I/C chute drain		19827600	1.60%
	Repair for protection work			
	Passing Places		1018039	0.08%
	(vi)Repairs to bridges/structures			
	(vii)Protection Works			
	Breast Wall		228245804	18.46%
	Retaining Wall		21889507	1.77%
	Parapet		17056060	1.38%
A	**Civil Cost**		**1236495103**	**123.65**
	Cost/KM at Civil Cost		102613702	10.26
B	Contingency Charges @ 2.8% of Civil Cost (A)	2.80%	34621863	3.46
C	**SUB TOTAL (A+B)**		**1271116966**	**127.11**
D	Supervision @ 3% on C	3.00%	38133509	3.81
E	Agency Charges @ 3% on C	3.00%	38133509	3.81
F	Quality Control @ 0.25 % on C	0.25%	3177792	0.32
G	Road Safety Cell Audit Charges @ 0.25% on C	0.25%	3177792	0.32
H	**Sub-Total (C+D+E+F+G)**		**1353739569**	**135.37**
I	Maintenance for 4 years @ 5% on C	5.00%	63555848	6.36
J	Escalation @ 5% per annum for 3 years	5.00%	190667545	19.07

	on C			
K	***Grand Total (H+I+J)***		***1607962962***	***160.80***
	Cost of Land Acquisition etc.		6455000	0.65
	Solatium Charges @ 30% on land value		1936500	
	Establishment Charges @ 8% on land value		516400	
	Contingency Charges @ 2% on land value		129100	
	Total Cost of Land Acquisition etc.		9037000	
	Total Cost of R&R		7500000	
	Shifting of Utility Service		6061000	0.61
	Environment Cost		6061000	0.61
	Total Cost		**1636621962**	**163.66**
	Cost/KM at Total Cost		**135819250**	**13.58**

Table 0.7: ABSTRACT OF COST : PACKAGE- II (KM 32+050 to KM 44+000)

Item	Description	Weightage in percentage to the Contact Price	Amount (in RS)	percentage Weightage vis a vis Overall Project Cost
	Design Length in Km	11.950		
	A- Widening and strengthening of existing road			
Road works including culverts, minor bridges, underpasses, overpasses, approaches to ROB/RUB/ Major Bridges/ Structures	(1) Earthwork up to top of the sub-grade including excavation in soil, soft rock and hard rock including Cleaning & grubbing with required site clearance etc.	73.19%	105443117	8.46%
	(2) Granular work (sub- base, shoulders)		27241048	2.19%
	(3) Bituminous work			
	a)DBM With Prime coat & Tack coat.		31906879	2.56%
	b)BC with Tack coat.		17364819	1.39%
	B - New 2-Lane alignment			
	(1) Earthwork up to top of the sub-grade including excavation in soil, soft rock and hard rock including Cleaning & grubbing with required site clearance etc.		375821828	30.15%
	(2) Granular work (sub- base, shoulders)		79906647	6.41%

	(3) Bituminous work			
	a)DBM With Prime coat & Tack coat.		94185678	7.55%
	b)BC with Tack coat.		51327692	4.12%
	C- New culverts, minor bridges, underpasses, overpasses on existing road, realignments, bypasses:			
	(1)Box / Slab culvert		103966492	8.34%
	(2) Minor Bridge		25238910	2.02%
	D-Other Engineering Works			
Other Works	Road Appurtenances	26.81%	665883	0.05%
	Protection Work (Provision of Rip-Rap or similar work in valley side of the curves as special safety features)		1654400	0.13%
	Road side drain & toe wall		55058103	4.42%
	Traffic Sign		632032	0.05%
	Pavement Marking		4711114	0.38%
	Crash barrier/W metal crash barrier		14220946	1.14%
	Boundary stone, km Stone,5th km stone and hectometer stone		99109	0.01%
	Traffic blinker LED delineator, stud, reflective payment marker, tree reflector		329284	0.03%
	Bus bays and Bus Shelter		363156	0.03%
	Minor Junction		11556716	0.93%
	Plantation (Vetiver, Hydro seeding and Mulching or similar techniques etc.) for slope protection on exposed hill slopes as slide mitigation measure.		22548360	1.81%
	Road side catch water drain		13345500	1.07%
	Passing Places		1018039	0.08%
	Breast Wall		180085115	14.45%
	Retaining Wall		18881012	1.51%
	Parapet		9116000	0.73%
A	**Civil Cost**		**1246687879**	**124.67**
	Cost/KM at Civil Cost		104325346	10.43
B	Contingency Charges @ 2.8% of Civil Cost (A)	2.80%	34907261	3.49
C	**SUB TOTAL (A+B)**		**1281595139**	**128.16**
D	Supervision @ 3% on C	3.00%	38447854	3.84
E	Agency Charges @ 3% on C	3.00%	38447854	3.84
F	Quality Control @ 0.25 % on C	0.25%	3203988	0.32
G	Road Safety Cell Audit Charges @ 0.25% on C	0.25%	3203988	0.32
H	**Sub-Total (C+D+E+F+G)**		**1364898823**	**136.49**

I	Maintenance for 4 years @ 5% on C	5.00%	64079757	6.41
J	Escalation @ 5% per annum for 3 years on C	5.00%	192239271	19.22
K	***Grand Total (H+I+J)***		***1621217851***	***162.12***
	Cost of Land Acquisition etc.		6455000	0.65
	Solatium Charges @ 30% on land value		1936500	0.19
	Establishment Charges @ 8% on land value		516400	0.05
	Contingency Charges @ 2% on land value		129100	0.01
	Total Cost of Land Acquisition etc.		9037000	0.90
	Total Cost of R&R		7500000	0.75
	Shifting of Utility Service		6061000	0.61
	Environment Cost		6061000	0.61
	Total Cost		**1649876851**	**164.99**
	Cost/KM at Total Cost		**138065008**	**13.81**

Table 0.8: ABSTRACT OF COST: PACKAGE- III (KM 44+000 to KM 59+363)

Sl. No	Description	Weightage in percentage to the Contact Price	Amount (in RS)	percentage Weightage vis a vis Overall Project Cost
	Design Length in Km	**15.363**		
	A- Widening and strengthening of existing road			
Road works including culverts, minor bridges, underpasses, overpasses, approaches to ROB/RUB/ Major Bridges/ Structures	(1) Earthwork up to top of the sub-grade including excavation in soil, soft rock and hard rock including Cleaning & grubbing with required site clearance etc.	74.18%	310392536	18.94%
	(2) Granular work (sub- base, shoulders)		57298638	3.50%
	(3) Bituminous work			
	a)DBM With Prime coat & Tack coat.		69034849	4.21%
	b)BC with Tack coat.		37585134	2.29%
	(4)Widening and repair of culvert		140000	0.01%
	B - New 2-Lane alignment			
	(1) Earthwork up to top of the sub-grade including excavation in soil, soft rock and hard rock including Cleaning & grubbing with required site		326237944	19.91%

Table 0.8: ABSTRACT OF COST: PACKAGE- III (KM 44+000 to KM 59+363)

Sl. No	Description	Weightage	Amount (in	percentage
	clearance etc.			
	(2) Granular work (sub- base, shoulders)		78191619	4.77%
	(3) Bituminous work			
	a)DBM With Prime coat & Tack coat.		92164181	5.63%
	b)BC with Tack coat.		50226051	3.07%
	C- New culverts, minor bridges, underpasses, overpasses on existing road, realignments, bypasses:			
	(1)Box / Slab culvert		122023750	7.45%
	(2) Minor Bridge		72137970	4.40%
	D-Other Engineering Works			
Other Works	Road Appurtenances	25.82%	640563	0.04%
	Protection Work (Provision of Rip-Rap or similar work in valley side of the curves as special safety features)		2583040	0.16%
	Road side drain & toe wall		101696074	6.21%
	Traffic Sign		715900	0.04%
	Pavement Marking		6055356	0.37%
	Crash barrier/W metal crash barrier		10675657	0.65%
	Boundary stone, km Stone,5th km stone and hectometer stone		144871	0.01%
	Traffic blinker LED delineator,stud,reflective payment marker, tree reflector		513917	0.03%
	Bus bays and Bus Shelter		726312	0.04%
	Minor Junction		13723600	0.84%
	Overhead Sign board		313047	0.02%
	Plantation (Vetiver, Hydro seeding and Mulching or similar techniques etc.) for slope protection on exposed hill slopes as slide mitigation measure.		30384620	1.85%
	Road side drain		17936352	1.09%
	Truck layby		1435204	0.09%
	Passing Places		1018039	0.06%
	Breast Wall		204583917	12.49%
	Retaining Wall		15333363	0.94%
	Parapet		14518656	0.89%
A		**Civil Cost**	**1638431160**	**163.84**
		Cost/KM at Civil Cost	106647866	10.66
B	Contingency Charges @ 2.8% of Civil Cost	2.80%	45876072	4.59

Table 0.8: ABSTRACT OF COST: PACKAGE- III (KM 44+000 to KM 59+363)				
Sl. No	**Description**	**Weightage**	**Amount (in**	**percentage**
	(A)			
C	**SUB TOTAL (A+B)**		**1684307232**	**168.43**
D	Supervision @ 3% on C	3.00%	50529217	5.05
E	Agency Charges @ 3% on C	3.00%	50529217	5.05
F	Quality Control @ 0.25 % on C	0.25%	4210768	0.42
G	Road Safety Cell Audit Charges @ 0.25% on C	0.25%	4210768	0.42
H	**Sub-Total (C+D+E+F+G)**		**1793787202**	**179.38**
I	Maintenance for 4 years @ 5% on C	5.00%	84215362	8.42
J	Escalation @ 5% per annum for 3 years on C	5.00%	252646085	25.26
K	***Grand Total (H+I+J)***		***2130648649***	***213.06***
	Cost of Land Acquisition etc.		8391000	**0.84**
	Solatium Charges @ 30% on land value		2517300	
	Establishment Charges @ 8% on land value		671280	
	Contingency Charges @ 2% on land value		167820	
	Total Cost of Land Acquisition etc.		11747400	
	Total Cost of R&R		7500000	
	Shifting of Utility Service		6061000	**0.61**
	Environment Cost		6061000	**0.61**
	Total Cost		**2162018049**	**216.20**
	Cost/KM at Total Cost		**140728897**	**14.07**

Table 0.9: ABSTRACT OF COST: PACKAGE- IV (KM 138+000 to KM 154+036)				
Item	**Description**	**Weightage in percentage to the Contact Price**	**Amount (in RS)**	**Percentage Weightage vis a vis Overall Project Cost**
	Design Length in Km	**16.036**		
	A- Widening and strengthening of existing road			
Road works including culverts, minor bridges, underpasses, overpasses, approaches to ROB/RUB/	(1) Earthwork up to top of the sub-grade including excavation in soil, soft rock and hard rock including Cleaning & grubbing with required site clearance etc.	72.23%	142289599	8.07%
	(2) Granular work (sub- base,		39600004	2.24%

Major Bridges/ Structures (but excluding service roads)	shoulders)			
	(3) Bituminous work			
	a)DBM With Prime coat & Tack coat.		44925451	2.55%
	b)BC with Tack coat.		24558083	1.39%
	B - New 2-Lane alignment			
	(1) Earthwork up to top of the sub-grade including excavation in soil, soft rock and hard rock including Cleaning & grubbing with required site clearance etc.		376028474	21.32%
	(2) Granular work (sub- base, shoulders)		98335542	5.57%
	(3) Bituminous work			
	a)DBM With Prime coat & Tack coat.		111238516	6.31%
	b)BC with Tack coat.		60896469	3.45%
	C- New culverts, minor bridges, underpasses, overpasses on existing road, realignments, bypasses:			
	(1)Box / Slab culvert		245928058	13.94%
	(2) Minor Bridges		130445450	7.39%
	D-Other Engineering Works			
Other Works	Major Junction		2398057	0.14%
	Road Appurtenances	27.77%	750600	0.04%
	Road side drain & toe wall		80828385	4.58%
	Traffic Sign		3306761	0.19%
	Pavement Marking		6352320	0.36%
	Crash barrier/W metal crash barrier		17153469	0.97%
	Protection Work (Provision of Rip-Rap or similar work in valley side of the curves as special safety features)		2329600	0.13%
	Boundary stone, km Stone,5th km stone and hectometer stone		204397	0.01%
	Traffic blinker LED delineator, stud, reflective payment marker, tree reflector		463493	0.03%
	Bus bays and Bus Shelter		309158	0.02%
	Minor Junction		7194170	0.41%
	Overhead signboard		643797	0.04%
	Plantation (Vetiver, Hydro seeding and Mulching or similar techniques etc.) for slope		29173920	1.65%

	protection on exposed hill slopes as slide mitigation measure.			
	Road side drain I/C chute drain, catch water drain		33572000	1.90%
	Passing Places		2532192	0.14%
	(vii)Protection Works			
	Breast Wall		234659095	13.30%
	Retaining Wall		63959850	3.63%
	Breast Wall Sausage Type		0	0.00%
	Parapet		4052620	0.23%
	Civil Cost		**1764129530**	**176.41**
	Cost/KM at Civil Cost		**110010572**	**11.00**
B	Contingency Charges @ 2.8% of Civil Cost (A)	2.80%	49395627	4.94
C	**SUB TOTAL (A+B)**		**1813525157**	**181.35**
D	Supervision @ 3% on C	3.00%	54405755	5.44
E	Agency Charges @ 3% on C	3.00%	54405755	5.44
F	Quality Control @ 0.25 % on C	0.25%	4533813	0.45
G	Road Safety Cell Audit Charges @ 0.25% on C	0.25%	4533813	0.45
H	**Sub-Total (C+D+E+F+G)**		**1931404292**	**193.14**
I	Maintenance for 4 years @ 5% on C	5.00%	90676258	9.07
J	Escalation @ 5% per annum for 3 years on C	5.00%	272028774	27.20
K	***Grand Total (H+I+J)***		***2294109323***	***229.41***
	Cost of Land Acquisition etc.		7796100	
	Solatium Charges @ 30% on land value		2338830	
	Establishment Charges @ 8% on land value		623688	
	Contingency Charges @ 2% on land value		155922	
	Total Cost of Land Acquisition etc.		10914540	
	Total Cost of R&R		7500000	
	Shifting of Utility Service		11471000	**1.15**
	Environment Cost		22942000	**2.29**
	Total Cost		**2346936863**	**234.69**
	Cost/KM at Total Cost		**146354257**	**14.64**

INTRODUCTION

1.0 INTRODUCTION

1.1 General

The President of India acting through the Ministry of Road Transport & Highways (MoRT&H), Government of India, represented by the Director General (Road Development) & Special Secretary is engaged in the development of National Highways and as part of this endeavour, MoRT&H has decided to undertake 2laning with paved shoulder and/or strengthening of the various sections of National Highways and it has entrusted NHIDCL for the execution of the DPR. National Highways and Infrastructure Development Corporation is a fully owned company of the Ministry of Road Transport & Highways, Government of India. National Highways & Infrastructure Development Corporation Limited (NHIDCL), Government of India has decided to implement the Two laning of Joram – Koloriang Road (NH-713) from Km 20.00 to Km 70.00 & Km 138.00 to Km 158.000 (total length 70km) in the state of Arunachal Pradesh on EPC mode. Accordingly, NHIDCL intends to take up the preparation of the feasibility and detailed project report for same.

Joram to Koloriang section (length about 70km) of NH- 713 is a part of such National Highways, project preparation for 2 laning with paved shoulder which is taken by MoRTH on priority basis.

1.2 Overview of NHIDCL Organization and Activities, SARDP Programme, Project Financing and Cost Recovery Mechanism

1.2.1 NHIDCL Organization and Activities

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

An approximate aggregate length of 10,000 kms has been identified to begin with for development through this company. The company envisages creating customized and

specialized skills in terms of addressing issues like complexities of geographical terrains and addressing extensive coordination requirements with security agencies. The company would also endeavor to undertake infrastructure projects including but not restricted to urban infrastructure and urban or city transport and to act as an agency for development of all types of Infrastructure. The company envisages working towards cross sharing of technical know-how and enhancing opportunities for business development with other nations and their agencies including the multilateral organizations and institutions.

The company also proposes to improve road connectivity and efficiency of the international trade corridor, by expanding about 500 KMs of roads in the North Bengal and Northeastern region of India to enable efficient and safe transport regionally with other South Asia Sub-regional economic Cooperation (SASEC) member countries. These projects are being funded by ADB (Asian Development Bank).

1.2.2 SARDP PROGRAMS

The Ministry of Road Transport & Highways has initiated mega road development programme in North East with name "Special Accelerated Road Development Programme in North East (SARDP-NE)".The scope of the programme has been enlarged from time to time, since September. 2005. As on date Government has given approval for 2/4 laning of 6418 km of various categories of roads under Phase 'A' and Arunachal Package of SARDP-NE in entire North East at an estimated investment of about Rs 33.500 crore. Apart from the above, Government has also given approval to preparation of detailed project report for 3723 km of roads under Phase 'B' so as to enable Government to plan expenditure on these roads during next 5 years plans.

1. Apart from SARDP-NE, National highways Authority of India is implementing the 4 laning of 672 km of East West Corridor from Srirampur (Assam/ W. Bengal border) to Silchar in Assam at an estimated cost of Rs 6000 crore and 2 laning with paved shoulders from Jowai to Rattecherra (104 km) in Meghalaya under NHDP-III.
2. As seen from the above an amount of about Rs 40,000 crore for massive road infrastructure development has been committed by the Government for North East. These programmes once implemented fully will change the face of the North Eastern States.

3. Objectives of SARDP-NE:
   - Upgrade National Highways connecting State Capitals to 2/ 4 lane.
   - To provide connectivity of all 88 District Headquarter towns of NER by at least 2- lane road;
   - Improve roads of strategic importance in border area.

- Improve connectivity to neighboring countries

4. The SARDP-NE programme has been divided into 3 parts:
   (i) Phase 'A
   (ii) Arunachal Pradesh Package of Roads and Highways (Arunachal Package)
   (iii) Phase 'B'

PROJECT DESCRIPTION

2.0 The Project Road

Joram to Koloriang Road section of NH-713 is in the state of Arunachal Pradesh. The total length of the Road is about 158 km. Out of total length, km 0 to 20 is already under implementation through the Border Roads Organization (BRO). Further km 70 to km 138 is in the project preparation stage through MORTH by another Consultant. For the balance section, i.e., the instant proposal from km 70 to km 138 and km 138 to km 158, MORTH entrusted the work of development including preparation of feasibility studies and Detailed Project Report (DPR).

Subsequently NHIDCL has appointed M/s Voyants Solutions Pvt. Ltd. For the above work to carry out the Feasibility Studies and Detailed Project Report including field investigations, road inventory, structure inventory, road crust sample (trial pits), material investigation, secondary data collection and traffic survey (classified volume count, O-D, intersection counts, axle load survey, animal/pedestrian crossing counts, toll rate survey, truck parking survey and speed-delay survey on the above mentioned project highway. The index map of the project road is presented in **Figure 2.1.**

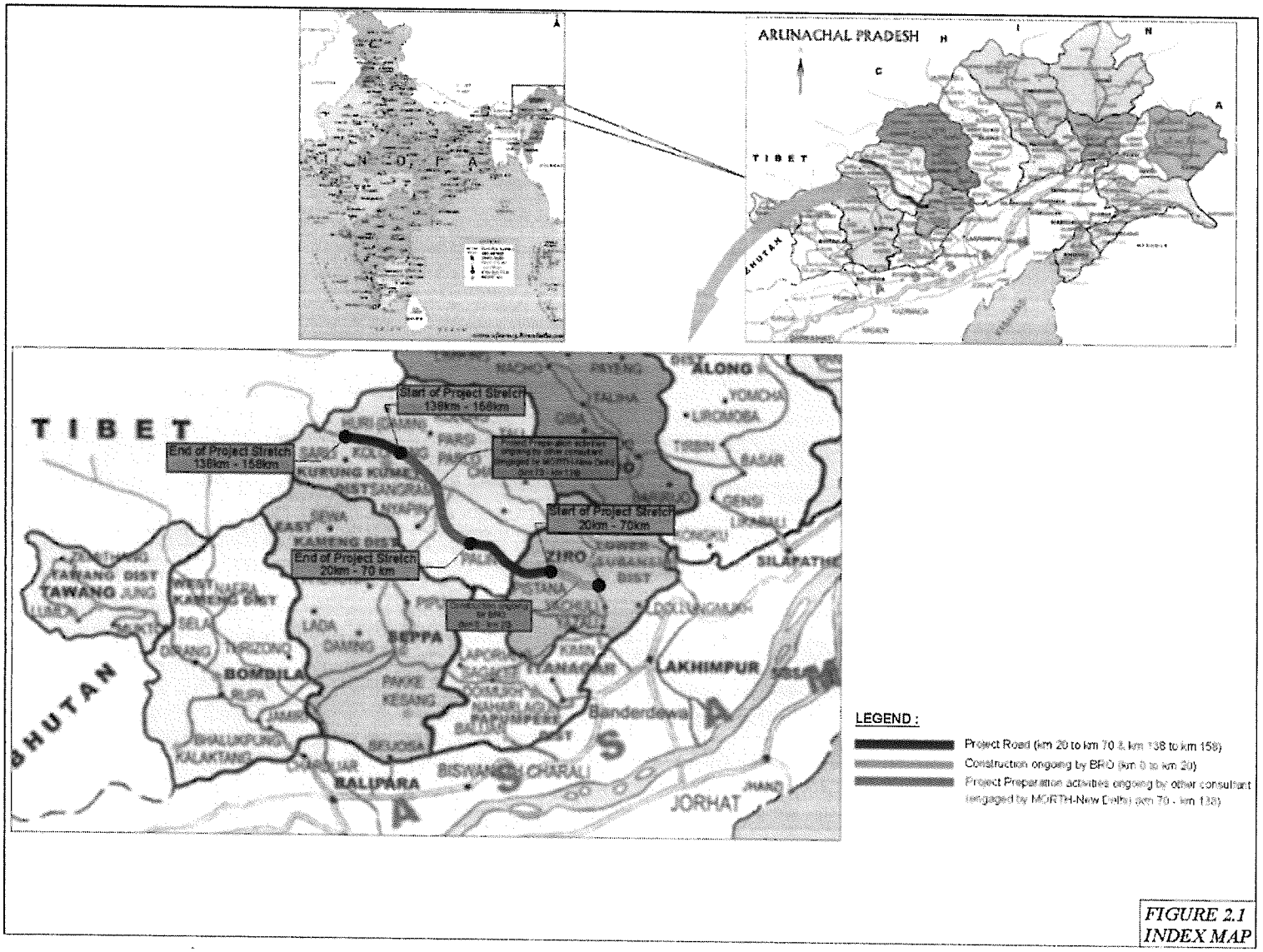
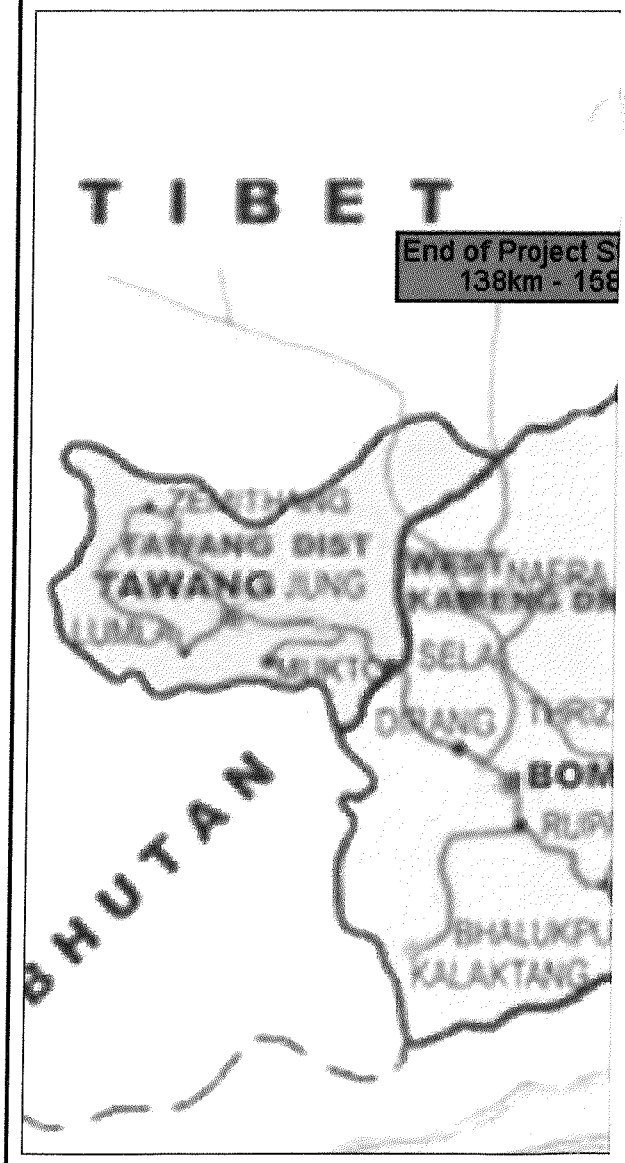


FIGURE 2.1
INDEX MAP



Project Road (km 20 to km 70 & km 138 to km 158)

Construction ongoing by BRO (km 0 to km 20)

Project Preparation activities ongoing by other consultant (engaged by MORTH-New Delhi) (km 70 - km 138)

FIGURE 2.1
INDEX MAP

2.1 Salient Features of the Project

2.1.1 Alignment

The project road takes off from NH 229 at Joram Junction very near to Joram church. Joram is about 14 km south of the location Ziro in the district of Lower Subansiri. However, the first 20 km (From km 0.00 to km 20.000) is being implemented by the BRO and outside the scope of this project and comes under the district of Lower Subansiri. Km 20.00 to km 70.00 is the first stage of this subject project and under districts of Lower Subasiri as well as Kra Daadi. New Palin town is the last point of this project. Then again km 70.00 to km 138.00 is under the scope of a different agency, being under project preparation stage through MORTH and falls in the district of Kurung Kumey. The last stage under this contract begins at km 138.00 and end at km 158.00 at Koloriang which is the district Head Quarter of Kurung Kumey district.

The existing length of the project road is 70 kms and it traverses through the districts of Lower Subansiri, KraDaadi and Kurung Kumey.

The project road is not continuous. The first part is of length 50.0km (from km 20.00 to km 70.00 near New Palin town) and the second part is of length 20.00km (from km 138.00 to km 158.00).

2.1.2 Terrain

Terrain is generally mountainous and steep. It is provided in **Annexure 2.1** also.

2.1.3 Abutting Land Use Pattern

The major part of the corridor passes through forest stretches. Besides, at few stretches it is built up, agriculture and open in nature. The details of land use pattern as derived during road inventory are given in **Annexure 2.1**. It is separately provided in **Annexure 2.2** also.

2.1.4 Important Towns

There are two important towns along the alignment. These are (1) New Palin near km 69.00, (2) Koloriang near km 158.00. The other settlements in general are villages with scattered kutcha houses. These are (1) New Pania near km 24.00, (2) Neelum near km 32.00, (3) Deed near km 35.200, (4) Daam near km 42.00, (5) Shakti near km 58.00.

2.1.5 Right of Way

The road land boundary pillars are not found along the road as dense forests abut either side of the existing road. According to site observations, the width from the road shoulder edge adjoining the valley side to the shoulder edge along the hill face varies from 6m to 12m. It has been learnt from the Deputy Commissioner of Kurung Kumey district, that the Land

Acquisition have been completed and the data available is with the BRO. Details of existing ROW are given in **Annexure 2.2**.

2.1.6 Carriageway Width

The existing carriageway width for most of the project road is about 3.0 to 3.5m. Details of existing carriageway width are provided in **Annexure 2.3**.

2.1.7 Junctions

There is one major junction and a number of minor junctions along the project road.
The major junction is at Koloriang at existing kilometer 158.000.This is shown in **Table 2.1** and the minor cross roads are shown in **Annexure 2.4**

Table 2.1: List of Junctions

Sl.No	Name	Ex. Chainage (km)	Side		Type of Junction	Type of Road	Remarks
			LHS	RHS			
1	Koloriang	158+000			4 - Legged	BT	End of project road. Forms a junction with some local roads leading to local destinations.

2.1.8 Pavement Condition

The existing pavement condition is generally varying from fair to poor with presence of pot holes and damaged pavement sections at major portion of the stretch. Black top is not visible along large portions of the stretches. No stretches were found with paved shoulders. Earthen shoulders on either side of the carriageway were found all along. Shoulder drop as well as pavement edge failure were found at many locations. The details of the pavement condition have been discussed in **Chapter 2** and is summarized below in **Table 2.2.** The existing pavement condition survey are presented in **Annexure 2.1**

Table 2.2: Pavement Condition

Condition	Percentage
Good	5%
Poor	70%
Fair	25%

2.1.9 Forest Area /Wild Life Sanctuary

The project road passes through forest for most part of its run except at some important settlements like Palin, Dam, Deed, Shakti where human habitation has been set up after removal of forests.

2.1.10 Cross Drainage Structures

a)	Major Bridges	-	00 Nos
b)	Minor Bridges	-	11 Nos
c)	Culverts	-	326 Nos

2.1.11 Land Slide Areas

Land Slide zones along the project stretch are not frequent. However, at three locations these are observed at km 43+000, km 144+000 and km 154+000.

2.1.12 Existing Bypass

There is no bypass along the project corridor.

2.1.13 Proposed Bypass

Proposal for bypasses for towns like Deed, Daam, New Palin have been studied but cannot be really implemented due to the topography of the regions with deep gorge on one side and steep mountains on the other.
The best proposal is to pass the widened facility thorough the built up areas by retro fitting the built up area cross sections.

2.1.14 Congested Areas

Palin town between km 67+000 to km 70+000 and Koloriang at km 158+000 are the most congested areas on the project road. Besides, some minor settlements with presence of lower order structures are also noted along the corridor.

2.1.15 Submergence

Submergence is generally not found in the project area.

2.1.16 Water Logged Area & Water Bodies

Water logged areas and water bodies are not found along the corridor.

2.1.17 Road Side Utilities

Low tension electrical lines exist on one or both sides of the project road at few locations. Underground utilities like OFC (BSNL and Bharti) and water pipe lines were found along the project corridor. New OFC lines being laid by the road edge was also observed at some locations. All necessary efforts will be made to collect relevant information from respective departments. The details of the existing utilities are covered in **Annexure 2.5.**

2.2 Objectives of Consultancy Services

The main objective of the consultancy service is to establish the technical, environmental, social, economic and financial viability of the project and prepare detailed project reports for rehabilitation and upgrading of the existing road to 2-lane/2-lane with paved shoulders configuration and/or its strengthening. The requirement of paved shoulder along with 2 laning is to be finalized based on the traffic levels.

The viability of the project shall be established taking into account the requirements with regard to rehabilitation, upgrading and improvement based on highway design, pavement design, provision of service roads wherever necessary, type of intersections, rehabilitation and widening of existing and/or construction of new bridges and structures, road safety features, quantities of various items of works and cost estimates and economic analysis.

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

As far as possible, the widening/improvement work to 2 lane/2 lane with paved shoulder shall be within the existing right of way avoiding land acquisition, except for locations having inadequate width and where provisions of short bypasses, service roads, alignment corrections, improvement of intersections are considered necessary and practicable and cost effective. The Consultant shall furnish land acquisition details (i.e. all necessary schedules as per L.A. act) as per revenue records/maps.

The Consultant will also make suitable proposals for widening/improvement of the existing road to 2 lane with paved shoulder etc. and strengthening of the carriageways, as required at the appropriate time to maintain the level of service over the design period.

Environmental Impact Assessment, Environmental Management Plan and Rehabilitation and Resettlement Studies shall be carried out by the Consultant meeting the requirements of the World Bank.

Wherever required, consultant will liaise with concerned authorities and arrange all clarifications. Consultant will also obtain 'NO Objection Certificate' from Ministry of Environment and Forest and also incorporate the estimates for shifting of utilities of all types involved from concerned local authorities in the DPR. Consultant is also required to prepare all Land Acquisition papers (i.e. all necessary schedules as per L.A. act) for acquisition of land either under NH Act or State Act.

Consultant shall obtain all types of necessary clearances required for implementation of the project on the ground from the concerned agencies. The client shall provide the necessary supporting letters and any official fees as per the demand note issued by such concerned agencies from whom the clearances are being sought to enable implementation. In case Consultant does not obtain all the necessary clearances upto the completion of the assignment, deduction upto 5% amount will be made from the final payment. The amount thus deducted will be released after all necessary clearances have been obtained.

2.3 Scope of Consultancy Services

As far as possible, the widening/improvement work to 2 lane with paved shoulder shall be within the existing right of way avoiding land acquisition, except for locations having inadequate width. However bypass proposals should also be considered, wherever in urban areas, improvement to 2 lane of the existing road is not possible. The consultant shall furnish land acquisition details (i.e. all necessary schedules as per L.A. act) as per revenue records/maps.

Truck Laybys, bus bays, passing places required on highway shall also be planned.

We will also make suitable proposals for widening/improvement of the existing road to 2 lane with paved shoulder etc. and strengthening of the carriageway, as required at the appropriate time to maintain the level of service over the design period.

All ready to implement 'good for construction' drawing shall be prepared.

Environmental Impact Assessment, Environmental Management Plan and Rehabilitation and resettlement study shall be carried out by the consultant meeting the requirements of the World Bank.

Wherever required, the consultant will liaise with concerned authorities and arrange all clarifications. We will also obtain 'No Objection Certificate' from Ministry of Environmental and Forest and also incorporate the estimate for shifting of utilities of all types involved from concern local authorities in the DPR.

We shall obtain all types of necessary clearances required for implementation of the project on the ground from the concerned agencies with the client's support and under the client's

guidance.

2.4 Stages of Submission

Project preparation activities are be split into three stages as set out in TOR.

Stage 1: Inception Report – Inception Report would be submitted with the following details:

i. Quality Assurance Plan (QAP) Document
ii. Data Formats of Field Studies

Stage 2: Feasibility Report - The consultants would commence the Feasibility Study of the project in accordance with the accepted IR. The Feasibility Report shall contain the following

i. The Main Report
ii. The Basic Data Obtained from Field Studies
iii. Strip Plan & Clearances

a. Strip Plan showing the proposed centerline along with the existing and proposed right-of-way
b. Widening Scheme
c. Land Acquisition Plan
d. Detail LA Schedules
e. Ownership Details
f. Utility Relocation Plans
g. Details of Various Clearances

iv. Land Acquisition Plans

Stage 3:

A. Land Acquisition Report – It shall contain the following:

i. Detail schedules about acquisition of land holdings as per revenue records and their locations in strip plans.
ii. The land acquisition report should be prepared in consultation with affected persons, non-governmental organisations and concerned government agencies and should cover land acquisition and resettlement plan and costs of resettlement and rehabilitation of such affected persons.
iii. It should include compensating afforestation, its land requirement with specific locations and cost involved for undertaking all activities.

B. Preliminary Project Report - PPR – The Draft PPR shall contain the following:

Volume – I: Preliminary Design Report
Volume – II: Design Report
Volume – III: Drawings
Volume – IV: Environment Impact Assessment

The basic data obtained from the field studies and investigations and the input data used for the preliminary design shall be submitted in a separate volume as an Appendix to PPR.

The Final PPR incorporating the comments, revisions and modifications suggested by NHIDCL shall be submitted within 15 days of the receipt of the comments from NHIDCL.

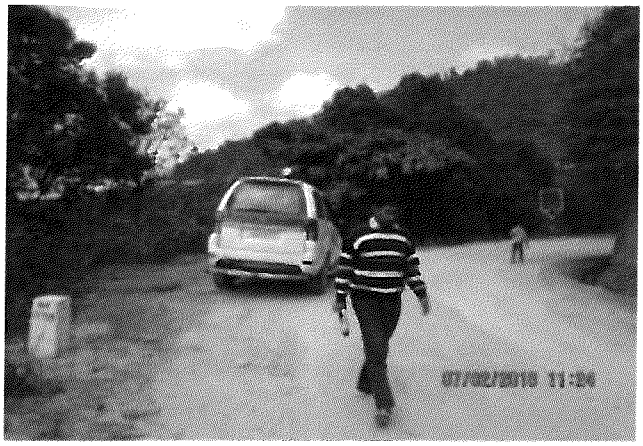
Stage 4 :Draft Detailed Project Report (DPR)

The draft DPR shall consist of construction package wise the following reports:

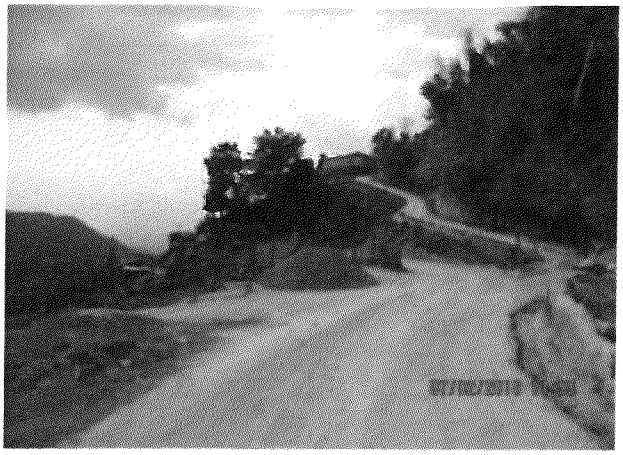
- Main Report
- Design Report
- Materials Report
- Engineering Report
- Drainage Design Report
- Environmental Assessment Report
- Package wise bid documents and drawings

2.5 Field Photographs

Field photographs are shown in **Plate 2.1** to **2.4**.



Start of Project Stretch of km 20+000 to 70+000 (At km. 20+000)

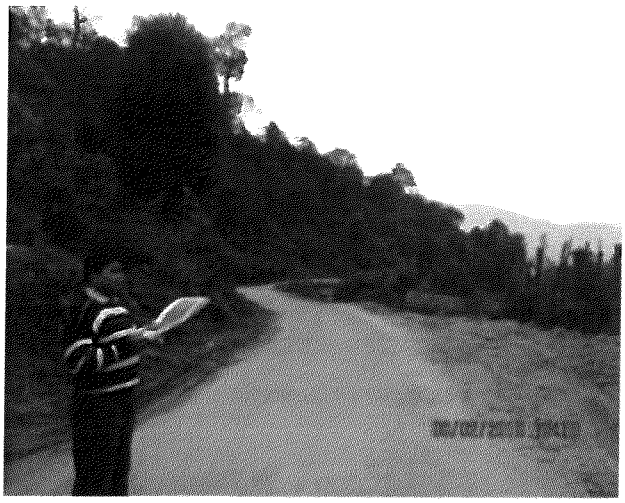


Project Stretch with Cross Road

Showing Road Side Electric Pole

Alignment Study on Project Road

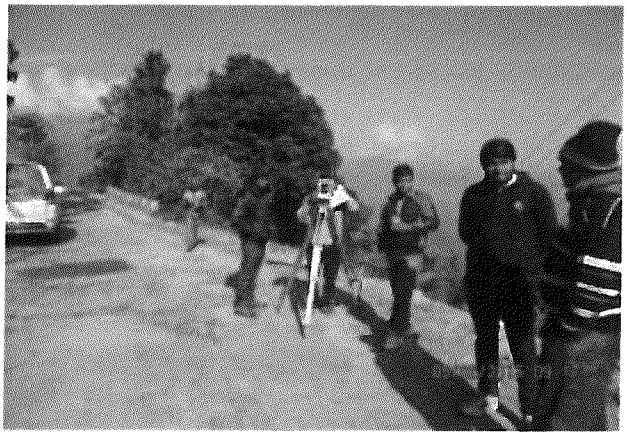
1 x 30.5 m Span Minor Bridge on Project road (Near km. 36+000)



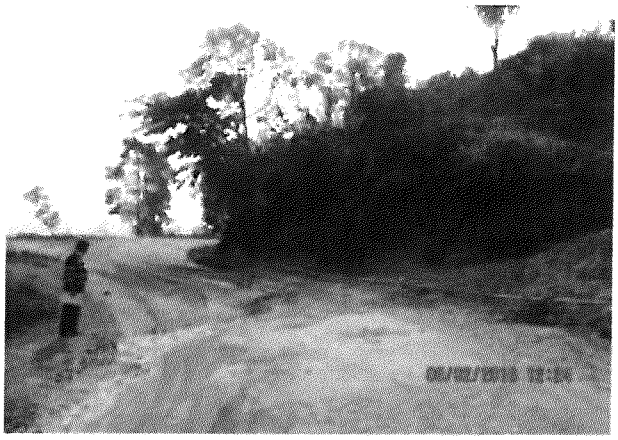
Alignment Study on Project Road

Plate 2.1

VOYANTS SOLUTIONS PVT. LTD. GURGAON

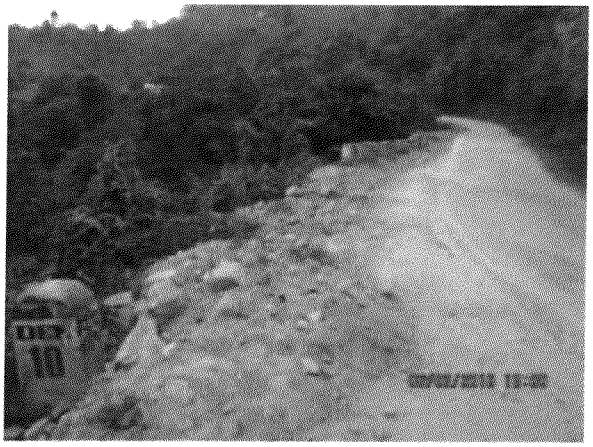


Topographic Survey

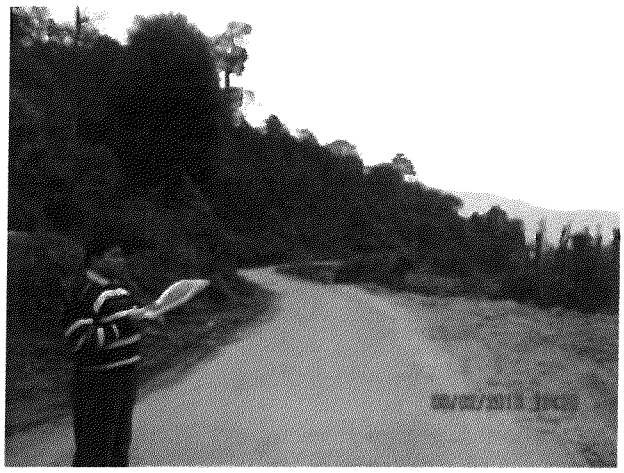


Sharp Curve along Project Road

Road Condition (At km. 52+000)



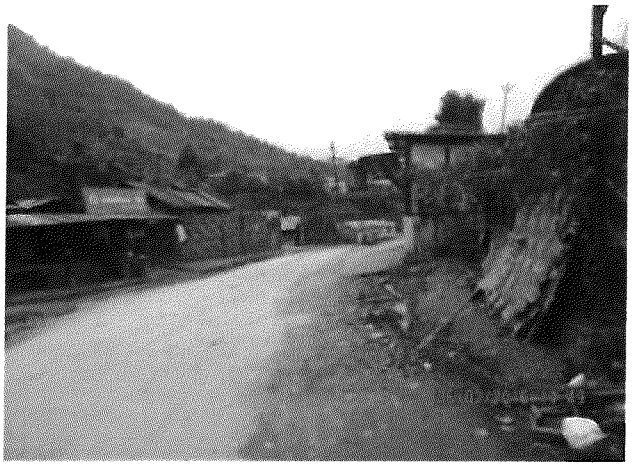
Stretch of Project Road(Near km.53+000)



Alignment Study

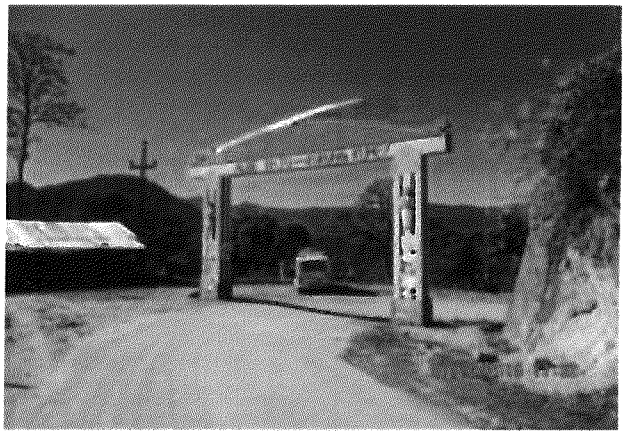
Electricity line along Project Road

Plate 2.2



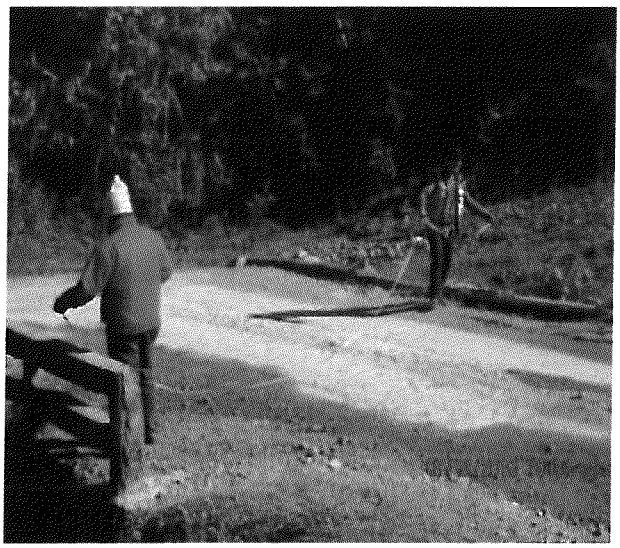
Both Side Habitation

Road side Utility line on RHS



District Boundary on Project Road (Near km. 50+000)

1 x 7.0 m Span Minor Bridge on Project road (Near km. 56+100)



1 x 6.75 m Span Minor Bridge on Project road (Near km. 56+600)

On Project road near Shakti village (Near km. 58+000)

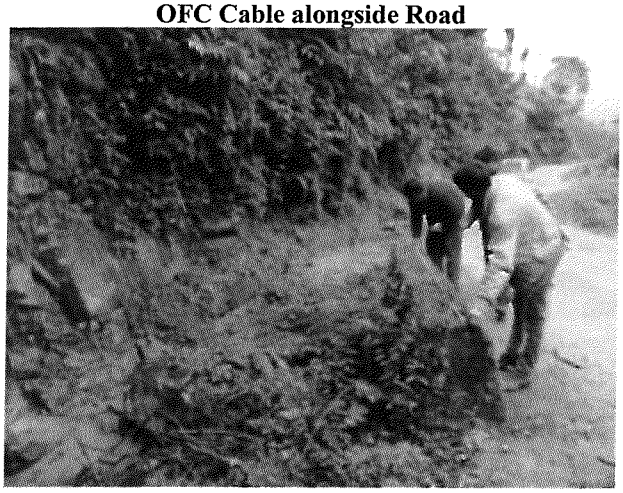
Plate 2.3

Road Condition along Project Road

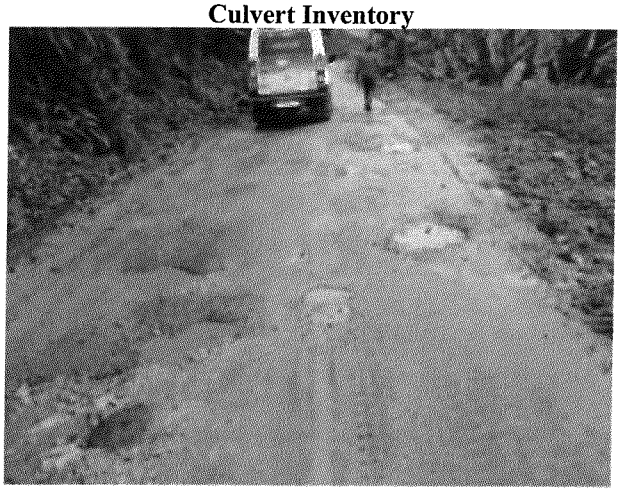
Slab Culvert on Project Stretch

OFC Cable alongside Road

Culvert Inventory



Culvert Inventory



Road Condition along Project Road

Plate 2.4

2.6 Meetings and Discussions

The following meetings and activities took place as for now in this project.

Sl	Meeting and visit details	Dates	List of Attendees	Purpose of meeting	Comments on any key agreements, Resolutions or Issues
1	Kick-off meeting	15.12.2015	NHIDCL: DGM and GM Consultants: Team Leader	Kick-off the project and introduction with consultants	Consultants were advised to submit Inception Report immediately. Also advised to submit work plan and schedules of submissions
2	Visit of site	04.12.2015 to 08.12.2015	Consultants: Team Leader, Highway Engineer cum pavement specialist, Senior Survey Engineer, Materials cum pavement specialist, Assistant Bridge Engineer, Assistant Highway Engineer	Reconnaissance of the project section.	Study of whole alignment including idea about environment, land slide zones material type utilization and social scenario of the project area. Gather information of various features of the project.
3	Meeting with PWD Itanagar	16.12.2015	PWD: Executive Engineer, Eastern Region Consultants: Team Leader	To get idea about others work zone around the project stretch which will help to integrate DPR work being done by other consultants.	No project specific information was available as PWD already handed over the project.
4	Meeting with BRO officials at Old Ziro	06.12.2015	Officers of Commanding Office (OC), 85 RCC (GREF), Consultant's team	The consultant requested for project area data/information about the project.	The consultant submitted a request letter to BRO. The consultants team is also liaisoning with the Chief Engineer office, BRO at Itanagar.
5	Meeting with Land Revenue Officer, Lower	Dec 2015	Land Revenue Officer and Consultant's team	Land Acquisition related issues were discussed.	Preparation of land plans and schedules are a critical activity of the project.

Sl	Meeting and visit details	Dates	List of Attendees	Purpose of meeting	Comments on any key agreements, Resolutions or Issues
	Subansiri at Ziro.				
6	Meeting with District Commissioner (DC), Koloriang	Dec 2016	DC, Koloriang and the Consultant's Resident Engineer	Discussed future development plans and schemes for the project stretch under their jurisdiction.	i) There is no separate development schemes ii) Required to study sinking and land slide areas.
7	Site visit with NHIDCL.	21.01.2016	DGM, NHIDCL and the Consultant's team.	Joint visit of the project road.	Discussion on improvement of geometrics and review of features.
8	Meeting with DC, Koloriang	21.01.2016	DGM, NHIDCL, Team Leader VSPL, DC Koloriang.	Status review.	Discussed project progress and requested to expedite the same. Also informed all helps will be provided from DC office as & when required.
9	Meeting with NHIDCL	22.02.2016	GM, DGM, NHIDCL , Material cum Geotechnical Eng.	Status review.	NHIDCL suggested the material testing laboratory to be Government approved.
10	Meeting with NHIDCL	19.03.2016	GM, DGM, NHIDCL , Highway cum pavement engineer, CAD Engineer	Draft Feasibility Report Submission	NHIDCL were overall satisfied with the alignment. They made the following suggestions: ➢ Some changes in the alignment. ➢ Review the civil costs for both packages. ➢ Review the protective works. ➢ Incorporation of one truck layby. ➢ Incorporation of one passer bye.

Sl	Meeting and visit details	Dates	List of Attendees	Purpose of meeting	Comments on any key agreements, Resolutions or Issues
					NHIDCL issued letters to the Chief Engineer-PWD(Eastern Zone), DCs of the three districts requesting consent on the alignment and land.
11	Meeting with Chief Engineer (PWD)Eastern Zone	21.03.2016	Chief Engineer (PWD)Eastern Zone, Highway cum pavement engineer, CAD Engineer	Consent on project alignment.	Drawing volume, main report, LAP, Utility Relocation Plan submitted for review by the Chief Engineer's office. Chief Engineer issued letter rendering his consent on the alignment and requesting to work in close association with the District administration.
12	Meeting with DC, DLRSO KRA DAADI	22.03.2016	DC, DLRSO KRA DAADI Highway cum pavement engineer, CAD Engineer	Consent on alignment and availability of land.	Drawing volume, from km 20.00 to km 70.00 submitted for review by the DC, DLRSO Kra Daadi. One modification in the alignment had been suggested by the DLRSO. Consent provided for the rest of the alignment.
13	Meeting with DC, DLRSO LOWER SUBANSIRI	22.03.2016	DC, DLRSO LOWER SUBANSIRI, Highway cum pavement engineer, CAD Engineer	Consent on alignment and availability of land.	Drawing volume, from km 20.00 to km 70.00 submitted for review by the DC, LOWER SUBANSIRI. One modification in the alignment had been suggested by the DLRSO. Consent provided for the rest of the alignment.
14	Visit to Forest	21.03.2016	Forest officials,	Procurement of	1. Documents

Sl	Meeting and visit details	Dates	List of Attendees	Purpose of meeting	Comments on any key agreements, Resolutions or Issues
	Department, Itanagar		Voyants representative.	BRO designed alignment from km 138.00 to km 158.00 and Forest Clearance process.	regarding procedure for forest clearance collected . 2. Photograph of BRO designed alignment on Topo Sheet snapped.
15	Meeting with DC, DLRSO LOWER SUBANSIRI	11.04.2016	DC, DLRSO LOWER SUBANSIRI, Highway cum pavement engineer.	Consent on alignment and availability of land.	Alignment plan and longitudinal profile submitted from km 20.00 to km 70.00 submitted in 1:500 scale for review by the DC, LOWER SUBANSIRI. Consent provided for the availability of land. (from km 20 to km 51).....Annexure II
16	Meeting with DC, DLRSO KRA DAADI	12.04.2016	DC, DLRSO KRA DAADI, Highway cum pavement engineer.	Consent on alignment and availability of land.	Alignment plan and longitudinal profile submitted from km 20.00 to km 70.00 submitted in 1:500 scale for review by the DC, KRA DAADI. Consent provided for the proposed alignment (from km 51 to km 70).....Annexure III
17	Meeting with NHIDCL	20.04.2016	GM, DGM, NHIDCL , Highway cum pavement engineer.	Consent on the proposed alignment and future course of action on the project.	NHIDCL were overall satisfied with the progress of the project. They insisted on submitting a comparative study on the three alternative alignments and presenting the same before the NHIDCL-HQ (New Delhi). They also suggested to expedite

Sl	Meeting and visit details	Dates	List of Attendees	Purpose of meeting	Comments on any key agreements, Resolutions or Issues
					the further remaining activities of the project as there is a chance of the project being transferred to the BRO.
18	Meeting with DC, DLRSO KRA DAADI	22.04.2016	DC, DLRSO KRA DAADI, CAD Engineer	Handing over of the alignment plan and profile in a scale of 1: 500 under Kurung Kumey District (km 138 to km 158).	The alignment plan and profile from km 138 to km 158 was handed over to DLRSO – KRA DAADI with a request for handing over the same to DC Office Kurung Kumey. The future activities of the project were also explained to the DLRSO.
19	Meeting with NHIDCL	26.04.2016	GM, DGM, NHIDCL , CAD Engineer	Consent on the proposed alignment and future course of action on the project.	GM Office – NHIDCL: Itanagar issued a letter to the Executive Director – NHIDCL requesting approval of the proposed alignment from the HQ and also for the release of Invoice - 2 payment.....Annexure V
20	Presentation to NHIDCL	03.06.2016	GM, DGM, NHIDCL	Presentation	NHIDCL were overall satisfied with the progress of the project. NHIDCL requested us to divide the Package-I in three packages and update the cost estimate and schedule. NHIDCL also requested us to increase the safety measure at the project site. Consultant has been incorporated the recommendation of

Sl	Meeting and visit details	Dates	List of Attendees	Purpose of meeting	Comments on any key agreements, Resolutions or Issues
					NHIDCL. Revised cost estimate and schedule has been submitted. It has also been decided consultant VSPL will submit the DPR as per TOR.

ENVIRONMENTAL IMPACT ASSESSMENT STUDY

3.0 Environment Screening

Environmental screening study has been carried out to identify critical issues and areas that would be studied in detail for Environment Impact Assessment. Findings of the screening are presented in this Chapter. This report has been based mainly on secondary data supported by field survey done by consultant team at some points along the route.
In the screening stage, existing environmental set-up of the study corridor (500m on either side of the center line) in particular were studied and is described in subsequent sections. However, existence of sensitive receptors was also studied beyond the study area. The environmental screening chapter covers the following:

- Methodology for study
- Legal Framework
- Baseline Environment
- Probable Environmental Impact & Mitigation Measures

3.1 Methodology

Screening process has taken place through desktop as well as onsite assessment of the project activities.

3.1.1 Desktop Study

Study of Project Documents: The 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 Arunachal Pradesh 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 for screening exercise.

3.1.2 Onsite Study

A team of consultant carried out field visit of the project road to identify water bodies, forests, public utilities, community resources, cultural sites etc. present along the project road. Discussions with local people and administrators were also held to obtain their opinion about the project.

3.1.3 Legislative Framework

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.

Table 3.1: Environment Laws and their Applicability

S. No.	Law / Regulation / Guidelines	Relevance	Applicable 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	Yes	All environmental notifications, rules and schedules are issued under the act	MoEFCC, State Department of Environment & Forest, CPCB and SPCB
2	The EIA Notification, 14th September 2006 & subsequent amendments	Identifies expansion of National highways projects greater than 100 Km involving additional ROW or land acquisition greater than 40m on existing alignments and 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	No	Project road is neither a new national highway nor NH expansion projects greater than 100 km	MoEF / SEIAA
3	Notification for use of Fly ash, 3rd November 2009	Reuse fly ash discharged from Thermal Power Station to minimise land use for dispersal and minimise borrow area material	No	No coal based thermal power project in 100km form the project road.	MoEF, SPCB
4	The Water (Prevention and Control of Pollution) Act, 1974	Central and State Pollution Control Board to establish / enforce water quality and effluent standards, monitor water quality, prosecute offenders,	Yes	Consent required for not polluting ground and surface water during construction	State Pollution Control Board

S. No.	Law / Regulation / Guidelines	Relevance	Applicable Yes / No	Reason for Application	Implementing / Responsible Agency
		and issue licenses for construction / operation of certain facilities.			
5	The Air (Prevention and Control of Pollution) Act. 1981	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, hot mix plants and crushers	State Pollution Control Board
6	Noise Pollution (Regulation And Control) Act, 1990	Standards for noise emission for various land uses	Yes	Construction machineries and vehicles to conform to the standards for construction	State Pollution Control Board
7	Forest (Conservation) Act, 1980	Conservation and definition of forest areas. Diversion of forest land follows the process as laid by the Forest conservation Act.	Yes	Part of road passes through the reserved forest	Forest Department, MoEF
8	Coastal Regulatory Zone Notification, 1991	Protect and manage coastal areas	No	The project area is not within designated coastal zone	MoEF, State Department of Environment
9	Wild Life Protection Act, 1972	Protection of wild life in sanctuaries and National Park	Yes	Talle Wildlife Sanctuary is about 15km from the project road. Demarcation of Eco-sensitive zone is under process. However, till than a 10km stretch from the outer periphery may be considered as eco-sensitive	NBWL, SBWL & Chief Wild Life Warden

S. No.	Law / Regulation / Guidelines	Relevance	Applicable Yes / No	Reason for Application	Implementing / Responsible Agency
				zone as per supreme court guidelines.	
10	Ancient Monuments and Archaeological sites & Remains Act 1958	To protect and conserve cultural and historical remains found.	No	No ASI notified archaeological monument along the project road	Archaeological Survey of India, State Dept. of Archaeology
11	The Motor Vehicle Act, 1988	Empowers State Transport Authority to enforce standards for vehicular pollution.	Yes	All vehicles used for construction will need to comply with the provisions of this act.	State Motor Vehicles Department
12	The Explosives Act (& Rules) 1884 (1983)	Sets out the regulations as to regards the use of explosives and precautionary measures while blasting & quarrying	Yes	New quarrying operation may require blasting	Chief Controller of Explosives
13	Public Liability and Insurance Act,1991	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
14	Hazardous Wastes (Management, Handling and Trans-boundary Movement) Rules, 2008	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
15	Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996	Protection against chemical accident while handling any hazardous chemicals resulting	Yes	Handling of hazardous (flammable, toxic and explosive) chemicals during road construction	District & Local Crisis Group headed by the DM and SDM
16	Mines &Minerals	Permission of Mining of aggregates and	Yes	Mining of sand or aggregates	State Department of Mining

S. No.	Law / Regulation / Guidelines	Relevance	Applicable Yes / No	Reason for Application	Implementing / Responsible Agency
	(Regulation & Development) Act, 1957 as amended in 1972	sand from river bed & aggregates			
17	The Building & Other Construction Workers (Regulation of Employment & Conditions of Service) BOCW Act, 1996	Employing Lab our / workers	Yes	Employment of labors	District labor Commissioner

Summary of the clearances / No Objection Certificate (NOC) as may require for the project for environment due diligence are as follows.

- Project road passes through the Forest Area. Hence, Forest Diversion Permission from Forest Department will be required
- Some of the trees likely to be felled due to proposed widening. Therefore, Tree felling permission from Forest Department / District Administration.
- Talle Wildlife Sanctuary is about 15km from the project road. Demarcation of Eco-sensitive zone is under process. However, till than a 10km stretch from the outer periphery of the wildlife sanctuary may be considered as eco-sensitive zone as per supreme-court guidelines. A Wildlife No Objection Certificate (NOC) may be required from National Board of Wildlife

Apart from the clearances NHIDCL / Contractor shall also obtain the NOCs & licenses from the various agencies & authorities prior to his work initiation. These are:

- NOC and Consents under Air, Water under Environmental Protection Acts & Noise rules of SPCB for establishing and operating noise generating equipment, Hot Mix Plant, etc.
- NOC under Hazardous Waste (Management and Handling) Rules, 1989 from SPCB
- PUC certificate for use of vehicles for construction from Department of Transport
- NOC for ground water extraction for construction and allied works from Ground Water Authority (If required)
- Environmental Clearance for opening of new Borrow Area or quarry (if any)

3.2 Environment Profile

Affected structure and trees were identified for 500m on either side from the centre line of the road. However, site sensitivity analysis has been undertaken for a distance of 15km form the project road.

3.2.1 Topography, Geology, Seismicity and Soil

The existing road follows generally mountainous topography with tall and rugged mountains with steep slopes especially in the Palin-Koloriang section. Vertical profile of the road is characteristic of hill roads dotted with sharp rises and falls.

Project road is the part of high mountain ranges falling in the Higher Himalayan zone. The project road is passing through by hard rock terrain.

The nature and properties of soil vary with the area. The soils of the valleys are generally loamy or sandy loam mixed with coarser soil particles. Soil in greater part of the project road is red sandy soils and skeletal soils. In the forested regions, the soil generally contains high humus and nitrogen due extensive cover of forests. Soils of the mountains are relatively lacking in organic materials. The soil along the foothill areas is alluvial, loamy or sandy loam mixed with gravel and pebble brought down by rain waters from high altitudes. The soil in the valley is clay alluvium and rich in organic content.

The soil in the valleys is favorable for cultivation of Kharif and Rabi crops. The soils of the hills are suitable for shifting cultivation and dry paddy, maize etc.

Project road is in Seismic Zone V as per BIS Standards. Zone V is the most vulnerable to earthquakes. Earthquakes with magnitudes in excess of 7.0 have occurred in these areas, and have had intensities higher than IX. The structures in this project stretch falls in Zone V as per IRC: 6 - 2014 and seismic loads will be considered accordingly.

3.2.2 Climatology

The project road is the part sub-tropical agro climate zone. The district falls within 15^{o} to 20' temperature zone often the temperature falls to 5 to 7 degree in winter. The region is very cold during winter but not so hot during summer. The average annual temperature of the district ranges from about 3^{o}C in January to nearly 38^{o}C during the months of August, September and October.

The area is windy in nature. Rainfall in the project district Lower Subansiri is not so high in comparison to other district of the state. The rainfall data for the period year 2009-2012 were collected from IMD and presented in Table below.

Table 3.2: Rainfall data for Lower Subansiri district

Month / Year	2009	2010	2011	2012
Jan	5.6	0.0	2.8	26.0
Feb	25.4	3.6	8.0	10.0
Mar	114.2	109.7	79.0	53.0
Apr	61.4	87.8	32.8	123.0
May	124.2	128.8	125.2	78.0
Jun	80.6	80.4	171.4	181.0
Jul	146.9	104.0	204.1	129.0
Aug	173.2	68.6	157.0	109.0
Sept	53.0	75.0	85.0	219.0
Oct	51.2	30.7	17.0	43.0

Month / Year	2009	2010	2011	2012
Nov	1.2	18.2	45.0	17.6
Dec	3.6	0.0	7.0	0.0
Annual Sum	**840.5**	**706.8**	**934.3**	**988.6**

3.2.3 Surface Water-Bodies

The river system of the project region is a part of the Subansiri river sub-basin. Generally roadsides borrow pits and ponds are not observed along the stretch. There are number of rivers and small water courses are flowing within the 10 km of project area. Rivers like Palin and Kurung crosses the project road where minor bridges are constructed. Rivers in the project region normally flow in the south-easterly direction. The drainage pattern is generally dendritic to sub-parallel in nature and follows the geomorphological trends of the hills and mountains. In the hilly terrain the rivers have deep narrow gorges along their courses.

3.2.4 Ground Water Source

A few dug wells and a good number of springs are utilized in this region as a source of water supply for the villagers. The project districts are occupied by hill ranges with very steep slopes. Moreover, no details about the recharge potential in these hills are available. Project districts fall under safe category as per district ground water brochure of prepared by CGWB.

Water Quality Kurung Kumey (including Kra Daddi)

As per district ground water brochure, pH values in the district range between 6.5 and 8.02. Electrical conductivity of the water is found to vary from 18-486 micromhos / cm at 25^{o}C. The concentration of fluoride ranges from 0.7 to 0.44 ppm. The range of concentration of calcium and magnesium is in between 2-54 and 1-22 ppm respectively. Concentration of chloride ranges from 7 to 14 ppm . In general, the chemical quality of ground water in the district is fresh and potable and can safely be used for domestic and industrial purposes.

Water Quality Lower Subansiri

The PH value of the water is normal, sometimes slightly rising towards alkalinity. The electrical conductivity is moderate and within safe limits being 41 to 339 micromohos / cm. The water is soft and the constituents like Ca, Mg, Na, K, HCO etc are low. The high concentration of Sodium and chlorine in Hija dug well may be due to the well is unused and dirty. The water quality collected from dug wells and springs reveals that the water is most suitable for all purposes. The source of above details is District Ground Water Brochure.

3.2.5 Air Quality

In absence of any industrial activities, air quality is not the issue of concern. Wind-blown fugitive dust is only source of pollution in the project vicinity.

3.2.6 Noise Level

As per general observation noise level in the area is well within the acceptable limits.

3.2.7 Ecological Feature

The forests of Arunachal Pradesh possess a phenomenal range of biological diversity, both in flora and fauna. The forests are also home to sizeable tribal population which continues to live in close association with nature and utilizes a wide variety of forest resources for sustenance and livelihood. One of the oldest community in this area is Nyishi community. Nature has been exceedingly kind and has endowed this beautiful State of Arunachal Pradesh with diverse forests and magnificent wildlife.

The flora of study area is rich owing to climatic condition. The richness of life forms i.e. the flora & fauna that occur in these forests presents a panorama of biological diversity with over 5000 plants, about 85 terrestrial mammals, over 500 birds and a large number of butterflies, insects and reptiles. These types of forests occur in districts between altitudes 800m to 1900m. These are essentially evergreen and dense in nature. The trees attain large dimensions (25-40m high). The forests are rich in species diversity and dominated by Fagaceae members. Luxurious growth of climbers, orchids & ferns, occurs in these forests.

The entire route passes through hilly / mountainous terrain. Settlement areas as mentioned above are found scattered along the project road more so between km 20 and km 70. Land use pattern for the major portion of the stretch is forest and dense vegetation. Agricultural land has been noticed few and far between. Project involves the diversion of about 126hectare of forest area for the proposed widening. Talle wildlife sanctuary is about 15 km from the km 20.000 milestone of the road. NOC from National Board of Wildlife may be required in absence of defined eco-sensitive zone along the Sanctuary.

3.3 Environmental Impact & Mitigation Measures

In general the summary of impact associated with proposed widening / improvement work and general mitigation measures are discussed in Table below. However, project specific impact and mitigation measures will be detailed out during EIA stage.

Table 3.3: Probable Impact and Mitigation Measures

Environment Parameters	Impacts associated	Mitigation Measures
Air Pollution	• Fugitive dust during site clearing activities • Exhaust gases due to operation of construction machineries • Exhaust emission likely after increment in the traffic numbers on the road	• Regular water sprinkling • Regular maintenance of construction machineries and vehicle • Only PUC certified vehicle shall be deployed during construction
Noise Level	• Increment in noise level due to construction activities and use of HEMMs • Increment in noise level due to increase in traffic numbers after proposed development	• Regulation of noise generating activities near sensitive receptors • Noise barrier near the sensitive areas

Environment Parameters	Impacts associated	Mitigation Measures
Water Pollution	• Sedimentation load in nearby water bodies due to run-off from construction areas • Chemical contamination due to run-off • Flow rate issue due to refurbishment of cross-drainage structures	• Silt fencing near surface water bodies • Flow rate shall be maintained as per existing scenario
Soil and land Contamination	• Soil contamination due to spillage of oil from construction and storage sites • Soil erosion near sloppy areas	• Oil will be stored in separate designated place having RCC foundation • Suitable turfing will be provided at slope
Ecological Disturbance	• Ecological disturbance due to construction activities in forest area • Forest area diversion and tree felling • Impact of fauna due to hunting and poaching	• Workers will be provided with sufficient fuel to avoid any tree cutting for the fuel purpose • Hunting and poaching will be not entertained by the workers • Compensatory afforestation will be done in minimum 1:2 ratio

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PROCUREMENT AND PACKAGING

4.0 PROCUREMENT AND PACKAGING

4.1 General

NHIDCL has decided to implement the two laning of Joram – Koloriang Road (NH-713) from km 20.0 to km 70 and km 138.000 to km 158.000(NH-713) in the state of Arunachal Pradesh on EPC mode.

EPC stands for engineering, procurement, construction and is a prominent form of contracting agreement in the highway construction industry. The engineering and construction contractor will carry out the detailed engineering design of the project, procure all the equipment and materials necessary and then construct to deliver the asset to client. In behalf of NHIDCL, the authority engineer will present in the site to execute the work. The client also places the project management team to overlook the EPC contractor. The PMC will ensure that EPC contractor is carrying out the works within the agreed scope of work in accordance with the contract and deliver the project within agreed time and budget.

Estimated Project Cost for first stretch of project corridor, existing chainage (km 20 to km 70) and design chainage (km 20 to km 59.363) is Rs 535.987 crores and for second stretch of project, existing chainage (km 138 to km 158) and design chainage (km 138 to km 154.036) is Rs 216.202 crores.

4.2 Packaging

Focuses on the technical requirement, social and cost, the project has been divided into four separate packages. The packages are stated below

1. Package-I(km20–km32+050), Length=12.050km
2. Package-III(km44+000–59+363), Length=15.363km
3. Package-III(km44+000–59+363), Length=15.363km
4. Package-IV(km138+000–km 154+036),Length=16.036km

The chainage w.r.t design chainage.

PRELIMINARY PROJECT COST ESTIMATE

5.0 PRELIMINARY PROJECT COST ESTIMATE

5.1 General

The preliminary project cost estimate has been prepared considering the various items of works associated with identified improvement proposals so as to assess the financial and economic costs for keeping provisions of finding as well as for evaluating viability of the project.

5.1.1 Methodology

Estimation of Quantities

Quantities of different items of work have been calculated on the basis of typical existing cross sections as developed from the information obtained through inventory and typical proposed cross sections. Quantities for other work items have also been computed based on proposed improvement, road alignment and widening proposals as recommended. The major items of work considered are:

- Site Clearance and Dismantling
- Earthwork
- Granular Sub Base and Base Courses
- Bituminous Courses (Flexible Pavement)
- Culverts
- Bridges
- Drainage and Protection Works
- Junctions
- Traffic Signs, Marking and Appurtenances
- Miscellaneous
- Maintenance

The Quantity Calculation of Earthwork in excavation/ filling of embankment has been calculated with Mx Roads software and calculation of pavement layer including subgrade is made on basis of Typical Cross Section.

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Unit Rates of Civil Works

The rate analysis has been prepared on basis of latest available SoR of Arunachal Pradesh in the year of 2014 & MORT&H data book.

The basis rate of Manpower and Machinery are adopted as per SoR and escalated rates @5% per year for financial year to bring the price of year 2016-17. The material rate has been increased Rs50/cum with the rate given in SoR as per site investigation.

The rate of Bitumen, Cement, Steel are adopted as per manufacturers rate and transportation cost , applicable taxes added thereon as tabulated below

Sl. No.	Items /Material	Source	Lead	Loading and Unloading	Remarks
1.	Bitumen	Rate is taken from IOCL website as on 1st July, 2016 for Haldia inclusive all taxes.	Haldia to Ziro 1460km and Ziro to site 1493km for km 20 to km 70 of NH-713 and km 1596km for km km 138 to km 158.	Loading at haldia and unloading HMP Plant Site.	
2.	Cement	Calcom Cement India Ltd. NHIDCL/Inampro/2015, from website -INAM Pro Annexure - I	From Nagaon, Lead 369km for km 20 to km 70 of NH-713 and km 472km for km km 138 to km 158.	Loading at Nagaon and unloading Camp Site.	
3.	Steel	SAIL Depot , Guwahati	From Guwahati, Lead 564km for km 20 to km 70 of NH-713 and km 667km for km 138 to km 158.	Loading at Guwahati and unloading camp Site.	
4.	Aggregate	Aggregate is considered Hill Cut material for construction of GSB and WMM. The average lead considered for hill cut aggregate is 5km. The aggregate for construction of BC, DBM and concrete is considered from Sangram. The average Lead from Sangram is taken 74km in surface road and 3km in unsurface road for km 20 to km 70 of NH-713. The average Lead from Sangram is taken 27km in surface road and 3km in unsurface road for km 138 to km 158.			

Land Acquisition Cost

Based on the ROW information obtained so far and widening schemes proposed at different locations, area of acquisition has been worked out.

Total quantum of LA, as mentioned earlier is 41.01 Ha for km 138.00 to km 154.036 and 105.35 Ha for km 20.00 to km 59.363. The land rate is Rs 11/per sqm for jhoom land, Rs 86/ per sqm and Rs. 300/ per sqm. for fish land so far as local enquiry is concerned. These rate have been employed while calculating the LA cost. According to this consideration total LA cost comes out to be about 2.34 crores for km 20 to km 59.363 and about 8.58millions for km 138 to km 154.036. The final rates adopted for land acquisition has been arrived at by adding 30% solatium, 8% as establishment charges and 2% as contingency charges on the basic land acquisition cost.

Cost Estimates

Considering various items of works associated with identified improvements and current unit rates, cost estimate has been prepared for use in subsequent economic evaluation.

Package	Design Chainage		Civil Cost(Cr)	Total Project Cost(Cr)
	From	To		
Package -I	Km 20+000	Km 32+050	123.650	160.796
Package -II	Km 32+050	Km 44+000	124.669	162.122
Package -III	Km 44+000	Km 53+363	163.843	213.065
Package-IV	Km 138+000	Km 154+036	176.413	229.411

In addition to this Estimated Project Cost, cost for afforestation, environmental, LA costs, social costs and utility shifting costs are to be considered, which have been tentatively estimated, as mentioned below, at this stage.

The package wise cost of summary is presented in **Table 5.1 to 5.4.**

Table 5.1: ABSTRACT OF COST : PACKAGE- I (KM 20+000 to KM 32+050)				
Sl. No	**Description**	**Percentage Weightage vis a vis overall project**	**Amount (in RS)**	**percentage Weightage vis a vis Overall Project**

				Cost
	Design Length in Km	**12.050**		
	A- Widening and strengthening of existing road			
Road works including culverts, minor bridges, underpasses, overpasses, approaches to ROB/RUB/ Major Bridges/ Structures (but excluding service roads)	(1) Earthwork up to top of the sub-grade including excavation in soil, soft rock and hard rock including Cleaning & grubbing with required site clearance etc.	65.39%	161995996	13.10%
	(2) Granular work (sub- base, shoulders)		45503744	3.68%
	(3) Bituminous work			
	a)DBM With Prime coat & Tack coat.		50498325	4.08%
	b)BC with Tack coat.		31250459	2.53%
	B - New 2-Lane alignment			
	(1) Earthwork up to top of the sub-grade including excavation in soil, soft rock and hard rock including Cleaning & grubbing with required site clearance etc.		263673627	21.32%
	(2) Granular work (sub- base, shoulders)		63310979	5.12%
	(3) Bituminous work			
	a)DBM With Prime coat & Tack coat.		71285424	5.77%
	b)BC with Tack coat.		44006536	3.56%
	C- New culverts, minor bridges, underpasses, overpasses on existing road, realignments, bypasses:			
	(1)Box / Slab culvert		76977320	6.23%
	D-Other Engineering Works			
Other Works	Road Appurtenances	34.61%	1027926	0.08%
	Road side drain & toe wall		50753318	4.10%
	Traffic Sign		700821	0.06%
	Pavement Marking		4714076	0.38%
	Crash barrier/W metal crash barrier		15971706	1.29%
	Protection Work (Provision of Rip-Rap or similar work in valley side of the curves as special safety features)		2963200	0.24%
	Boundary stone, km Stone,5th km stone and hectometer stone		112690	0.01%
	Traffic blinker LED delineator, stud, reflective payment marker, tree reflector		2859968	0.23%
	Bus bays and Bus Shelter		1089468	0.09%

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	Minor Junction		18779663	1.52%
	Overhead signboard		313047	0.03%
	Plantation (Vetiver, Hydro seeding and Mulching or similar techniques etc.) for slope protection on exposed hill slopes as slide mitigation measure.		40669800	3.29%
	Road side drain I/C chute drain		19827600	1.60%
	Repair for protection work			
	Passing Places		1018039	0.08%
	(vi)Repairs to bridges/structures			
	(vii)Protection Works			
	Breast Wall		228245804	18.46%
	Retaining Wall		21889507	1.77%
	Parapet		17056060	1.38%
A	**Civil Cost**		**1236495103**	**123.65**
	Cost/KM at Civil Cost		102613702	10.26
B	Contingency Charges @ 2.8% of Civil Cost (A)	2.80%	34621863	3.46
C	**SUB TOTAL (A+B)**		**1271116966**	**127.11**
D	Supervision @ 3% on C	3.00%	38133509	3.81
E	Agency Charges @ 3% on C	3.00%	38133509	3.81
F	Quality Control @ 0.25 % on C	0.25%	3177792	0.32
G	Road Safety Cell Audit Charges @ 0.25% on C	0.25%	3177792	0.32
H	**Sub-Total (C+D+E+F+G)**		**1353739569**	**135.37**
I	Maintenance for 4 years @ 5% on C	5.00%	63555848	6.36
J	Escalation @ 5% per annum for 3 years on C	5.00%	190667545	19.07
K	***Grand Total (H+I+J)***		***1607962962***	***160.80***
	Cost of Land Acquisition etc.		6455000	0.65
	Solatium Charges @ 30% on land value		1936500	
	Establishment Charges @ 8% on land value		516400	
	Contingency Charges @ 2% on land value		129100	
	Total Cost of Land Acquisition etc.		9037000	
	Total Cost of R&R		7500000	
	Shifting of Utility Service		6061000	0.61
	Environment Cost		6061000	0.61
	Total Cost		**1636621962**	**163.66**
	Cost/KM at Total Cost		**135819250**	**13.58**

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Table 5.2: ABSTRACT OF COST : PACKAGE- II (KM 32+050 to KM 44+000)				
Item	**Description**	**Weightage in percentage to the Contact Price**	**Amount (in RS)**	**percentage Weightage vis a vis Overall Project Cost**
	Design Length in Km	11.950		
	A- Widening and strengthening of existing road			
Road works including culverts, minor bridges, underpasses, overpasses, approaches to ROB/RUB/ Major Bridges/ Structures	(1) Earthwork up to top of the sub-grade including excavation in soil, soft rock and hard rock including Cleaning & grubbing with required site clearance etc.	73.19%	105443117	8.46%
	(2) Granular work (sub- base, shoulders)		27241048	2.19%
	(3) Bituminous work			
	a)DBM With Prime coat & Tack coat.		31906879	2.56%
	b)BC with Tack coat.		17364819	1.39%
	B - New 2-Lane alignment			
	(1) Earthwork up to top of the sub-grade including excavation in soil, soft rock and hard rock including Cleaning & grubbing with required site clearance etc.		375821828	30.15%
	(2) Granular work (sub- base, shoulders)		79906647	6.41%
	(3) Bituminous work			
	a)DBM With Prime coat & Tack coat.		94185678	7.55%
	b)BC with Tack coat.		51327692	4.12%
	C- New culverts, minor bridges, underpasses, overpasses on existing road, realignments, bypasses:			
	(1)Box / Slab culvert		103966492	8.34%
	(2) Minor Bridge		25238910	2.02%
	D-Other Engineering Works			
Other Works	Road Appurtenances	26.81%	665883	0.05%
	Protection Work (Provision of Rip-Rap or similar work in valley side of the curves as special safety features)		1654400	0.13%
	Road side drain & toe wall		55058103	4.42%
	Traffic Sign		632032	0.05%
	Pavement Marking		4711114	0.38%
	Crash barrier/W metal crash barrier		14220946	1.14%

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	Boundary stone, km Stone,5th km stone and hectometer stone		99109	0.01%
	Traffic blinker LED delineator, stud, reflective payment marker, tree reflector		329284	0.03%
	Bus bays and Bus Shelter		363156	0.03%
	Minor Junction		11556716	0.93%
	Plantation (Vetiver, Hydro seeding and Mulching or similar techniques etc.) for slope protection on exposed hill slopes as slide mitigation measure.		22548360	1.81%
	Road side catch water drain		13345500	1.07%
	Passing Places		1018039	0.08%
	Breast Wall		180085115	14.45%
	Retaining Wall		18881012	1.51%
	Parapet		9116000	0.73%
A	**Civil Cost**		**1246687879**	**124.67**
	Cost/KM at Civil Cost		104325346	10.43
B	Contingency Charges @ 2.8% of Civil Cost (A)	2.80%	34907261	3.49
C	**SUB TOTAL (A+B)**		**1281595139**	**128.16**
D	Supervision @ 3% on C	3.00%	38447854	3.84
E	Agency Charges @ 3% on C	3.00%	38447854	3.84
F	Quality Control @ 0.25 % on C	0.25%	3203988	0.32
G	Road Safety Cell Audit Charges @ 0.25% on C	0.25%	3203988	0.32
H	**Sub-Total (C+D+E+F+G)**		**1364898823**	**136.49**
I	Maintenance for 4 years @ 5% on C	5.00%	64079757	6.41
J	Escalation @ 5% per annum for 3 years on C	5.00%	192239271	19.22
K	***Grand Total (H+I+J)***		***1621217851***	***162.12***
	Cost of Land Acquisition etc.		6455000	0.65
	Solatium Charges @ 30% on land value		1936500	0.19
	Establishment Charges @ 8% on land value		516400	0.05
	Contingency Charges @ 2% on land value		129100	0.01
	Total Cost of Land Acquisition etc.		9037000	0.90
	Total Cost of R&R		7500000	0.75
	Shifting of Utility Service		6061000	0.61
	Environment Cost		6061000	0.61
	Total Cost		**1649876851**	**164.99**
	Cost/KM at Total Cost		**138065008**	**13.81**

Table 5.3: ABSTRACT OF COST: PACKAGE- III (KM 44+000 to KM 59+363)

Sl. No	Description	Weightage in percentage to the Contact Price	Amount (in RS)	percentage Weightage vis a vis Overall Project Cost
	Design Length in Km	**15.363**		
	A- Widening and strengthening of existing road			
Road works including culverts, minor bridges, underpasses, overpasses, approaches to ROB/RUB/ Major Bridges/ Structures	(1) Earthwork up to top of the sub-grade including excavation in soil, soft rock and hard rock including Cleaning & grubbing with required site clearance etc.	74.18%	310392536	18.94%
	(2) Granular work (sub- base, shoulders)		57298638	3.50%
	(3) Bituminous work			
	a)DBM With Prime coat & Tack coat.		69034849	4.21%
	b)BC with Tack coat.		37585134	2.29%
	(4)Widening and repair of culvert		140000	0.01%
	B - New 2-Lane alignment			
	(1) Earthwork up to top of the sub-grade including excavation in soil, soft rock and hard rock including Cleaning & grubbing with required site clearance etc.		326237944	19.91%
	(2) Granular work (sub- base, shoulders)		78191619	4.77%
	(3) Bituminous work			
	a)DBM With Prime coat & Tack coat.		92164181	5.63%
	b)BC with Tack coat.		50226051	3.07%
	C- New culverts, minor bridges, underpasses, overpasses on existing road, realignments, bypasses:			
	(1)Box / Slab culvert		122023750	7.45%
	(2) Minor Bridge		72137970	4.40%
	D-Other Engineering Works			
Other Works	Road Appurtenances	25.82%	640563	0.04%
	Protection Work (Provision of Rip-Rap or similar work in valley side of the curves as special safety features)		2583040	0.16%
	Road side drain & toe wall		101696074	6.21%
	Traffic Sign		715900	0.04%
	Pavement Marking		6055356	0.37%

Table 5.3: ABSTRACT OF COST: PACKAGE- III (KM 44+000 to KM 59+363)

Sl. No	Description	Weightage	Amount (in	percentage
	Crash barrier/W metal crash barrier		10675657	0.65%
	Boundary stone, km Stone,5th km stone and hectometer stone		144871	0.01%
	Traffic blinker LED delineator,stud,reflective payment marker, tree reflector		513917	0.03%
	Bus bays and Bus Shelter		726312	0.04%
	Minor Junction		13723600	0.84%
	Overhead Sign board		313047	0.02%
	Plantation (Vetiver, Hydro seeding and Mulching or similar techniques etc.) for slope protection on exposed hill slopes as slide mitigation measure.		30384620	1.85%
	Road side drain		17936352	1.09%
	Truck layby		1435204	0.09%
	Passing Places		1018039	0.06%
	Breast Wall		204583917	12.49%
	Retaining Wall		15333363	0.94%
	Parapet		14518656	0.89%
A	**Civil Cost**		**1638431160**	**163.84**
	Cost/KM at Civil Cost		106647866	10.66
B	Contingency Charges @ 2.8% of Civil Cost (A)	2.80%	45876072	4.59
C	**SUB TOTAL (A+B)**		**1684307232**	**168.43**
D	Supervision @ 3% on C	3.00%	50529217	5.05
E	Agency Charges @ 3% on C	3.00%	50529217	5.05
F	Quality Control @ 0.25 % on C	0.25%	4210768	0.42
G	Road Safety Cell Audit Charges @ 0.25% on C	0.25%	4210768	0.42
H	**Sub-Total (C+D+E+F+G)**		**1793787202**	**179.38**
I	Maintenance for 4 years @ 5% on C	5.00%	84215362	8.42
J	Escalation @ 5% per annum for 3 years on C	5.00%	252646085	25.26
K	***Grand Total (H+I+J)***		***2130648649***	***213.06***
	Cost of Land Acquisition etc.		8391000	**0.84**
	Solatium Charges @ 30% on land value		2517300	
	Establishment Charges @ 8% on land value		671280	
	Contingency Charges @ 2% on land value		167820	
	Total Cost of Land Acquisition etc.		11747400	
	Total Cost of R&R		7500000	
	Shifting of Utility Service		6061000	**0.61**
	Environment Cost		6061000	**0.61**

Table 5.3: ABSTRACT OF COST: PACKAGE- III (KM 44+000 to KM 59+363)				
Sl. No	**Description**	**Weightage**	**Amount (in**	**percentage**
	Total Cost		**2162018049**	**216.20**
	Cost/KM at Total Cost		**140728897**	**14.07**

Table 5.4: ABSTRACT OF COST: PACKAGE- IV (KM 138+000 to KM 154+036)				
Item	**Description**	**Weightage in percentage to the Contact Price**	**Amount (in RS)**	**Percentage Weightage vis a vis Overall Project Cost**
	Design Length in Km	**16.036**		
	A- Widening and strengthening of existing road			
Road works including culverts, minor bridges, underpasses, overpasses, approaches to ROB/RUB/ Major Bridges/ Structures (but excluding service roads)	(1) Earthwork up to top of the sub-grade including excavation in soil, soft rock and hard rock including Cleaning & grubbing with required site clearance etc.	72.23%	142289599	8.07%
	(2) Granular work (sub- base, shoulders)		39600004	2.24%
	(3) Bituminous work			
	a)DBM With Prime coat & Tack coat.		44925451	2.55%
	b)BC with Tack coat.		24558083	1.39%
	B - New 2-Lane alignment			
	(1) Earthwork up to top of the sub-grade including excavation in soil, soft rock and hard rock including Cleaning & grubbing with required site clearance etc.		376028474	21.32%
	(2) Granular work (sub- base, shoulders)		98335542	5.57%
	(3) Bituminous work			
	a)DBM With Prime coat & Tack coat.		111238516	6.31%
	b)BC with Tack coat.		60896469	3.45%
	C- New culverts, minor bridges, underpasses, overpasses on existing road,			

	realignments, bypasses:			
	(1)Box / Slab culvert		245928058	13.94%
	(2) Minor Bridges		130445450	7.39%
	D-Other Engineering Works			
Other Works	Major Junction		2398057	0.14%
	Road Appurtenances	27.77%	750600	0.04%
	Road side drain & toe wall		80828385	4.58%
	Traffic Sign		3306761	0.19%
	Pavement Marking		6352320	0.36%
	Crash barrier/W metal crash barrier		17153469	0.97%
	Protection Work (Provision of Rip-Rap or similar work in valley side of the curves as special safety features)		2329600	0.13%
	Boundary stone, km Stone,5th km stone and hectometer stone		204397	0.01%
	Traffic blinker LED delineator, stud, reflective payment marker, tree reflector		463493	0.03%
	Bus bays and Bus Shelter		309158	0.02%
	Minor Junction		7194170	0.41%
	Overhead signboard		643797	0.04%
	Plantation (Vetiver, Hydro seeding and Mulching or similar techniques etc.) for slope protection on exposed hill slopes as slide mitigation measure.		29173920	1.65%
	Road side drain I/C chute drain, catch water drain		33572000	1.90%
	Passing Places		2532192	0.14%
	(vii)Protection Works			
	Breast Wall		234659095	13.30%
	Retaining Wall		63959850	3.63%
	Breast Wall Sausage Type		0	0.00%
	Parapet		4052620	0.23%
	Civil Cost		**1764129530**	**176.41**
	Cost/KM at Civil Cost		**110010572**	**11.00**
B	Contingency Charges @ 2.8% of Civil Cost (A)	2.80%	49395627	4.94
C	**SUB TOTAL (A+B)**		**1813525157**	**181.35**
D	Supervision @ 3% on C	3.00%	54405755	5.44
E	Agency Charges @ 3% on C	3.00%	54405755	5.44
F	Quality Control @ 0.25 % on C	0.25%	4533813	0.45
G	Road Safety Cell Audit Charges	0.25%	4533813	0.45

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	@ 0.25% on C			
H	**Sub-Total (C+D+E+F+G)**		**1931404292**	**193.14**
I	Maintenance for 4 years @ 5% on C	5.00%	90676258	9.07
J	Escalation @ 5% per annum for 3 years on C	5.00%	272028774	27.20
K	***Grand Total (H+I+J)***		***2294109323***	***229.41***
	Cost of Land Acquisition etc.		7796100	0.78
	Solatium Charges @ 30% on land value		2338830	
	Establishment Charges @ 8% on land value		623688	
	Contingency Charges @ 2% on land value		155922	
	Total Cost of Land Acquisition etc.		10914540	
	Total Cost of R&R		7500000	
	Shifting of Utility Service		11471000	
	Environment Cost		22942000	
	Total Cost		**2346936863**	**234.69**
	Cost/KM at Total Cost		**146354257**	**14.64**

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DEVELOPMENT PROPOSALS

6.0 DEVELOPMENT PROPOSALS

6.1 General

The salient proposals for upgradation and improvement of the project road are classified into the following engineering aspects.

- Widening of the project road based on traffic capacity.
- Improving the horizontal and vertical geometry of the existing road based on the design standards.
- Extra widening done for curve radii between 40m and 300m. A detail of the existing curve radii and the subsequent extra widening are presented in **Annexure 6.1.**
- Design of new pavement for widening and strengthening of the existing road.
- Improvement of all major and minor intersections.
- Rehabilitation and widening of the existing structures including bridges, culverts etc. and design of new ones.
- Provision of comprehensive road furniture for complete road safety.

6.2 Geometric Design Standards

The design standards proposed to be adopted are indicated in **Table 6.1**.

Table 6.1: Geometric Design Standards

Sl No.	Attributes	Geometric Design Standards		Adopted in Design
		Two lane Manual	Hill Manual	
		IRC:SP-73: 2015	IRC:SP-48-1998	
	Design Speed			
1	Mountainous and Steep Terrain (Cross slope of the ground between 25 to 60 percent)	Ruling: 60 kmph Minimum: 40 kmph	Ruling: 40 kmph Minimum: 30 kmph	Ruling: 40 kmph Minimum: 30 kmph
2	Carriageway Width	2 x 3.5m	2 x 3.75m	2 x 3.5m
3	Width of Shoulder			
	a) Paved Shoulder	2 x 1.5 m	2 x 1.25m	2 x 1.5 m

Sl No.	Attributes	Geometric Design Standards		Adopted in Design
		Two lane Manual	**Hill Manual**	
		IRC:SP-73: 2015	**IRC:SP-48-1998**	
	b) Earthen Shoulder (For valley with lesser depth)	1.0 m		1.0 m at valley side
4	Footpath width at built-up areas	2 x 2.5 m or 2 x 1.5 m (depending upon space availability)		2 x 2.5 m or 2 x 1.5 m (depending upon space availability)
5	Camber			
	a) Carriageway	2.5%	2% to 2.5%	2.5%
	b) Shoulder	3.0%	3.0%	3.0%
6	Maximum and Minimum Super-elevation	Maximum limited to 7.0% Minimum limited to Camber (2.5%)	Maximum limited to 10.0% for hill areas not snow bound. Minimum limited to Camber (2.5%)	Maximum limited to 7.0% Minimum limited to Camber (2.5%)
7	Minimum Radius of Horizontal Curves			
	a) Mountainous and Steep Terrain	Desirable Minimum: 150m Absolute Minimum: 75m	Desirable Minimum: 50m Absolute Minimum: 30m	Desirable Minimum: 50m Absolute Minimum: 30m
8	Sight Distances for Various Speeds	45m – 90m	45m – 90m	45m – 90m
9	Longitudinal Gradient			
	a) Mountainous Terrain	Ruling: 5.0%, Limiting: 6.0%	Ruling: 5.0%, Limiting: 6.0%	Ruling: 5.0%, Limiting: 6.0%
10	Extra Width of Pavement			
	Radius of Curve	Extra Width		
	41-60m		1.2m	1.2m
	75-100m	0.9m	0.9m	0.9m
	101-300m	0.6m	0.6m	0.6m

Typical cross sections adopted for development of the project highway are attached as **Figure 6.1** to **6.4**, these are included in Volume-III, also.

Typical Cross Section

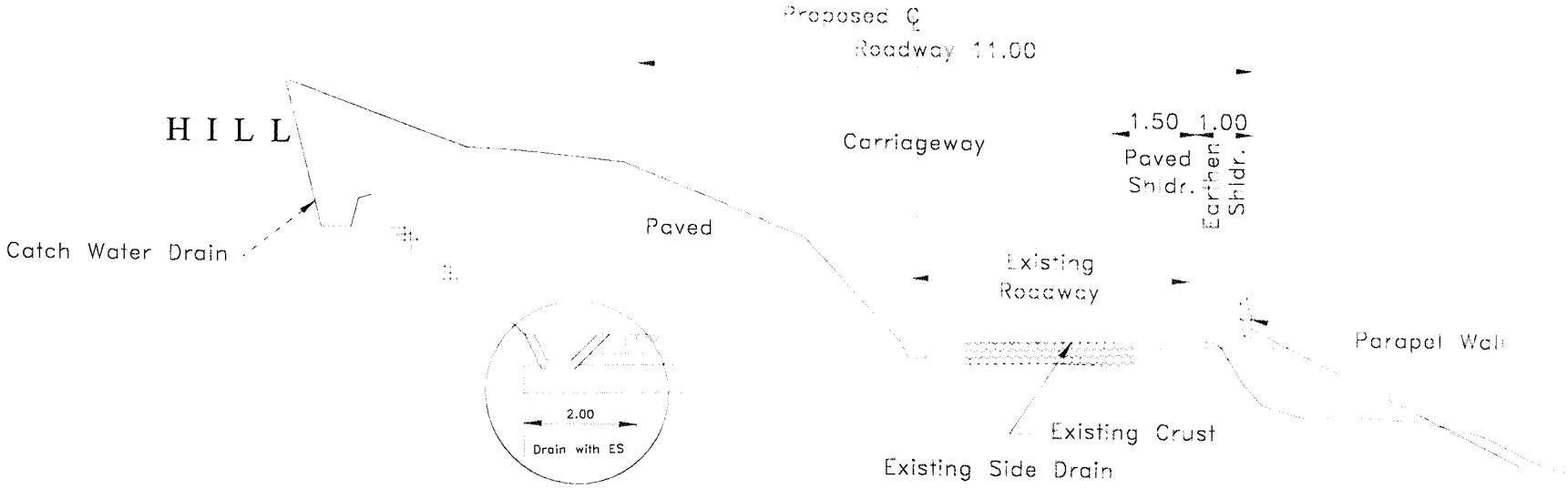

Fig 6.1: TYPICAL CROSS SECTION OF 2 LANE CARRIAGEWAY VALLEY
(Mountainous Terrain without retaining wall and parapet)

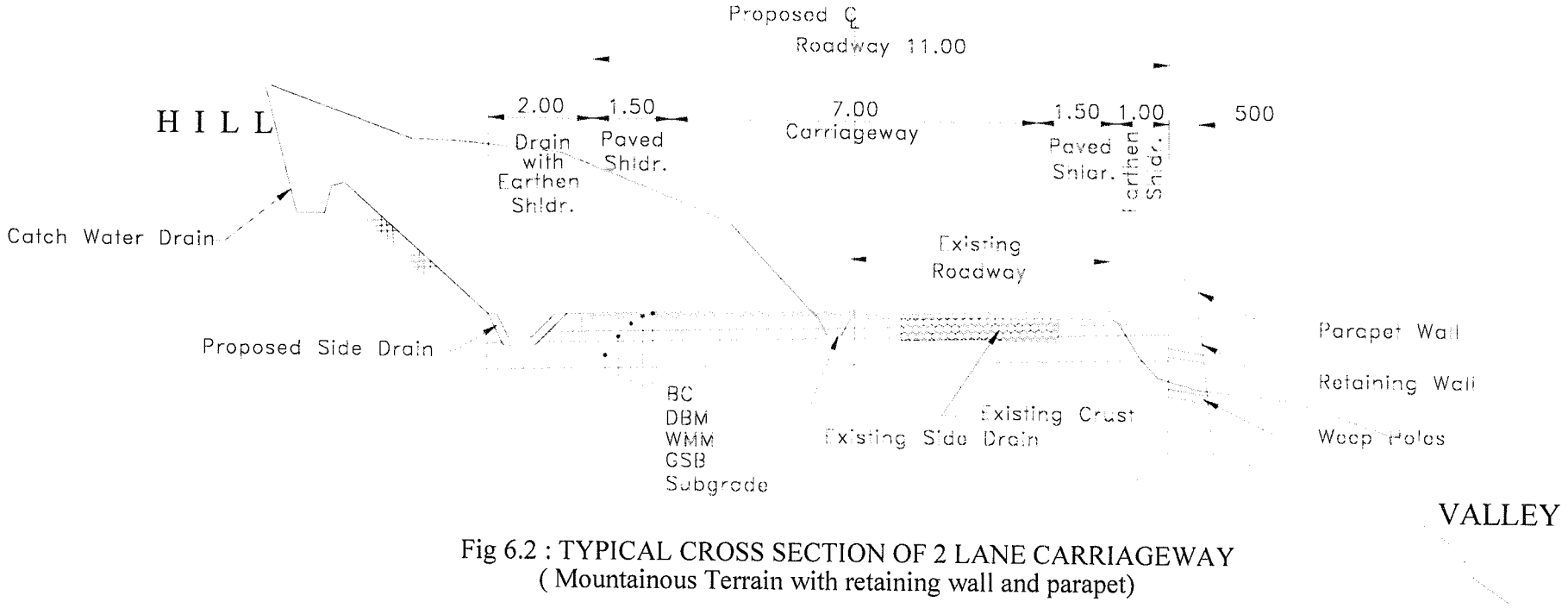

Fig 6.2 : TYPICAL CROSS SECTION OF 2 LANE CARRIAGEWAY
(Mountainous Terrain with retaining wall and parapet)

Note:

1. Breast Wall to be considered at the hill side cut section as required.

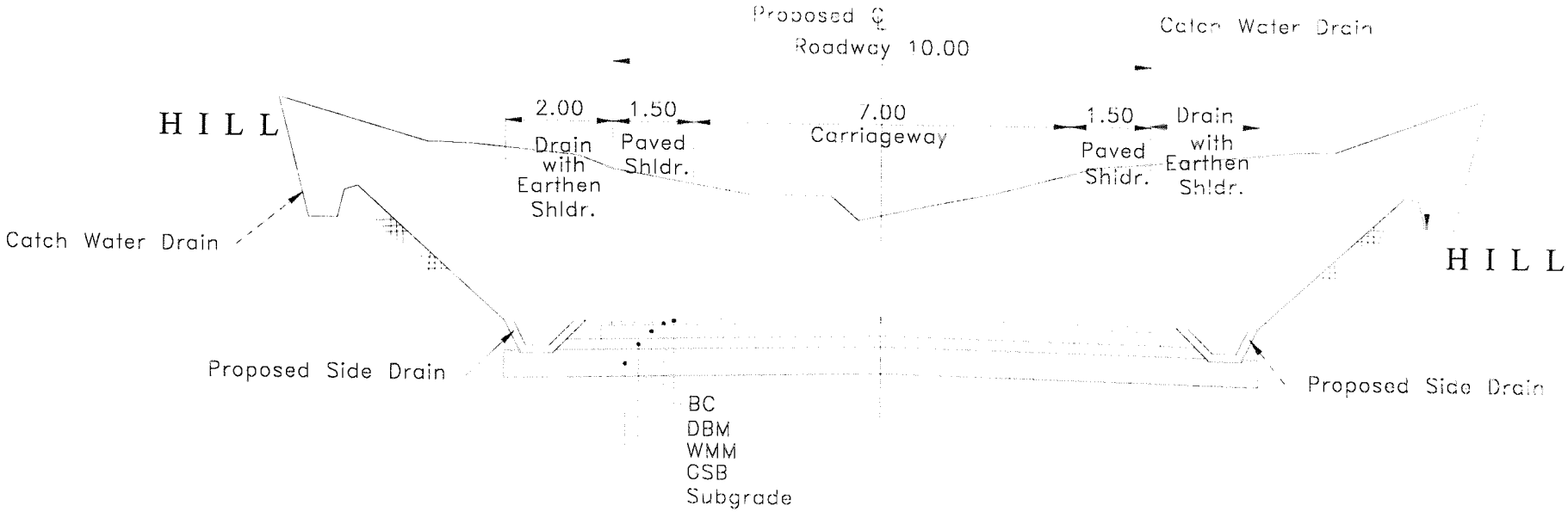

Fig 6.3 : TYPICAL CROSS SECTION OF REALIGNMENT BY HILL CUTTING

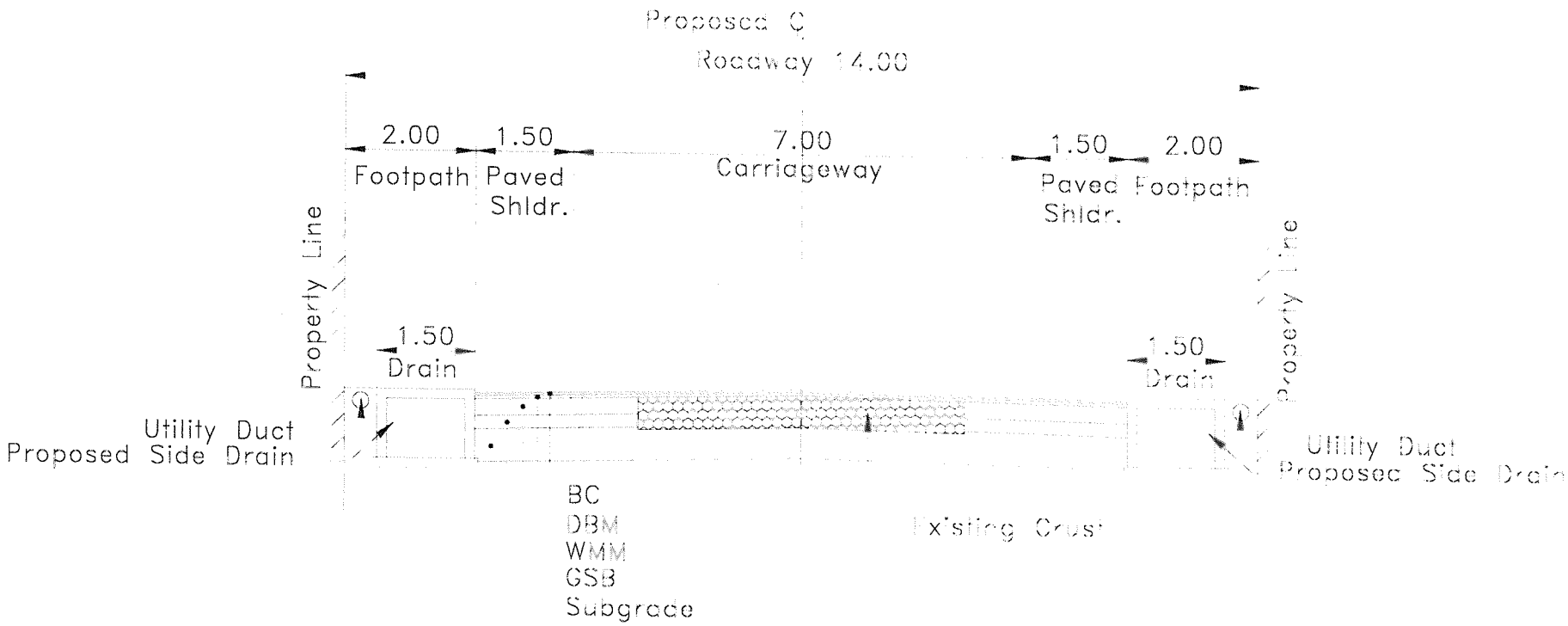

Fig 6.4 : TYPICAL CROSS SECTION OF PAVEMENT IN BUILT-UP AREA

6.3 Widening and Strengthening of Carriageway

In all the cases the shoulders have to be rebuilt and all sections are required to be widened to two lane carriageway.

6.4 Extra Widening for curves with small radii

A table for extra widening has been provided as **Annexure 6.1.**
This will be incorporated in the plan during the Final Feasibility Report stage after approval of the alignment.

6.5 Proposals for Realignments

No bypass is required for the project highway. However, minor realignments have been identified at several locations for geometric improvement as mentioned in **Table 6.2**.

Table 6.2: List of Minor Realignments

DESIGN CHAINAGE		EXISTING CHAINAGE		LENGTH
FROM	TO	FROM	TO	(m)
20200	20600	20280	21018	400
20600	20610	21018	21050	10
20610	20690	21050	21100	80
20690	20700	21100	21145	10
20700	21000	21145	21510	300
21130	21140	21650	21660	10
21240	21270	21760	21790	30
21270	21840	21790	22460	570
21840	21850	22460	22480	10
21850	21940	22480	22570	90
21940	21990	22570	22630	50
21990	22000	22630	22640	10
22200	22220	22870	22890	20
22220	22230	22890	22900	10
22230	22300	22900	23000	70
22300	22310	23000	23010	10
22310	22700	23010	23460	390
22850	23000	23610	23805	150
23500	24000	24350	25700	500

DESIGN CHAINAGE		EXISTING CHAINAGE		LENGTH
FROM	TO	FROM	TO	(m)
24500	24700	26300	26510	200
24700	24710	26510	26520	10
24710	25010	26520	26860	300
25010	25090	26860	26950	80
25090	25500	26950	27550	410
25800	27400	27860	29990	1600
27600	27630	30195	30225	30
27630	27650	30225	30250	20
27650	28310	30250	31080	660
28310	28350	31080	31140	40
28350	28400	31140	31180	50
28680	28720	31465	31510	40
28720	28920	31510	31710	200
28920	28970	31710	31760	50
29600	29790	32410	32680	190
29790	29820	32680	32722	30
29820	30200	32722	33160	380
30400	30600	33360	33595	200
30800	31300	33803	34335	500
31480	31600	34515	34700	120
33400	33950	36562	37310	550
33950	33970	37310	37350	20
33970	34280	37350	37690	310
34280	34290	37690	37700	10
34290	35145	37700	38710	855
35145	35155	38710	38720	10
35155	35175	38720	38740	20
35175	35185	38740	38750	10
35185	35215	38750	38765	30
35215	35235	38765	38785	20
35235	35265	38785	38815	30
35265	35285	38815	38840	20
35285	35530	38840	39190	245
35530	35540	39190	39195	10
35540	35600	39195	39260	60
35600	35610	39260	39270	10
35610	35890	39270	39650	280
35890	35900	39650	39660	10

DESIGN CHAINAGE		EXISTING CHAINAGE		LENGTH
FROM	TO	FROM	TO	(m)
35900	36030	39660	39823	130
36030	36040	39823	39840	10
36040	36080	39840	39900	40
36080	36090	39900	39910	10
36090	36480	39910	40460	390
36480	36500	40460	40490	20
36500	36790	40490	40860	290
36790	36825	40860	40900	35
36825	36845	40900	40920	20
36845	36855	40920	40930	10
36855	36890	40930	40970	35
36890	36920	40970	41000	30
36920	37005	41000	41112	85
37005	37025	41112	41135	20
37025	37715	41135	42160	690
37715	37725	42160	42170	10
37725	37830	42170	42300	105
37830	37850	42300	42320	20
37850	38000	42320	42615	150
38200	38590	42860	43295	390

DESIGN CHAINAGE		EXISTING CHAINAGE		LENGTH
FROM	TO	FROM	TO	(m)
44000	44080	50050	50180	80
44100	44180	50190	50300	80
44200	44230	50330	50360	30
44340	44420	50485	50610	80
44540	44580	50725	50760	40
44640	44720	50830	50950	80
44790	44960	51010	51270	170
45070	45310	51370	51850	240
45430	45510	51970	52130	80
45590	45620	52200	52225	30
45730	45800	52375	52440	70
45830	45920	52490	52675	90
46000	46110	52745	52850	110
46190	46230	52930	52975	40

DESIGN CHAINAGE		EXISTING CHAINAGE		LENGTH
FROM	TO	FROM	TO	(m)
46360	46560	53100	53305	200
46580	46900	53350	53890	320
46960	47780	53950	55150	820
47880	48000	55330	55460	120
48500	48850	56160	56550	350
48880	48950	56580	56640	70
49230	49250	56930	57000	20
49370	49390	57110	57150	20
49420	49650	57200	57550	230
49690	49980	57595	57900	290
50000	50230	57920	58330	230
50270	50290	58350	58370	20
50310	50340	58400	58480	30
50460	50580	58590	58700	120
50630	50670	58800	58820	40
50960	51080	59150	59250	120
51180	51270	59350	59450	90
51390	51460	59630	59700	70
51630	52310	59900	60650	680
52360	52675	60705	61060	315
52685	52840	61070	61250	155
52870	52950	61270	61400	80
53020	53070	61510	61600	50
53346	53500	61910	62070	154
53700	55250	62270	64350	1550
55400	57200	64505	66790	1800

DESIGN CHAINAGE		EXISTING CHAINAGE		LENGTH
FROM	TO	FROM	TO	(m)
138150	138160	138165	138175	10
138160	138200	138175	138220	40
138200	138300	138220	138320	100
138300	138350	138320	138370	50
138400	138410	138420	138430	10
138410	138500	138430	138530	90
138550	138700	138580	138750	150
138700	138710	138750	138760	10
138710	138910	138760	139020	200
138910	138940	139020	139060	30
138940	138990	139060	139115	50

DESIGN CHAINAGE		EXISTING CHAINAGE		LENGTH
FROM	TO	FROM	TO	(m)
138990	139000	139115	139125	10
139000	139040	139125	139180	40
139040	139160	139180	139305	120
139160	139210	139305	139360	50
139210	139500	139360	139690	290
139500	139620	139690	139800	120
139620	140450	139800	140685	830
140450	140510	140685	140750	60
140510	140550	140750	140800	40
140800	140960	140060	141215	160
140960	141010	141215	141270	50
141010	141090	141270	141350	80
141090	141100	141350	141360	10
141200	141240	141470	141520	40
141240	141500	141520	141830	260
141650	142350	142005	142730	700
142400	142500	142780	142885	100
142500	142550	142885	142935	50
142550	143210	142935	143803	660
143210	143220	143803	143813	10
143220	143400	143813	144000	180
143650	143700	144253	144305	50
143700	143770	144305	144380	70
143770	143870	144380	144475	100
143870	144100	144475	144710	230
144500	144550	145120	145170	50
144550	144660	145170	145280	110
144660	144720	145280	145340	60
144720	144840	145340	145450	120
144840	144900	145450	145660	60
145000	145020	145790	145810	20
145020	145120	145810	145910	100
145120	145220	145910	146030	100
145220	145250	146030	146060	30
145250	145340	146060	146150	90
145340	145360	146150	146170	20
145360	145550	146170	146370	190
145550	145610	146370	146440	60
145610	145670	146440	146660	60
145670	145710	146660	146560	40
145710	146200	146560	147290	490

DESIGN CHAINAGE		EXISTING CHAINAGE		LENGTH
FROM	TO	FROM	TO	(m)
146250	146450	147350	147600	200
146450	146460	147600	147610	10
146460	146900	147610	148100	440
147000	147090	148190	148410	90
147090	147170	148410	148480	80
147170	147230	148480	148550	60
147230	147250	148550	148570	20
147250	147370	148570	148690	120
147370	147410	148690	148730	40
147410	148400	148730	149940	990
148400	148440	149940	149970	40
148440	148550	149970	150100	110
148550	148570	150100	150115	20
148570	148830	150115	150405	260
148830	148860	150405	150435	30
148860	148940	150435	150550	80
148940	149000	150550	150615	60
149000	149100	150615	150720	100
149100	149180	150720	150805	80
149180	149250	150805	150880	70
149250	149270	150880	150900	20
149270	149310	150900	150940	40
149310	149350	150940	150980	40
149350	149430	150980	151050	80
149430	149450	151050	151070	20
149450	149720	151070	151405	270
149720	149770	151405	151455	50
149770	149800	151455	151500	30
149800	149810	151500	151510	10
149810	149990	151510	151700	180
149990	150010	151700	151720	20
150010	150080	151720	151795	70
150080	150100	151795	151820	20
150100	150300	151820	151060	200
150400	150410	152170	152180	10
150410	150470	152180	152245	60
150470	150490	152245	152265	20
150490	150750	152265	152550	260
150850	151300	152660	153100	450
151400	151620	153200	153420	220
151620	151640	153420	153450	20

DESIGN CHAINAGE		EXISTING CHAINAGE		LENGTH
FROM	TO	FROM	TO	(m)
151640	151800	153450	153750	160
151800	151810	153750	153760	10
151810	152100	153760	154195	290
152100	152110	154195	154200	10
152110	152220	154200	154370	110
152220	152260	154370	154410	40
152260	152300	154410	154455	40
152300	152340	154455	154495	40
152340	152540	154495	154715	200
152540	152570	154715	154745	30
152570	152670	154745	154870	100
152670	152690	154870	154900	20
152690	153323	154900	155810	633
153323	154036	155810	156535	713

6.6 Pavement Design

The pavement composition to be considered is given below:

(a) New Construction and Widening Stretches

The adopted pavement thicknesses for new and widened pavement are given in **Table 6.3**.

Table 6.3 : Pavement Composition for New/Widened Pavement

Pavement Composition	Thickness (mm)
BC	40
DBM	80
WMM	250
GSB	200
Sub-grade	500

Sub-grade CBR of 10% (4 Days Soaked) and 20 MSA have been considered for 15 years design period for pavement design. Min 20 MSA has been considered as recommended in Paragraph 5.4.1 of IRC:SP:73-2015 .

6.7 Life Cycle Cost Analysis

In the Life Cycle Cost analysis the present values of all the costs for each of the options have been computed. User-delay costs and residual life of materials have not been considered to

compare different alternatives / options of pavement composition. The analysis gave the following results in respect of the per kilometer development of proposed new carriageway for two-lane with paved shoulders. Life cycle cost analysis is given in **Table 6.4**

Table 6.4: Comparison of Cost (in Rs) of Rigid/ Flexible Pavement

Particulars	Options		Ratio of Rigid to Flexible Option
	Flexible	Rigid	
Initial Construction Cost (Rs.)	24272829	35416515	1.459
Present value of all Costs (Rs.)	32358019	37322237	1.153

Thus the flexible option for the new carriageway proves to be advantageous from both economic angle (life cycle cost) and initial construction cost. Accordingly, this option (flexible pavement option) is recommended for adoption for the project road. To make the comparison, following average parameters for pavement have been take:

Flexible pavement: BC=40mm, DBM=80mm, WMM=250mm and GSM=200mm
Rigid pavement = PQC-M40 = 250mm, DLC-M10 = 150mm, GSB =150mm

Routine Maintenance cost for Flexible pavement has been considered as Rs 1.0L per km and the same to be escalated every year @5% per annum

Periodic Maintenance cost for every 5th year has been considered as Rs 5.0L (on Flexible pavement)

Overlay of 50mm BC has been considered at 20th year at flexible pavement- present BC rate has been escalated @5% per annum to arrive 20th year cost)

Routine maintenance of Rs 20000/- per year and escalation @5% per annum has been taken for Rigid pavement

Further, considering low traffic road, use of rigid pavement will not be economical.

6.8 Bridges

No major bridges exist along the entire project corridor. Only 10 no's minor bridges exist along the project road. Proposals for reconstruction, widening or retaining of these minor bridges are shown in **Table 6.5.** Tentative sub soil investigation schedule for these structures has been presented in **Table 6.6**

Table 6.5 : Proposals for Reconstruction, Widening or Retaining of Minor Bridges

Sr.No.	Existing Chainage (km)	Type of Structure	High level (HL) or Submersible (SL) Bridge	No.of Span	Span (m)	Total Length (m)	Carriageway (m)	Total width (m)	Over all Condition	River/Nalla Name	Height at Up/Down stream (m)	Flow Direction	Proposal	Proposed Span Arrangement (m)
1	36+500	Bailey bridge	HL	1	30.5	30.5	3.5	5.3	Poor	-	~7.3	R-L	New Bridge	1x31.0
2	56+400	RCC Slab	HL	1	7.0	7.0	6.1	6.6	Fair	-	~3.0	R-L	New Bridge	1x7.0
3	56+600	RCC Slab	HL	1	6.75	6.75	5.0	5.5	Fair	-	~3.2	R-L	New Bridge	1x7.0
4	62+900	Bailey bridge	HL	1	15.5	15.5	3.5	5.0	Fair	-	~5.3	L-R	New Bridge	1x16.0
5	69+975	Bailey bridge	HL	1	33.0	33.0	3.3	4.5	Fair	-	~8.6	L-R	New Bridge	1x33.0
6	140+975	Bailey bridge	HL	1	34.0	34.0	3. 5	5.5	Fair	-	~8.5	L-R	New Bridge	1x34.0
7	142+500	RCC Slab	HL	1	10.0	10.0	5.5	6.0	Fair	-	~4.0	L-R	New Bridge	1x10.0
8	145+500	Bailey bridge	HL	1	39.0	39.0	3.5	5.5	Fair	Pape	~17.0	L-R	New Bridge	1x39.0
9	147+500	RCC Slab	HL	1	6.5	6.5	5.3	5.75	Fair	-	~6.0	R-L	New Bridge	1x7.0
10	153+500	Bailey bridge	HL	1	25.0	25.0	3.5	5.5	Fair	-	~8.5	L-R	New Bridge	1x25.0

Additional New Minor Bridges : New minor bridges at the following locations on the project highways shall be constructed

Sl. No.	Bridge Location (Km)	Span Arrangement (m)	Carriageway Width (m)	Total Width (m)	Type of Superstucture	Type of Foundation
1	153+215	1 x 30.0m	11.0m	16.0m	PSC Girder	Open

Table 6.6 : Tentative Sub Soil Investigation Schedule for Bridges

Sr.No.	Existing Chainage (km)	Type of Structure	High level (HL) or Submersible (SL) Bridge	No.of Span	Span (m)	Total Length (m)	Carriageway (m)	Total width (m)	Over all Condition	River/Nalla Name	Height at Up/Down stream (m)	Flow Direction	Proposal	Proposed Span Arrangement (m)	Total Length (m)	No's of Bore Hole
1	36+500	Bailey bridge	HL	1	30.5	30.5	3.5	5.3	Poor	-	~7.3	R-L	New Bridge	1x31.0	31.0	2
2	56+400	RCC Slab	HL	1	7.0	7.0	6.1	6.6	Fair	-	~3.0	R-L	New Bridge	1x7.0	7.0	1
3	56+600	RCC Slab	HL	1	6.75	6.75	5.0	5.5	Fair	-	~3.2	R-L	New Bridge	1x7.0	7.0	1
4	62+900	Bailey bridge	HL	1	15.5	15.5	3.5	5.0	Fair	-	~5.3	L-R	New Bridge	1x16.0	16.0	1
5	69+975	Bailey bridge	HL	1	33.0	33.0	3.3	4.5	Fair	-	~8.6	L-R	New Bridge	1x33.0	33.0	2
6	140+975	Bailey bridge	HL	1	34.0	34.0	3. 5	5.5	Fair	-	~8.5	L-R	New Bridge	1x34.0	34.0	2
7	142+500	RCC Slab	HL	1	10.0	10.0	5.5	6.0	Fair	-	~4.0	L-R	New Bridge	1x10.0	10.0	1
8	145+500	Bailey bridge	HL	1	39.0	39.0	3.5	5.5	Fair	Pape	~17.0	L-R	New Bridge	1x39.0	39.0	2
9	147+500	RCC Slab	HL	1	6.5	6.5	5.3	5.75	Fair	-	~6.0	R-L	New Bridge	1x7.0	7.0	1
10	153+500	Bailey bridge	HL	1	25.0	25.0	3.5	5.5	Fair	-	~8.5	L-R	New Bridge	1x25.0	25.0	1
11	153+215	New Bridge at realignment portion												1 X 30	30.0	2

6.9 Culverts

There are 323 culverts existing at project road. A summary of the improvement proposals of culverts are given below:

Improvement Type	Nos. of culverts
Reconstruction	118
New Proposal	192
Repair and replacement	16

The proposal for Reconstruction, widening or retaining of all is given in **Annexure 6.4.**

6.10 Road Side Drains

RCC trapezoidal drain is proposed at one/both sides of project road in open, built up areas and along box cut sections of the realignment stages. Locations are provided in **Table 6.7**.

Table 6.7 : Road Side Drains

Design Chainage(m)		Length(m)	Side	Remarks
From	To			
20000	20010	10	One	Widening
20010	20200	190	One	Widening
20200	20600	800	Both	Realignment
20600	20610	10	One	Widening
20610	20690	160	Both	Realignment
20690	20700	10	One	Widening
20700	21000	600	Both	Realignment
21000	21130	130	One	Widening
21130	21140	10	One	Widening
21140	21240	100	One	Widening
21240	21270	30	One	Widening
21270	21840	1140	Both	Realignment
21840	21850	10	One	Widening
21850	21940	180	Both	Realignment
21940	21990	50	One	Widening
21990	22000	20	Both	Realignment
22000	22200	200	One	Widening
22200	22220	40	Both	Realignment
22220	22230	10	One	Widening
22230	22300	140	Both	Realignment
22300	22310	10	One	Widening
22310	22700	780	Both	Realignment
22700	22850	150	One	Widening
22850	23000	300	Both	Realignment
23000	23500	500	One	Widening
23500	24000	1000	Both	Realignment

Design Chainage(m)		Length(m)	Side	Remarks
From	To			
24000	24500	500	One	Widening
24500	24700	400	Both	Realignment
24700	24710	10	One	Widening
24710	25010	600	One	Realignment
25010	25090	80	One	Widening
25090	25500	820	Both	Realignment
25500	25800	300	One	Widening
25800	27400	3200	Both	Realignment
27400	27520	120	One	Widening
27520	27590	70	One	Widening
27590	27600	10	One	Widening
27600	27630	60	Both	Realignment
27630	27650	20	One	Widening
27650	28310	1320	Both	Realignment
28310	28350	40	One	Widening
28350	28400	100	Both	Realignment
28400	28680	280	One	Widening
28680	28720	40	One	Widening
28720	28920	400	Both	Realignment
28920	28970	50	One	Widening
28970	29260	290	One	Widening
29260	29280	20	One	Widening
29280	29340	60	One	Widening
29340	29400	60	One	Widening
29400	29600	200	One	Widening
29600	29790	380	Both	Realignment
29790	29820	30	One	Widening
29820	30200	760	Both	Realignment
30200	30400	200	One	Widening
30400	30600	400	Both	Realignment
30600	30800	200	One	Widening
30800	31300	1000	Both	Realignment
31300	31480	180	One	Widening
31480	31600	480	Both	Realignment
31600	32050	450	One	Widening
32050	33235	1185	One	Widening
33235	33245	10	One	Widening
33245	33300	55	One	Widening
33300	33310	10	One	Widening
33310	33320	10	One	Widening
33320	33330	10	One	Widening
33330	33370	40	One	Widening
33370	33400	30	One	Widening
33400	33950	1100	Both	Realignment
33950	33970	20	One	Widening
33970	34280	620	Both	Realignment
34280	34290	10	One	Widening

Design Chainage(m)		Length(m)	Side	Remarks
From	To			
34290	35145	1710	Both	Realignment
35145	35155	10	One	Widening
35155	35175	40	Both	Realignment
35175	35185	10	One	Widening
35185	35215	60	Both	Realignment
35215	35235	20	One	Widening
35235	35265	60	Both	Realignment
35265	35285	20	One	Widening
35285	35530	490	Both	Realignment
35530	35540	10	One	Widening
35540	35600	120	Both	Realignment
35600	35610	10	One	Widening
35610	35890	560	Both	Realignment
35890	35900	10	One	Widening
35900	36030	260	Both	Realignment
36030	36040	10	One	Widening
36040	36080	80	Both	Realignment
36080	36090	10	One	Widening
36090	36480	780	Both	Realignment
36480	36500	20	One	Widening
36500	36790	580	Both	Realignment
36790	36825	35	One	Widening
36825	36845	40	Both	Realignment
36845	36855	10	One	Widening
36855	36890	70	Both	Realignment
36890	36920	30	One	Widening
36920	37005	170	Both	Realignment
37005	37025	20	One	Widening
37025	37715	1380	Both	Realignment
37715	37725	10	One	Widening
37725	37830	210	Both	Realignment
37830	37850	20	One	Widening
37850	38000	300	Both	Realignment
38000	38200	200	One	Widening
38200	38590	780	Both	Realignment
38590	38600	10	One	Widening
38600	38955	710	Both	Realignment
38955	38965	10	One	Widening
38965	39005	80	Both	Realignment
39005	39015	10	One	Widening
39015	39055	80	Both	Realignment
39055	39065	10	One	Widening
39065	39155	180	Both	Realignment
39155	39165	10	One	Widening
39165	39400	470	Both	Realignment
39400	39410	10	One	Widening
39410	39460	100	Both	Realignment

Design Chainage(m)		Length(m)	Side	Remarks
From	To			
39460	39480	20	One	Widening
39480	39515	70	Both	Realignment
39515	39525	10	One	Widening
39525	41000	2950	Both	Realignment
41000	41200	200	One	Widening
41200	42300	2200	Both	Realignment
42300	42600	300	One	Widening
42600	42800	400	Both	Realignment
42800	42960	160	One	Widening
42960	44000	2080	Both	Realignment
44000	44080	160	Both	Realignment
44080	44100	20	One	Widening
44100	44180	160	Both	Realignment
44180	44200	20	One	Widening
44200	44230	60	Both	Realignment
44230	44340	110	One	Widening
44340	44420	160	Both	Realignment
44420	44540	120	One	Widening
44540	44580	80	Both	Realignment
44580	44640	60	One	Widening
44640	44720	160	Both	Realignment
44720	44790	70	One	Widening
44790	44960	340	Both	Realignment
44960	45070	110	One	Widening
45070	45310	480	Both	Realignment
45310	45430	120	One	Widening
45430	45510	160	Both	Realignment
45510	45590	80	One	Widening
45590	45620	60	Both	Realignment
45620	45730	110	One	Widening
45730	45800	140	Both	Realignment
45800	45830	30	One	Widening
45830	45920	180	Both	Realignment
45920	46000	80	One	Widening
46000	46110	220	Both	Realignment
46110	46190	80	One	Widening
46190	46230	80	Both	Realignment
46230	46360	130	One	Widening
46360	46560	400	Both	Realignment
46560	46580	20	One	Widening
46580	46900	640	Both	Realignment
46900	46960	60	One	Widening
46960	47780	1640	Both	Realignment
47780	47810	30	One	Widening
47810	47830	20	One	Widening
47830	47880	50	One	Widening
47880	48000	240	Both	Realignment

Design Chainage(m)		Length(m)	Side	Remarks
From	To			
48000	48450	450	One	Widening
48450	48490	40	One	Widening
48490	48500	10	One	Widening
48500	48850	700	Both	Realignment
48850	48880	30	One	Widening
48880	48950	140	Both	Realignment
48950	49000	50	One	Widening
49000	49200	200	One	Widening
49200	49230	30	One	Widening
49230	49250	40	Both	Realignment
49250	49370	120	One	Widening
49370	49390	40	Both	Realignment
49390	49420	30	One	Widening
49420	49650	460	Both	Realignment
49650	49690	40	One	Widening
49690	49980	580	Both	Realignment
49980	50000	20	One	Widening
50000	50230	460	Both	Realignment
50230	50270	40	One	Widening
50270	50290	40	Both	Realignment
50290	50310	20	One	Widening
50310	50340	60	Both	Realignment
50340	50460	120	One	Widening
50460	50580	240	Both	Realignment
50580	50630	50	One	Widening
50630	50670	80	Both	Realignment
50670	50960	290	One	Widening
50960	51080	240	Both	Realignment
51080	51180	100	One	Widening
51180	51270	180	Both	Realignment
51270	51390	120	One	Widening
51390	51460	140	Both	Realignment
51460	51630	170	One	Widening
51630	52310	1360	Both	Realignment
52310	52360	50	One	Widening
52360	52675	630	Both	Realignment
52675	52685	10	One	Widening
52685	52840	310	Both	Realignment
52840	52870	30	One	Widening
52870	52950	160	Both	Realignment
52950	53020	70	One	Widening
53020	53070	100	Both	Realignment
53070	53346	276	One	Widening
53346	53500	308	Both	Realignment
53500	53700	200	One	Widening
53700	55250	3100	Both	Realignment
55250	55400	150	One	Widening

Design Chainage(m)		Length(m)	Side	Remarks
From	To			
55400	57200	3600	Both	Realignment
57200	59363	4326	Both	Built up area
138000	138150	150	One	Widening
138150	138160	20	Both	Realignment
138160	138200	40	One	Widening
138200	138300	100	One	Widening
138300	138350	100	Both	Realignment
138350	138390	40	One	Widening
138390	138400	10	One	Widening
138400	138410	10	One	Widening
138410	138500	180	Both	Realignment
138500	138530	30	One	Widening
138530	138550	20	One	Widening
138550	138700	300	Both	Realignment
138700	138710	20	Both	Realignment
138710	138910	400	Both	Realignment
138910	138940	30	One	Widening
138940	138990	100	Both	Realignment
138990	139000	10	One	Widening
139000	139040	40	One	Widening
139040	139160	240	Both	Realignment
139160	139210	50	One	Widening
139210	139500	580	Both	Realignment
139500	139620	120	One	Widening
139620	140450	1660	Both	Realignment
140450	140510	120	Both	Realignment
140510	140550	80	Both	Realignment
140550	140640	90	One	Widening
140640	140660	20	One	Widening
140660	140790	130	One	Widening
140790	140800	10	One	Widening
140800	140960	160	One	Widening
140960	141010	100	Both	Realignment
141010	141090	80	One	Widening
141090	141100	20	Both	Realignment
141100	141160	60	One	Widening
141160	141200	40	One	Widening
141200	141240	40	One	Widening
141240	141500	520	Both	Realignment
141500	141650	150	One	Widening
141650	142350	1400	Both	Realignment
142350	142400	50	One	Widening
142400	142500	200	Both	Realignment
142500	142550	50	One	Widening
142550	143210	1320	Both	Realignment
143210	143220	10	One	Widening
143220	143400	360	Both	Realignment

Design Chainage(m)		Length(m)	Side	Remarks
From	To			
143400	143650	250	One	Widening
143650	143700	100	Both	Realignment
143700	143770	140	Both	Realignment
143770	143870	100	One	Widening
143870	144100	460	Both	Realignment
144100	144320	220	One	Widening
144320	144430	110	One	Widening
144430	144500	70	One	Widening
144500	144550	100	Both	Realignment
144550	144660	220	Both	Realignment
144660	144720	120	Both	Realignment
144720	144840	240	Both	Realignment
144840	144900	120	Both	Realignment
144900	145000	100	One	Widening
145000	145020	40	Both	Realignment
145020	145120	100	One	Widening
145120	145220	200	Both	Realignment
145220	145250	30	One	Widening
145250	145340	180	Both	Realignment
145340	145360	20	One	Widening
145360	145550	380	Both	Realignment
145550	145610	60	One	Widening
145610	145670	120	Both	Realignment
145670	145710	80	Both	Realignment
145710	146200	980	Both	Realignment
146200	146250	50	One	Widening
146250	146450	400	Both	Realignment
146450	146460	10	One	Widening
146460	146900	880	Both	Realignment
146900	146930	30	One	Widening
146930	147000	70	One	Widening
147000	147090	180	Both	Realignment
147090	147170	160	Both	Realignment
147170	147230	120	Both	Realignment
147230	147250	40	Both	Realignment
147250	147370	240	Both	Realignment
147370	147410	40	One	Widening
147410	148400	1980	Both	Realignment
148400	148440	40	One	Widening
148440	148550	220	Both	Realignment
148550	148570	20	One	Widening
148570	148830	520	Both	Realignment
148830	148860	30	One	Widening
148860	148940	160	Both	Realignment
148940	149000	60	One	Widening
149000	149100	200	Both	Realignment
149100	149180	80	One	Widening

Design Chainage(m)		Length(m)	Side	Remarks
From	To			
149180	149250	140	Both	Realignment
149250	149270	20	One	Widening
149270	149310	80	Both	Realignment
149310	149350	40	One	Widening
149350	149430	160	Both	Realignment
149430	149450	40	Both	Realignment
149450	149720	540	Both	Realignment
149720	149770	100	Both	Realignment
149770	149800	60	Both	Realignment
149800	149810	10	One	Widening
149810	149990	360	Both	Realignment
149990	150010	20	One	Widening
150010	150080	140	Both	Realignment
150080	150100	20	One	Widening
150100	150300	400	Both	Realignment
150300	150380	80	One	Widening
150380	150400	20	One	Widening
150400	150410	10	One	Widening
150410	150470	120	Both	Realignment
150470	150490	20	One	Widening
150490	150750	520	Both	Realignment
150750	150850	100	One	Widening
150850	151300	900	Both	Realignment
151300	151400	100	One	Widening
151400	151620	440	Both	Realignment
151620	151640	20	One	Widening
151640	151800	320	Both	Realignment
151800	151810	10	One	Widening
151810	152100	580	Both	Realignment
152100	152110	10	One	Widening
152110	152220	220	Both	Realignment
152220	152260	40	One	Widening
152260	152300	80	Both	Realignment
152300	152340	40	One	Widening
152340	152540	400	Both	Realignment
152540	152570	30	One	Widening
152570	152670	200	Both	Realignment
152670	152690	20	One	Widening
152690	153323	1266	Both	Realignment
153323	154036	1426	Both	Built up

6.11 Major and Minor Junctions

There is only one major and large number of minor cross roads which required improving as at grade junction. List of one major junction is given in **Table 6.8**.

Table 6.8 : List of Major Junctions

S.No.	Name	Chainage as per NH-713	Design Chainage (km)	Side		Type of Junction	Type of Road	Remarks
				LHS	RHS			
1	Koloriang	156+585.865	153+800	Information Bunglow	Circuit House	4-Arm	BT	

6.12 Proposal for Congested Area

As such there are no congested areas along the project area though there are some small towns and settlements like Deed, Dem, New Palin, Koloriang. The population density however, do not qualify these settlements as congested. No separate proposals are made for these areas.

6.13 Bus Shelters

Provision of bus shelters have been made at all towns and settlements. The list of proposed bus shelters is given in **Table 6.9.**

Table 6.9 :List of Proposed Bus Shelters

Sl. No.	Design Chainage (km)	Side	Village/Town
1	24.500	Left Side	New Pania
2	31.400	Left Side	Neelum
3	34.800	Left Side	Deed
4	41.400	Left Side	Dem
5	57.800	Left Side	Shakti
6	67.900	Left Side	New Palin
7	156.800	Left Side	Koloriang

6.14 Truck Lay Bye

Provision of a truck lay by has been made near New Palin Town.

6.15 Passing Places

Provision of passing places have been done throughout the project stretch at the rate of every 2-3km.

6.16 Cattle Crossing

There is no significant cattle movement across the road and hence there is no proposal of separate cattle crossing.

6.17 Pedestrian Guard Rails

Pedestrian guard rail shall be used mainly in the built up location where footpath has been provided for the safety of pedestrians.

6.18 Pedestrian Crossings

Pedestrian crossings shall be provided at major intersection (Koloriang) and other sensitive location like school, hospital religious structure located along the project corridor.

6.19 Traffic Safety And Other Appurtenances

Following road furniture and miscellaneous items have been designed keeping safety aspect in mind.

- Road markings
- Road Signs
- Crash Barriers

- Noise Barriers
- Hard Topping
- Landscaping

6.19.1 Road Markings

Road Markings on the carriageway and on the objects within and adjacent to the roadway are used as a means of guiding and controlling the traffic. They promote road safety and ensure smooth flow of traffic in the required paths of travel.

The location and type of marking lines, material and colour is followed using IRC: 35-1997 – "Code of Practice for Road Markings".

The road markings were carefully planned on carriageways, intersections, toll plazas and bridge locations.

6.19.2 Road Signs

Road signs were planned to supply information, to regulate traffic by imparting messages to the drivers. The type, locations, sizes were planned using IRC: 67-2001 "Code of Practice for Road Sign".

6.19.3 Road Delineators

The role of delineators is to provide visual assistance to driver about alignment of the road ahead, especially at night. Reflectors are used on the delineators for better night visibility. IRC: 79-1981 "Recommended Practice for Road Delineators" was followed to plan locations details. Two types of road delineators were planned i.e. hazard markers and object markers. Hazard markers are to define obstructions like guardrails, and abutments adjacent to the carriageway, for instance at culverts and bridges. Object markers are used to indicate hazards and obstructions within the vehicle flow path, at channelling islands close to intersections.

6.19.4 Crash Barrier

Metal crash barriers are proposed/ provided for safety of the traffic on the stretches on approaches of bridges. It is also proposed on the curves for safety of traffic irrespective of embankment height as per NHAI Circular (NHAI/PH-II/NHDP/ADB/GM (NS)-I dated May 19, 2004).

6.19.5 Parapet Wall

Parapet walls are provided along the edge of the shoulders at the valley side throughout the

project stretch excluding the settlement areas. These are provided to prevent the vehicles from toppling over.

6.19.6 Noise Barriers

At the locations where Schools or Religious Structures are located along the project road, a double brick wall is proposed to act as noise barrier.

6.19.7 Hard Topping

Approaches to schools, dispensaries and other community centres from the highway are proposed to provide hard surfaces.

6.19.8 Landscaping

i)The aim of landscaping will be conservation of existing natural or man made features e.g. ponds, historical buildings and scenic vistas along the highway.

ii)Landscaping will address the issue of drainage to ensure minimum disturbance to the natural drainage and at the same time ensure protection of natural surfaces from erosion.

iii)Proper landscaping will be provided for highway Alignment to fit-in with surroundings for pleasing appearance, reducing headlight glare and adverse environmental effects such as air pollution, noise pollution and visual intrusion.

iv)Landscaping will include stabilization of embankment by pitching and/or turfing/ plantation. The treatment of embankment slopes along the highway will be as per recommendations of IRC: 56 – 1974, depending upon soil type involved. Planting of shrubs, hedges and trees on medians and sides for highways of reducing glare effect, reducing visual intrusion, noise pollution and air pollution.

v)Trees, their spacing and arrangement in different situations will be as per IRC: 21 – 1979 and IRC: SP: 66 – 1976.

6.20 LAND ACQUISITION

Based on the surveys conducted and information obtained so far, tentative land acquisition plans have been prepared and presented in Volume-V. The existing ROW has been taken from site inspection and the proposed ROW is taken as 35m/40m in general, except at built up areas where the space between the properties have been considered as ROW. A buffer space of 10m has been added with the actual output of the software to consider the subsidence that may occur along the hill cuts. The total LA requirement estimated at this stage is of the order of 146 Ha. The brief details are indicated in **Table 6.10.**

Table- 6.10

Joram Koloriang Land Acquisition Plan (KM 20 TO KM 70)			
Proposed Chainage	**LA Area (sqm)**	**Area Hec.**	**Area Acre.**
20+000 to 21+000	30063.453	3.01	7.43
21+000 to 22+000	28610.812	2.86	7.07
22+000 to 23+000	29469.130	2.95	7.28
23+000 to 24+000	22531.565	2.25	5.57
24+000 to 25+000	27819.140	2.78	6.87
25+000 to 26+000	26890.135	2.69	6.64
26+000 to 27+000	29672.959	2.97	7.33
27+000 to 28+000	29656.629	2.97	7.33
28+000 to 29+000	14883.748	1.49	3.68
29+000 to 30+000	18021.045	1.80	4.45
30+000 to 31+000	28707.102	2.87	7.09
31+000 to 32+000	11425.034	1.14	2.82
32+000 to 33+000	12389.881	1.24	3.06
33+000 to 34+000	26138.153	2.61	6.46
34+000 to 35+000	21271.375	2.13	5.26
35+000 to 36+000	32268.736	3.23	7.97
36+000 to 37+000	30225.035	3.02	7.47
37+000 to 38+000	16922.729	1.69	4.18
38+000 to 39+000	34396.219	3.44	8.50
39+000 to 40+000	31722.435	3.17	7.84
40+000 to 41+000	35140.872	3.51	8.68
41+000 to 42+000	30374.940	3.04	7.51
42+000 to 43+000	32729.481	3.27	8.09
43+000 to 44+000	28947.344	2.89	7.15
44+000 to 45+000	29127.688	2.91	7.20
45+000 to 46+000	30028.964	3.00	7.42
46+000 to 47+000	32072.340	3.21	7.93
47+000 to 48+000	35131.158	3.51	8.68
48+000 to 49+000	34859.127	3.49	8.61
49+000 to 50+000	15889.927	1.59	3.93
50+000 to 51+000	26303.547	2.63	6.50
51+000 to 52+000	30970.568	3.10	7.65
52+000 to 53+000	33479.319	3.35	8.27
53+000 to 54+000	30910.871	3.09	7.64
54+000 to 55+000	30694.032	3.07	7.58
55+000 to 56+000	33400.196	3.34	8.25
56+000 to 57+000	26611.033	2.66	6.58
57+000 to 58+000	15859.301	1.59	3.92
58+000 to 59+000	13701.233	1.37	3.39
59+000 to 59+363	4186.281	0.42	1.03
Total		**105.35**	**260.33**

Joram to Koloriang Land Acquisition Plan (km 138 to km 158)			
Proposed Chainage	**LA Area (sqm)**	**Area Hec.**	**Area Acre.**
138+000 to 139+000	22992.651	2.30	5.68
139+000 to 140+000	25377.626	2.54	6.27
140+000 to 141+000	24614.336	2.46	6.08
141+000 to 142+000	22865.587	2.29	5.65
142+000 to 143+000	27189.168	2.72	6.72
143+000 to 144+000	23299.389	2.33	5.76
144+000 to 145+000	24755.843	2.48	6.12
145+000 to 146+000	26077.289	2.61	6.44
146+000 to 147+000	35734.470	3.57	8.83

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Joram Koloriang Land Acquisition Plan (KM 20 TO KM 70)			
Proposed Chainage	**LA Area (sqm)**	**Area Hec.**	**Area**
147+000 to 148+000	28695.824	2.87	7.09
148+000 to 149+000	26551.259	2.66	6.56
149+000 to 150+000	22105.938	2.21	5.46
150+000 to 151+000	26497.911	2.65	6.55
151+000 to 152+000	29508.028	2.95	7.29
152+000 to 153+000	34837.575	3.48	8.61
153+000 to 154+036	8971.662	0.90	2.22
Total		**41.01**	**101.33**

6.21 SLOPE PROTECTION AND EROSION CONTROL

6.21.1 General

The terrain of the project road can be broadly classified as Hilly to steep. Steep slopes descend from high ridges towards gorges bisected by the project road in cut formation. Preliminary observations suggest relatively stable hill slope despite near vertical inclination. In the first section from Joram to Palin predominantly weathered rock formations can be seen which are stable even during rainy season. Soil mixed with boulder frequently encountered in the second section is comparatively fragile especially during monsoon. Prolonged monsoon softens the matrix of soil and moorum thereby loosening the bond with which the scattered boulders are held in place. This triggers sliding tendencies and the condition gets aggravated when sub to surface seepage intercepts the cut sections.

6.21.2 Slope stability

Hill roads are characterized by cutting into the hill or part cut and part fill type formations. Stability of slopes especially on the hill side is of utmost significance for a hill road. If these slopes are not stable land slide may occur especially during monsoon which may cause great inconvenience and loss of life and property. Disturbance to slope can occur due steep cutting, erosion caused by rain fall and run off. Proper method of hill cutting with the gentlest possible slope and effective erosion control measures protect slopes and prevent slides. The subject of slope stability and erosion control, therefore, become very vital for control and prevention of land slides/slips.

6.21.3 Land slide

Landslide occurrence and its prevention and mitigation is one of the most critical components of a hill road design. Study of stability of natural and cut slopes helps in identifying problem areas and formulation of appropriate counter to measures.

Landslide is basically failure of the hill slope mainly under the action of its own weight in which the displacement of the mass of earth/loose rock/soil mixed with boulder move both vertically and horizontally down the slope. The moving mass follows any one of three

principal types of movements viz. falling, sliding, flowing or their combinations. The rate of movement may vary from slow to rapid.

6.21.4 Investigation and slope stability analysis

Laboratory investigations: The following basic tests that shall be carried out on the soil and rock samples collected from probable slide area.

a) Determination of index properties of soil samples.

b) Determination of shear characteristics of slope material by appropriate type of shear tests. Triaxial shear test shall be carried out on undisturbed samples collected from the hill slopes. Sampling shall be carried out for as representative samples for homogeneous sections.

c) Rock sample shall be examined to find out the nature of rock, extent of weathering, presence of any weak inter layer etc.

The above data shall be used to carry out stability analysis of the slopes and formulate corrective measures.

6.21.5 Stability Analysis

Slopes predominantly of soil often fail by rotation forming a slip circle of failure. The failure surface is dependent on many factors such as the presence of weak layers, strength properties of slope materials, the height and inclination of slope etc. Usually the slope bulges outward near the toe and cracks develop near the crest of the slope, the failure plane being approximately arc of a circle. The analysis consists of drawing trial circles and calculating the factor of safety of each circle. Analysis may be done either by considering the stability of the slope ento mass or by dividing the strip mass into many vertical slices and considering equilibrium of each slice i.e. the Equilibrium Method.

The stability of the slopes shall be analysed by Fellenius method or Swedish slip circle method as described in IRC:75to1979. In this method continuous failure surfaces are assumed and calculations are made for several such surfaces. The slip surface for which the Factor of Safety is minimum is called the critical slip surface. A sketch showing analysis by this method is given below:

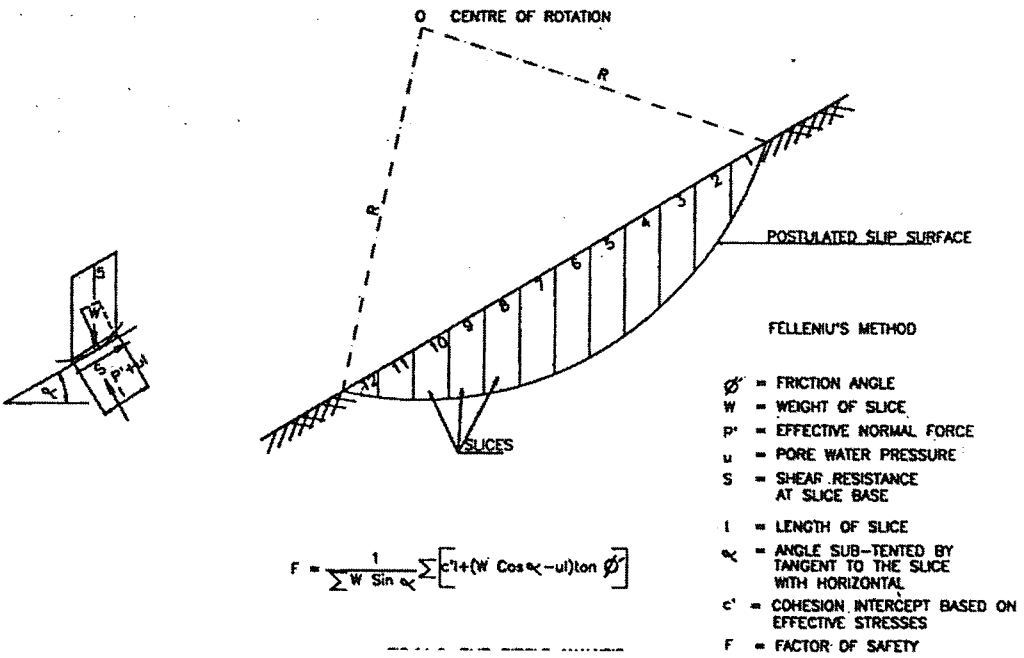

Fig 6.5 : SLIP CIRCLE ANALYSIS

6.21.6 Mitigation Measures and Design Considerations

Variety of measures adopted for prevention, correction and mitigation of hill slopes against landslides are broadly classified into three categories :

a) Avoid or eliminate the problem
b) Reduce the detostabilising forces, and
c) Increase the forces resisting the movement

Various methods which collectively fall under the above categories of countertomeasures areto

i) Change of alignment to avoid problematic areas.
ii) Removal of overlying material to reduce loads
iii) Bridging ,tunneling, etc.
iv) Improving drainage system to reduce pore pressure and erosion
v) Construction of Breast wall, toe wall, Gabions, etc.
vi) Turfing of slopes with grass sods, vettiver system, etc

ROAD SAFETY AUDIT

7.0 ROAD SAFETY AUDIT

7.1 Introduction

Road safety is now recognized as a major socioeconomic concern in India. Increasing traffic volumes, the rapid growth in two and three wheeled traffic, higher speeds due to construction improvement / rehabilitation of roads has increased safety problem. A Road Safety Audit (RSA) is the safety performance examination of a road section through experienced road safety expert. It qualitatively estimates and reports on potential road safety issues and identifies opportunities for improvements in safety for all road users. The road safety audit investigates general safety conditions, focuses on specific concerns or users. This also includes pedestrian safety as well as safety of bus and train users.

7.2 Stages of Road Safety Audit (RSA)

As per the scope of works RSA needs to be performed in the following stages:

- During Feasibility Study Stage (planning stage)
- On completion of Preliminary Design Stage
- On completion of Detailed Design Stage

This chapter is related to safety audit report at feasibility study stage (planning stage). The audit team reviewed proposed design from road safety perspective and checked the following aspects.

RSA related to construction stage and monitoring existing road stage is not discussed here.

7.3 Aspects Reviewed

Broadly following items have been checked or reviewed during the feasibility study stage based on site data, existing road and proposed designs.

- Safety and operational implications of proposed alignment and junction strategy with particular references to expected road users and vehicle types likely to use the road.
- Width options considered for various sections.
- Departures from standards, if any and accordingly actions taken.
- Provisions of pedestrians, cyclists and intermediate transport.
- Safety implications of the schemes beyond its physical limits, i.e., how the scheme fits into its environs and road hierarchy.

Road Safety Audit is a formal procedure that uses extensive safety engineering knowledge to identify safety deficiencies in road sections. A broad experience in road, traffic and safety engineering needs to be acquired to ensure that a Road Safety Auditor has the knowledge and

ability to refer back to the basic principles in road safety, and propose appropriate mitigation measures. Following points are generally adequately clarified during a road safety audit.

- Confusion or ambiguity due to design layout for road users that could lead to potential road traffic accidents
- Insufficient information for road users
- Improper visibility, or an obstruction to road view s of road users
- Hazards in layout create or obstacles to road users that could contribute to an increased risk of injuries

In the above cases safety of the scheme may be compromised and remedial measures may be required to remove this potential or actual deficiency. Road users need to perceive and process vast amounts of sensory and visual information to negotiate a road layout. On the other hand role of designer is to provide a safe road environment that should:

- provide adequate information for road users of the layout and conditions ahead;
- provide adequate warning of hazards or unusual layouts ahead;
- provide positive control of road users passage through conflict points or unusual sections;
- provide a road performance that can nullify road users errors or inappropriate behavior.

Desirable minimum Design Standards should be used wherever possible and advance information and warning should be used to inform road users of the layout ahead. However, driver overload must be avoided as it may cause road users to focus too much on the unimportant data and shed vital information. Conflicting information, an over abundance of road signs or a lack of delineation can cause overload. Therefore a "safer" road environment can be defined as a layout that:

- provides clear, concise and phased release of road user information;
- provides a consistent standard of road design and traffic control;
- Provides adequate warning of hazards.

It is important that a road improvement caters for all road users. Often the needs of the motorist are incorporated within a scheme whilst the needs of the vulnerable user are ignored. The vulnerable road users that need to be considered are: pedestrians – the old, young and those with mobility or sight impairment; cyclists – children, commuters and leisure users; and motorcyclists.

Each vulnerable road user has different needs from the road network. In the habitation environment the pedestrian is likely to be the principal user and designs must incorporate safe crossing locations, adequate visibility to and from the crossings and appropriate lighting.

In addition to the needs of vulnerable road users, particular attention should be paid to the needs of trucks, buses or other specialist vehicles.

Safe road design varies from the urban to the rural road network; and a number of external factors can create a situation in which a safe road in one location becomes unsafe due to external factors. These factors can include traffic volumes, population density, noise, or road user familiarity. The function of a road should be clear to all road users, and a well planned and defined road hierarchy can assist in providing a safe road network. The design speed can also be an important factor in influencing the safety of a road and should be appropriate to the location, local road users and level of private access control.

One important aspect to the safety of junctions is that layout as well as control method need to be simple and clear, with defined priorities for all road users. The assumption that 'straight on' traffic has priority is widely accepted and it needs to be remembered that alterations to this, despite reinforcement with signs and lines can still be confusing if visual clues such as fences, kerbing or lighting remain unchanged. It is important to attempt to make any minor approach perpendicular to the main road. Y junctions with acute angles should be avoided. These angled junctions pose problem for road users, including restriction of forward and side visibility. Similarly, it is advisable to avoid intersections on the inside of bends as foliage often encroaches into sight lines after several years. Roundabouts used as a form of junction control have their own rules and design requirements. One of the primary requirements in good roundabout design is that the radius is tighter on the entry than the exit. This ensures a slow entry and lower circulating speed. Visibility is a key requirement for all junction types, all road users need to see and be seen by others. Care should be taken with fixing street furniture and vegetation within visibility splays. Vulnerable road users often experience difficulties during crossing at junctions. It is important that their needs are provided for and that safe crossing places are implemented where required.

The relationship between cross sectional elements (carriageway, shoulders, etc.) and safety is affected by the type and volume of traffic, and also by the surrounding environment. Lane widths can be critical in affecting safety, where they are too narrow vehicles may collide on horizontal curves, and there may also be inadequate space for two wheeled vehicles. Where lane widths are too wide the alignment may encourage excess speed. On high speed links there is a safety benefit to be gained by the provision of a hard shoulder and central reserve gaps should be of adequate width, depending on the size of vehicles turning. Vehicles parked on the carriageway affect the road environment, layout and consequently safety. Safety problems experienced with parked vehicles are:

- parked vehicles causing physical obstructions which are sideswiped or run into;
- parked vehicles causing sudden braking or nose-tail shunts;
- parked vehicles which deflect oncoming vehicles into adjacent vehicle paths;

- parked vehicles blocking visibility for any road user;
- parked vehicles between which pedestrians emerge.

To reduce the risk of parked vehicles contributing to an accident it is important that designs should minimize parking in main traffic lanes. Trees and foliage can greatly enhance the environmental impact of the street scene. However, left unmaintained, they can also restrict visibility considerably. In addition to this, saplings grow into large trees, which can provide an unforgiving road hazard in the event of a road traffic accident.

With the above discussions and study / analysis of the project road sections safety issues have been conceived, which are presented in the following table.

Content	Items	Observation w.r.t. Safety		Remarks
		Existing Situation	Proposed Situation	
A1. General	Departure from Standards	The existing geometry of the road is not adequate with presence of sharp curves and steeper gradient	The proposed alignment has been designed based on IRC:SP 73-2015. Realignment has proposed at several sharp curve locations to improve horizontal geometry.	The design speed to be reduced based on restricted site conditions and non availability of adequate land
	Cross sectional Variation	The existing carriageway width of most of the project road is about 3.5m.	The Proposed carriageway width of the project road is 7.0m (2lane configuration) with 1.5m paved shoulder on both sides having a total roadway width of 10m as per IRC: SP 73-2015. In built up location trapezoidal drains are provided at both sides of the road edge. The total road way width of 10m comprising of carriageway width of 7.0m with 1.5m paved shoulder on both sides remains the same.	Extra widening has been provided on the curves having radius less or equal to 60m.
	Drainage	Existing drainage	Efficient drainage	Detail design of drains will

Content	Items	Observation w.r.t. Safety		Remarks
		Existing Situation	**Proposed Situation**	
		condition is poor with improper camber and longitudinal gradient of carriageway and shoulder and absence of roadside drain.	system is provided along the project road including structure and outfall facility. For quick disposal of precipitations, carriageway and shoulder have the requisite camber and longitudinal gradient. The water from road and adjacent areas to be intercepted and carried through roadside drains to natural outfall. Mostly in rural areas unlined trapezoidal drain shall be provided, whereas in built up stretches RCC drain is proposed both side of Project road.	be carried out detailed project report stage
	Climatic Conditions	The climate of Arunachal Pradesh varies with elevation. Arunachal Pradesh receives heavy rainfall of 2,000 to 4,100 mm (79 to 161 in) annually, most of it between April to May and September. Temperature is ranging from 2to5 degree Celsius during winter and 25to30 degree Celsius during summer time		HFL and Pond water level has been considered to fix road top level
	Landscaping	Landscaping on the existing road is not proper due to dense forests and vegetations, absence of proper turfing on hill slopes.	Proper Road side Plantation is being provided Shrubs on median / island are also considered Turfing is being provided on embankment slope.	Trees and vegetations on the site should be properly trimmed and removed if required so that these should not interfere with the overhead services, clear view of signs and efficiency of roadway lighting. A regular program of

Content	Items	Observation w.r.t. Safety		Remarks
		Existing Situation	Proposed Situation	
				pruning of the offending trees shall be undertaken as a part of the maintenance operation. Trees shall be selected based on the soil, temperature, rainfall, water level and should be deep rooted to avoid any damage to the pavement crust.
	Utilities	Existing utilities like Electric poles, Transformer, OFC, High Tension Line, Telephone Pole, Water Tap Tube well etc. are found along the existing road	Shifting of existing utilities due to widening of road Utilities to be relocated at proposed utility corridor within the proposed ROW	It will be safe during maintenance
	Lay byes	No truck lay byes have been observed along the existing road.	Truck lay byes are proposed at one location near New Palin.	
	Footpaths	No footpaths are observed along the existing road	In built up areas and major intersections footpaths are provided.	Footpaths are provided for smooth and safe movement of pedestrian
	Pedestrian Crossings	No pedestrian crossings are observed along the existing road.	Pedestrian crossings are provided at major intersections and other locations like schools, religious structure etc. where substantial conflicts exist between Vehicular and Pedestrian movement.	Installation of proper traffic sign/ signal near pedestrian crossings is mandatory. Pedestrian guard rails are also required to guide people
	Cattle Crossings	No cattle crossings are observed along the existing road.	No cattle crossings provided.	
	Access	Existing situation shows maximum access to the private property. As such there is no access	Private access should be minimized directly from the proposed carriageway by providing footpath at	Private access needs be minimized to maintain the design speed of the corridor as well safe passage to traffic and

Content	Items	Observation w.r.t. Safety		Remarks
		Existing Situation	**Proposed Situation**	
		control	built up locations	persons
	Emergency vehicles	No emergency vehicle have been found along the existing corridor	No emergency vehicle provided.	
	Public Transport	Existing traffic survey shows that 2 wheeler and Car/Jeep/Taxi/Van are act major public transport as less number of bus and minibus are plying on the existing track	After improvement of road surface from single /intermediate lane to 2lane public transport like bus and minibus will be increased.	Traffic report shows increase in public transport along the project road
	Future Widening	Existing ROW is less for future widening w.r.t four lanes	Proposed road is of 2 lane configuration and as per that 24m ROW has been proposed.	Traffic projection shows that there is no need of future widening till 2035.
	Adjacent Development	Existing shoulders are generally damaged through out the road Footpaths are not found in the built up stretches Insufficient traffic signs observed along the corridor.	Proposed hard shoulder on both sides of the carriageway can be used for the movement of slow moving vehicle during emergency as well as parking for stalled vehicle. Footpaths cum RCC drains have been proposed in built up areas for safe movement of pedestrians. Installation of traffic sign (for example to horn prohibited in front of school, hospital, religious structure etc.) is being proposed. Improvement of roads will help in development of new industry along	No significant development as such in the near future.

Content	Items	Observation w.r.t. Safety		Remarks
		Existing Situation	Proposed Situation	
			project road	
A2. Local Alignment	Visibility	Visibility is not proper in many places as the existing profile of the road not does not follow required sight distances (horizontal as well as vertical)	For proposed 2 lane roads Intermediate Sight distance is being taken throughout. The attempt has been made to design the vertical profile considering stopping sight distance. However, site constraints have been considered also.	In stretches where intermediate sight distance is not available the profile shall be designed with safe stopping sight distance and overtaking prohibited traffic shall be installed in the location.
	Safety Aids on Steep Hills	Existing site shows not much safety measures on the hill side	Retaining wall, Breast wall, Boulder nets, parapets, railings have be considered as protective structures for traffic	Maintenance during operation is very much important in these sections.
A3. Junctions	Minimize potential conflicts	Existing junctions are not properly developed with insufficient turning radius and absence of road signage as well as markings	01 Major Junction and 46 minor junctions to be developed with proper turning radius, signage and markings to minimize potential conflict between pedestrians and vehicles	Provide pedestrian guard rail on Footpath, median for the safety of pedestrians Pedestrian crossings shall be provided in proper places in the junctions with signage and markings
	Layout	Layout of the junctions are not proper	Layout of the proposed junctions are to be made with proper turning radius, acceleration/deceleration lane, island and median etc.	These are designed as per respective IRC guidelines and land acquisition to be kept absolute minimum
	Visibility	Visibility of the existing junctions are not proper	To improve the visibility of the proposed junctions vertical profile of the road shall be designed with overtaking sight distance. If it is not found it should be taken care that at least intermediate sight	Traffic Sign at junctions should informative enough

Content	Items	Observation w.r.t. Safety		Remarks
		Existing Situation	**Proposed Situation**	
			distance should be available throughout	
A4. Non - Motorized road users provisions	Pedestrians Cyclists Non motorized vehicles	Existing Scenario shows Pedestrians, Cyclists and non motorized vehicles are plying on the existing road due to damage road shoulder and absence of footpath in built up areas and causing conflicts with fast moving vehicles which decrease the design speed	For smooth movement of non motorized road users, pedestrians, cyclist hard shoulder having 2.5m width has been proposed on both side of the carriageway. Also in built up stretches 2.5m wide footpath has been proposed for less conflict between fast moving vehicle and pedestrians, cyclists etc.	
A5. Signs and Lighting	Lighting	Insufficient Lighting shall be found in built up areas	Lighting shall be provided on major junctions and build up locations	
	Signs/ Markings	Insufficient signs found on existing road Markings are not found in the existing road	Traffic Signs and Road Markings are provided on the proposed road for safe guidance of traffic	
A6. Construction and Operation	Build to ability Operational Network Management	Guidelines for safety during construction need to be followed as per IRC SP 55. Traffic control devices have to be provided as per requirements. Few of these are: barricading, signs and delineators.		

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Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

ROAD INVENTORY : Land use pattern

NAME OF ROAD: Joram to Koloriang 20Km to 70 Km & 138Km to 158 Km

DISTRICT:

Lower Subansiri, Kra Daadi, Kurung Kumey

km _____ **to km**

Chainage		Terrain	Landuse	
From	To		Left	Right
(m)	(m)			
20000	20500	H	F	F
20500	21000	H	F	B
21000	21500	H	F	B
21500	22000	H	F	F
22000	22500	H	F	F
22500	23000	H	F	F
23000	23500	H	F	F
23500	24000	H	F	F
24000	24500	H	F	F
24500	25000	H	O	B
25000	25500	H	F	F
25500	26000	H	F	F
26000	26500	H	F	F
26500	27000	H	F	F
27000	27500	H	F	F
27500	28000	H	F	F
28000	28500	H	F	F
28500	29000	H	F	F
29000	29500	H	F	F
29500	30000	H	F	F
30000	30500	H	F	F
30500	31000	H	F	F
31000	31500	H	F	F
31500	32000	H	B	B
32000	32500	H	B	B
32500	33000	H	F	F
33000	33500	H	F	F
33500	34000	H	F	F
34000	34500	H	F	F
34500	35000	H	F	F
35000	35500	H	B	B

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ROAD INVENTORY : Land use pattern

NAME OF ROAD: Joram to Koloriang 20Km to 70 Km & 138Km to 158 Km

DISTRICT: Lower Subansiri, Kra Daadi, Kurung Kumey

km _____ to km

Chainage		Terrain	Landuse	
From	To		Left	Right
(m)	(m)			
35500	36000	H	B	B
36000	36500	H	F	F
36500	37000	H	F	F
37000	37500	H	F	F
37500	38000	H	F	F
38000	38500	H	F	F
38500	39000	H	F	F
39000	39500	H	F	F
39500	40000	H	F	F
40000	40500	H	F	F
40500	41000	H	F	F
41000	41500	H	F	F
41500	42000	H	F	F
42000	42500	H	F	F
42500	43000	H	F	F
43000	43500	H	F	F
43500	44000	H	F	F
44000	44500	H	F	F
44500	45000	H	F	F
45000	45500	H	F	F
45500	46000	H	F	F
46000	46500	H	F	F
46500	47000	H	F	F
47000	47500	H	F	F
47500	48000	H	F	F
48000	48500	H	F	F
48500	49000	H	F	F
49000	49500	H	F	F
49500	50000	H	F	F
50000	50500	H	F	F
50500	51000	H	F	F

Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

ROAD INVENTORY : Land use pattern

NAME OF ROAD: Joram to Koloriang 20Km to 70 Km & 138Km to 158 Km

DISTRICT: Lower Subansiri, Kra Daadi, Kurung Kumey

km _____ to km

Chainage		Terrain	Landuse	
From	To		Left	Right
(m)	(m)			
51000	51500	H	F	F
51500	52000	H	F	F
52000	53000	H	F	F
53000	53500	H	F	F
53500	54000	H	F	F
54000	54500	H	F	F
54500	55000	H	F	F
55000	55500	H	F	F
55500	56000	H	F	F
56000	56500	H	F	F
56500	57000	H	F	F
57000	57500	H	F	F
57500	58000	H	F	F
58000	58500	H	F	F
58500	59000	H	F	F
59000	59500	H	F	F
59500	60000	H	F	F
60000	60500	H	F	F
60500	61000	H	F	F
61000	61500	H	F	F
61500	62000	H	F	F
62000	62500	H	F	F
62500	63000	H	F	F
63000	63500	H	F	F
63500	64000	H	F	F
64000	64500	H	F	F
64500	65000	H	F	F
65000	65500	H	F	F
65500	66000	H	F	F
66000	66500	H	F	F
66500	67000	H	F	F

Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

ROAD INVENTORY : Land use pattern

NAME OF ROAD: Joram to Koloriang 20Km to 70 Km & 138Km to 158 Km

DISTRICT: Lower Subansiri, Kra Daadi, Kurung Kumey

km _____ to km

Chainage		Terrain	Landuse	
From	To		Left	Right
(m)	(m)			
67000	67500	H	F	F
67500	68000	H	F	F
68000	68500	H	B	B
68500	69000	H	B	B
69000	69500	H	B	B
69500	70000	H	B	B
138000	138500	H	F	F
138500	139000	H	F	F
139000	139500	H	F	F
139500	140000	H	F	F
140000	140500	H	F	F
140500	141000	H	F	F
141000	141500	H	F	F
141500	142000	H	F	F
142000	142500	H	F	F
142500	143000	H	F	F
143000	143500	H	F	F
143500	144000	H	F	F
144000	144500	H	F	F
144500	145000	H	F	F
145000	145500	H	F	F
145500	146000	H	F	F
146000	146500	H	F	F
146500	147000	H	F	F
147000	147500	H	F	F
147500	148000	H	F	F
148000	148500	H	F	F
148500	149000	H	F	F
149000	149500	H	F	F
149500	150000	H	F	F
150000	150500	H	F	F

Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

ROAD INVENTORY : Land use pattern

NAME OF ROAD: Joram to Koloriang 20Km to 70 Km & 138Km to 158 Km

DISTRICT:

Lower Subansiri, Kra Daadi, Kurung Kumey

km _____ **to km**

Chainage		Terrain	Landuse	
From	To		Left	Right
(m)	(m)			
150500	151000	H	F	F
151000	151500	H	F	F
151500	152000	H	F	F
152000	152500	H	F	F
152500	153000	H	F	F
153000	153500	H	F	F
153500	154000	H	F	F
154000	154500	H	F	F
154500	155000	H	F	F
155000	155500	H	F	F
155500	156000	H	F	F
156000	156500	H	F	F
156500	157000	H	B	B
157000	157500	H	B	B
157500	158000	H	B	B

Terrain	Code
Plain	P
Rolling	R
Hilly	H

Landuse
Agricultural
Built-up
Plantation
Forest
Open

Client : National Highways & Infrastructure Development Corporation Ltd. (NHIDCL)

_____

Signature of Surveyor

VOYANTS SOLUTIONS PVT. LTD. GURGAON

Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

ROAD INVENTORY : DETAILS OF EXISTING ROW

NAME OF ROAD: Joram to Koloriang 20Km to 70 Km & 138Km to 158 Km

DISTRICT:

Lower Subansiri, Kra Daadi, Kurung Kumey

km to km

Existing Chainage		Length	Existing ROW (m)
From	To		
(m)	(m)	(m)	
km 20-km 70			
20000	20500	500	6.250
20500	21000	500	6.250
21000	21500	500	6.250
21500	22000	500	6.250
22000	22500	500	6.250
22500	23000	500	6.250
23000	23500	500	6.250
23500	24000	500	6.250
24000	24500	500	6.250
24500	25000	500	5.250
25000	25500	500	6.250
25500	26000	500	6.250
26000	26500	500	6.250
26500	27000	500	6.250
27000	27500	500	6.250
27500	28000	500	6.250
28000	28500	500	6.250
28500	29000	500	6.250
29000	29500	500	6.250
29500	30000	500	6.250
30000	30500	500	6.250
30500	31000	500	6.250
31000	31500	500	6.250
31500	32000	500	5.350
32000	32500	500	5.350
32500	33000	500	6.000
33000	33500	500	6.000
33500	34000	500	6.000
34000	34500	500	6.250
34500	35000	500	6.250
35000	35500	500	6.250
35500	36000	500	6.250
36000	36500	500	6.250
36500	37000	500	6.250
37000	37500	500	6.000
37500	38000	500	6.000
38000	38500	500	6.000
38500	39000	500	6.000

Annexure- 1.2

Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

ROAD INVENTORY : DETAILS OF EXISTING ROW

NAME OF ROAD: Joram to Koloriang 20Km to 70 Km & 138Km to 158 Km

DISTRICT: Lower Subansiri, Kra Daadi, Kurung Kumey

km to km

Existing Chainage		Length	Existing ROW (m)
From	To		
(m)	(m)	(m)	
39000	39500	500	6.250
39500	40000	500	6.250
40000	40500	500	6.250
40500	41000	500	6.250
41000	41500	500	6.250
41500	42000	500	5.950
42000	42500	500	5.950
42500	43000	500	6.250
43000	43500	500	6.250
43500	44000	500	6.250
44000	44500	500	6.250
44500	45000	500	6.250
45000	45500	500	6.250
45500	46000	500	6.250
46000	46500	500	6.250
46500	47000	500	6.250
47000	47500	500	6.250
47500	48000	500	6.000
48000	48500	500	6.250
48500	49000	500	6.250
49000	49500	500	6.250
49500	50000	500	6.250
50000	50500	500	6.250
50500	51000	500	6.250
51000	51500	500	6.250
51500	52000	500	6.250
52000	53000	1000	6.000
53000	53500	500	6.250
53500	54000	500	6.250
54000	54500	500	6.250
54500	55000	500	6.250
55000	55500	500	6.250
55500	56000	500	6.250
56000	56500	500	6.250
56500	57000	500	6.250
57000	57500	500	6.000
57500	58000	500	6.250
58000	58500	500	6.250
58500	59000	500	6.250

Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

ROAD INVENTORY : DETAILS OF EXISTING ROW

NAME OF ROAD: Joram to Koloriang 20Km to 70 Km & 138Km to 158 Km

DISTRICT:

Lower Subansiri, Kra Daadi, Kurung Kumey

km to km

Existing Chainage		Length	Existing ROW (m)
From	To		
(m)	(m)	(m)	
59000	59500	500	6.250
59500	60000	500	6.250
60000	60500	500	6.000
60500	61000	500	6.000
61000	61500	500	6.000
61500	62000	500	6.000
62000	62500	500	6.250
62500	63000	500	6.250
63000	63500	500	6.250
63500	64000	500	6.250
64000	64500	500	6.250
64500	65000	500	6.250
65000	65500	500	6.250
65500	66000	500	6.250
66000	66500	500	6.250
66500	67000	500	6.250
67000	67500	500	6.250
67500	68000	500	6.250
68000	68500	500	6.500
68500	69000	500	10.000
69000	69500	500	10.000
69500	70000	500	10.000
km 138.000-km 154.000			
138000	138500	500	6.250
138500	139000	500	6.250
139000	139500	500	6.250
139500	140000	500	6.750
140000	140500	500	6.750
140500	141000	500	6.250
141000	141500	500	6.250
141500	142000	500	6.250
142000	142500	500	6.250
142500	143000	500	6.250
143000	143500	500	6.000
143500	144000	500	6.000
144000	144500	500	6.000
144500	145000	500	6.000
145000	145500	500	6.000
145500	146000	500	6.000

Annexure- 1.2

Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

ROAD INVENTORY : DETAILS OF EXISTING ROW

NAME OF ROAD: Joram to Koloriang 20Km to 70 Km & 138Km to 158 Km

DISTRICT: Lower Subansiri, Kra Daadi, Kurung Kumey

km to km

Existing Chainage		Length	Existing ROW (m)
From	To		
(m)	(m)	(m)	
146000	146500	500	5.250
146500	147000	500	5.250
147000	147500	500	5.250
147500	148000	500	5.250
148000	148500	500	5.250
148500	149000	500	5.250
149000	149500	500	5.550
149500	150000	500	5.300
150000	150500	500	5.300
150500	151000	500	5.300
151000	151500	500	5.300
151500	152000	500	5.300
152000	152500	500	5.300
152500	153000	500	5.300
153000	153500	500	5.300
153500	154000	500	5.000
154000	154500	500	5.000
154500	155000	500	5.000
155000	155500	500	5.000
155500	156000	500	5.000
156000	156500	500	20.000
156500	156585	85	20.000

Client : National Highways & Infrastructure Development Corporation Ltd. (NHIDCL)

Signature of Surveyor

VOYANTS SOLUTIONS PVT. LTD. GURGAON

Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

ROAD INVENTORY : DETAILS OF ROADWAY

NAME OF ROAD: Joram to Koloriang 20Km to 70 Km & 138Km to 158 Km

DISTRICT: Lower Subansiri, Kra Daadi, Kurung Kumey

DAY/DATE:

SURVEYOR:

km _____ to km _____

Chainage		Terrain	Landuse		Water body		Name of Village / Town	Carriageway			Shoulder				Observed Roadway Width	Embankment Height		Submergence	Drain			
											Left		Right						Left		Right	
From	To		Left	Right	Location	Offset		Surfacing Type	Average Width	Condition	Type	Avg. Width	Type	Avg. Width		Left	Right		Type	Width	Type	Width
(m)	(m)				(m)	(m)			(m)			(m)		(m)	(m)	(m)	(m)			(m)		(m)
20000	20500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
20500	21000	H	F	B				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
21000	21500	H	F	B				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
21500	22000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
22000	22500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
22500	23000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
23000	23500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
23500	24000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
24000	24500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
24500	25000	H	O	B			NEW PANIA	B	3.0m	F	E	1m	E	0.5m							K	0.250m
25000	25500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
25500	26000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
26000	26500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
26500	27000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
27000	27500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
27500	28000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
28000	28500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
28500	29000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
29000	29500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
29500	30000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
30000	30500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
30500	31000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
31000	31500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m

Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

ROAD INVENTORY : DETAILS OF ROADWAY

NAME OF ROAD: Joram to Koloriang 20Km to 70 Km & 138Km to 158 Km

DISTRICT: Lower Subansiri, Kra Daadi, Kurung Kumey

DAY/DATE:

SURVEYOR:

km _____ **to km** _____

Chainage		Terrain	Landuse		Water body		Name of Village / Town	Carriageway			Shoulder				Observed Roadway Width	Embankment Height		Submergence	Drain			
											Left		Right			Left	Right		Left		Right	
From	To		Left	Right	Location	Offset		Surfacing Type	Average Width	Condition	Type	Avg. Width	Type	Avg. Width					Type	Width	Type	Width
(m)	(m)				(m)	(m)			(m)			(m)		(m)	(m)	(m)	(m)			(m)		(m)
31500	32000	H	B	B			NEELAM	B	2.8	P	E	1.0m	E	0.6m							K	0.250m
32000	32500	H	B	B			NEELAM	B	2.8	P	E	1.0m	E	0.6m							K	0.250m
32500	33000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
33000	33500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
33500	34000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
34000	34500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
34500	35000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
35000	35500	H	B	B			DEED	B	3.0 m	P	E	1.0m	E	1.5m					K	0.250m		
35500	36000	H	B	B			DEED	B	3.0 m	P	E	1.0m	E	1.5m					K	0.250m		
36000	36500	H	F	F				B	3.5m	P	E	1.0m	E	1.5m					K	0.250m		
36500	37000	H	F	F				B	3.5m	P	E	1.0m	E	1.5m					K	0.250m		
37000	37500	H	F	F				B	3.5m	P	E	1.0m	E	1.5m								
37500	38000	H	F	F				B	3.5m	P	E	1.0m	E	1.5m								
38000	38500	H	F	F				B	3.5m	F	E	1.0m	E	1.5m								
38500	39000	H	F	F				B	3.5m	F	E	1.0m	E	1.5m								
39000	39500	H	F	F				B	3.5m	F	E	1.0m	E	1.5m					K	0.250m		
39500	40000	H	F	F				B	3.5m	F	E	1.0m	E	1.5m					K	0.250m		
40000	40500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
40500	41000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
41000	41500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
41500	42000	H	F	F			DEM	B	3.2m	P	E	1.5m	E	1.0m							K	0.250m
42000	42500	H	F	F			DEM	B	3.2m	P	E	1.5m	E	1.0m							K	0.250m
42500	43000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m

Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

ROAD INVENTORY : DETAILS OF ROADWAY

NAME OF ROAD: Joram to Koloriang 20Km to 70 Km & 138Km to 158 Km

DISTRICT: Lower Subansiri, Kra Daadi, Kurung Kumey

DAY/DATE:

SURVEYOR:

km _____ **to km** _____

Chainage		Terrain	Landuse		Water body		Name of Village / Town	Carriageway			Shoulder				Observed Roadway Width	Embankment Height		Submergence	Drain			
											Left		Right			Left	Right		Left		Right	
From	To		Left	Right	Location	Offset		Surfacing Type	Average Width	Condition	Type	Avg. Width	Type	Avg. Width					Type	Width	Type	Width
(m)	(m)				(m)	(m)			(m)			(m)		(m)	(m)	(m)	(m)			(m)		(m)
43000	43500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
43500	44000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
44000	44500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
44500	45000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
45000	45500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
45500	46000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
46000	46500	H	F	F				B	3.5m	F	E	1.0m	E	1.5m					K	0.250m		
46500	47000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
47000	47500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
47500	48000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
48000	48500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
48500	49000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
49000	49500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
49500	50000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
50000	50500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
50500	51000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
51000	51500	H	F	F				B	3.5m	F	E	1.0m	E	1.5m					K	0.250m		
51500	52000	H	F	F				B	3.5m	F	E	1.0m	E	1.5m					K	0.250m		
52000	53000	H	F	F				B	3.5m	F	E	1.0m	E	1.5m								
53000	53500	H	F	F				B	3.5m	F	E	1.0m	E	1.5m					K	0.250m		
53500	54000	H	F	F				B	3.5m	F	E	1.0m	E	1.5m					K	0.250m		
54000	54500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
54500	55000	H	F	F				B	3.5m	F	E	1.0m	E	1.5m					K	0.250m		

Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

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NAME OF ROAD: Joram to Koloriang 20Km to 70 Km & 138Km to 158 Km

DISTRICT: Lower Subansiri, Kra Daadi, Kurung Kumey

DAY/DATE:

SURVEYOR:

km _____ **to km** _____

Chainage		Terrain	Landuse		Water body		Name of Village / Town	Carriageway			Shoulder				Observed Roadway Width	Embankment Height		Submergence	Drain			
											Left		Right			Left	Right		Left		Right	
From	To		Left	Right	Location	Offset		Surfacing Type	Average Width	Condition	Type	Avg. Width	Type	Avg. Width					Type	Width	Type	Width
(m)	(m)				(m)	(m)			(m)			(m)		(m)	(m)	(m)	(m)			(m)		(m)
55000	55500	H	F	F				B	3.5m	F	E	1.0m	E	1.5m					K	0.250m		
55500	56000	H	F	F				B	3.5m	F	E	1.0m	E	1.5m					K	0.250m		
56000	56500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
56500	57000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
57000	57500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
57500	58000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
58000	58500	H	F	F			SHAKTI	B	3.5m	P	E	1.5m	E	1.0m							K	0.250m
58500	59000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
59000	59500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
59500	60000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
60000	60500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
60500	61000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
61000	61500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
61500	62000	H	F	F				B	3.5m	P	E	1.5m	E	1.0m								
62000	62500	H	F	F				B	3.5m	P	E	1.5m	E	1.0m							K	0.250m
62500	63000	H	F	F				B	3.3m	F	E	1.5m	E	1.0m							K	0.250m
63000	63500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
63500	64000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
64000	64500	H	F	F				B	3.2m	F	E	1.5m	E	1.0m							K	0.250m
64500	65000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
65000	65500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
65500	66000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
66000	66506	H	F	F				B	3.3m	F	E	1.5m	E	1.0m							K	0.250m

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ROAD INVENTORY : DETAILS OF ROADWAY

NAME OF ROAD: Joram to Koloriang 20Km to 70 Km & 138Km to 158 Km

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DAY/DATE:

SURVEYOR:

km _____ **to km** _____

Chainage		Terrain	Landuse		Water body		Name of Village / Town	Carriageway			Shoulder				Observed Roadway Width	Embankment Height		Submergence	Drain			
											Left		Right						Left		Right	
From	To		Left	Right	Location	Offset		Surfacing Type	Average Width	Condition	Type	Avg. Width	Type	Avg. Width		Left	Right		Type	Width	Type	Width
(m)	(m)				(m)	(m)			(m)			(m)		(m)	(m)	(m)	(m)			(m)		(m)
66500	67000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
67000	67500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
67500	68000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
68000	68500	H	B	B			NEW PALIN	B	3.5m	P	E	1.5m	E	1.0m					K	0.250m	K	0.250m
68500	69000	H	B	B			NEW PALIN	B	3.5m	P	E	1.5m	E	1.0m							K	0.250m
69000	69500	H	B	B			NEW PALIN	B	3.5m	P	E	1.5m	E	1.0m							K	0.250m
69500	70000	H	B	B			NEW PALIN	B	3.5m	P	E	1.5m	E	1.0m					K	0.250m		
138000	138500	H	F	F				B	4.0	G	E	1.5m	E	0.5m					K	0.250m		
138500	139000	H	F	F				B	4.0	G	E	1.5m	E	0.5m					K	0.250m		
139000	139500	H	F	F				B	4.0	G	E	1.5m	E	0.5m					K	0.250m		
139500	140000	H	F	F				B	4.0	G	E	1.5m	E	1.0m					K	0.250m		
140000	140500	H	F	F				B	4.0	G	E	1.5m	E	1.0m					K	0.250m		
140500	141000	H	F	F				B	4.0	G	E	1.5m	E	0.5m					K	0.250m		
141000	141500	H	F	F				B	4.0	G	E	1.5m	E	0.5m					K	0.250m		
141500	142000	H	F	F				B	4.0	G	E	1.5m	E	0.5m					K	0.250m		
142000	142500	H	F	F				B	4.0	G	E	1.5m	E	0.5m					K	0.250m		
142500	143000	H	F	F				B	4.0	G	E	1.5m	E	0.5m					K	0.250m		
143000	143500	H	F	F				B	3.5	P	E	1.5m	E	0.75m					K	0.250m		
143500	144000	H	F	F				B	3.5	F	E	1.5m	E	0.75m					K	0.250m		
144000	144500	H	F	F				B	3.5	F	E	1.5m	E	0.75m					K	0.250m		
144500	145000	H	F	F				B	3.5	F	E	1.5m	E	0.75m					K	0.250m		
145000	145500	H	F	F				B	3.5	F	E	1.5m	E	0.75m					K	0.250m		
145500	146000	H	F	F				B	3.5	F	E	0.75m	E	1.5m							K	0.250m

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Chainage		Terrain	Landuse		Water body		Name of Village / Town	Carriageway			Shoulder				Observed Roadway Width	Embankment Height		Submergence	Drain			
											Left		Right			Left	Right		Left		Right	
From	To		Left	Right	Location	Offset		Surfacing Type	Average Width	Condition	Type	Avg. Width	Type	Avg. Width					Type	Width	Type	Width
(m)	(m)				(m)	(m)			(m)			(m)		(m)	(m)	(m)	(m)			(m)		(m)
146000	146500	H	F	F				B	3.5	F	E	0.5m	E	1.0m							K	0.250m
146500	147000	H	F	F				B	3.5	F	E	0.5m	E	1.0m							K	0.250m
147000	147500	H	F	F				B	3.3	F	E	0.5m	E	1.0m							K	0.250m
147500	148000	H	F	F				B	3.3	F	E	0.5m	E	1.0m							K	0.250m
148000	148500	H	F	F				B	3.4	F	E	0.5m	E	1.0m							K	0.250m
148500	149000	H	F	F				B	3.5	F	E	0.5m	E	1.0m							K	0.250m
149000	149500	H	F	F				B	3.5	F	E	0.8m	E	1.0m							K	0.250m
149500	150000	H	F	F				B	3.5	F	E	0.8m	E	1.0m							K	0.250m
150000	150500	H	F	F				B	3.5	F	E	0.8m	E	1.0m								
150500	151000	H	F	F				B	3.5	F	E	0.8m	E	1.0m								
151000	151500	H	F	F				B	3.5	F	E	0.8m	E	1.0m								
151500	152000	H	F	F				B	3.3	F	E	0.8m	E	1.0m								
152000	152500	H	F	F				B	3.5	F	E	0.8m	E	1.0m								
152500	153000	H	F	F				B	3.5	F	E	0.8m	E	1.0m								
153000	153500	H	F	F				B	3.5	F	E	0.8m	E	1.0m								
153500	154000	H	F	F				B	3.5	P	E	0.50m	E	1.0m								
154000	154500	H	F	F				B	3.5	P	E	0.50m	E	1.0m								
154500	155000	H	F	F				B	3.5	P	E	0.50m	E	1.0m								
155000	155500	H	F	F				B	3.5	P	E	0.50m	E	1.0m								
155500	156000	H	F	F				B	3.5	P	E	0.50m	E	1.0m								
156000	156500	H	F	F			Koloriang	B	3.5	P	E	0.50m	E	1.0m							K	0.250m
156500	157000	H	B	B			Koloriang	B	3.5	P	E	0.50m	E	1.0m							K	0.250m
157000	157500	H	B	B			Koloriang	B	3.5	P	E	0.50m	E	1.0m							K	0.250m

Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

ROAD INVENTORY : DETAILS OF ROADWAY

NAME OF ROAD: Joram to Koloriang 20Km to 70 Km & 138Km to 158 Km

DISTRICT: Lower Subansiri, Kra Daadi, Kurung Kumey

DAY/DATE:

SURVEYOR:

km _____ **to km** _____

Chainage		Terrain	Landuse		Water body		Name of Village / Town	Carriageway			Shoulder				Observed Roadway Width	Embankment Height		Submergence	Drain			
											Left		Right			Left	Right		Left		Right	
From	To		Left	Right	Location	Offset		Surfacing Type	Average Width	Condition	Type	Avg. Width	Type	Avg. Width					Type	Width	Type	Width
(m)	(m)				(m)	(m)			(m)			(m)		(m)	(m)	(m)	(m)			(m)		(m)
157500	158000	H	B	B			Koloriang	B	3.5	P	E	0.50m	E	1.0m							K	0.250m

Terrain	Code
Plain	P
Rolling	R
Hilly	H

Landuse	Code
Agricultural	A
Built-up	B
Plantation	P
Forest	F
Open	O

Carriageway Surfacing Type	Code
Bituminous	B
Concrete	C
Gravel / Moorum	G
Kutcha	K
Brick Paved	BP
Stone Paved	SP

Condition	Code
Very Good	VG
Good	G
Fair	F
Poor	P
Very Poor	VP

Shoulder Type	Code
Earthen	E
Hard	H
Bituminious	B

Drain Type	Code
Kutcha	K
Brick Line	B
Concrete	C

bankment
Fill
Cut

Client : National Highways & Infrastructure Development Corporation Ltd. (NHIDCL)

Signature of Surveyor

Sheet No. /

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VOYANTIS SOLUTIONS PVT. LTD. GURGAON

Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

ROAD INVENTORY: DETAILS OF CROSS ROAD

NAME OF ROAD: Joram to Koloriang 20Km to 70 Km & 138Km to 158 Km

DAY/DATE:

DISTRICT: Lower Subansiri, Kra Daadi, Kurung Kumey

SURVEYOR:

CROSS ROAD									
Sl. No.	Location	Name of Crossing	Side	Destination	Category	Skew Angle	Surfacing Type	Carriageway Width	Roadway Width
	(km)					(deg)		(m)	(m)
1	20+495		LHS	-	4	45	4	3	5
2	23+550		RHS	-	4	40	4	2.5	4
3	23+600		LHS	-	4	40	4	2.5	4
4	23+780		LHS	Neulíbar	4	90	4	3	5
5	24+300		LHS	-	4	90	4	4	6
6	24+350		RHS	-	4	30	4	3	5
7	25+020		RHS	-	4	45	4	3	5
8	25+175		LHS	-	4	120	4	2.5	4
9	30+480		RHS	-	4	30	4	2.5	4
10	30+575		LHS	-	4	90	4	3	5
11	30+680		RHS	-	4	30	4	3	5
12	31+150		LHS	-	4	40	4	3	5
13	31+520		RHS	-	4	35	4	2.5	4
14	32+200		RHS	-	4	30	4	2.5	4
15	32+275		LHS	-	4	35	4	3	5
16	32+475		LHS	-	4	35	4	3	5
17	33+910		RHS	-	4	40	4	3	5
18	34+125		RHS	-	4	35	4	2.5	4
19	34+450		BOTH	-	4	90	4	2.5	4
20	34+650		RHS	-	4	120	4	3	5
21	34+850		LHS	-	4	90	4	3	5
22	35+275		RHS	-	4	135	4	3	5
23	35+600		LHS	-	4	45	4	3	5
24	36+175		LHS	-	4	120	4	2.5	4
25	38+475		LHS	Radhipur	4	45	4	2.5	4
26	38+825		LHS	-	4	45	4	3	5

VOYANTA SOLUTIONS PVT. LTD. GURGAON

Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

ROAD INVENTORY: DETAILS OF CROSS ROAD

NAME OF ROAD: Joram to Koloriang 20Km to 70 Km & 138Km to 158 Km

DAY/DATE:

DISTRICT: Lower Subansiri, Kra Daadi, Kurung Kumey

SURVEYOR:

CROSS ROAD									
Sl. No.	Location	Name of Crossing	Side	Destination	Category	Skew Angle	Surfacing Type	Carriageway Width	Roadway Width
	(km)					(deg)		(m)	(m)
27	42+850		BOTH	-	4	40	4	3	5
28	43+350		RHS	-	4	120	4	3.5	5
29	43+800		LHS	-	4	120	4	2.5	4
30	49+820		RHS	-	4	40	4	3	5
31	50+450		LHS	-	4	120	4	3	5
32	56+875		RHS	-	4	135	4	2.5	4
33	60+300		LHS	-	4	45	4	3	5
34	65+025		RHS	-	4	135	4	3	5
35	68+300		LHS	-	4	90	4	2.5	4
36	142+953		LHS	-	4	40	4	3	5
37	144+700		RHS	-	4	90	4	3	5
38	149+560		RHS	-	4	40	4	3	5
39	149+950		LHS	-	4	30	4	2.5	4
40	152+070		RHS	-	4	35	4	2.5	4
41	154+300		LHS	-	4	90	4	2.5	4
42	156+000		RHS	-	4	35	4	2.5	4
43	156+100		RHS	-	4	35	4	2.5	4
44	156+250		RHS	-	4	90	4	2.5	4
45	156+300		RHS	-	4	90	4	2.5	4
46	156+450		RHS	-	4	90	4	3	5
47	158+000		4-legged		1	-	1	4	6

Category	Code
NH	1
SH	2
DR	3
VR	4

Surfacing Type	Code
Bituminous	1
Concrete	2
Gravel / Moorum	3
Kutcha	4
Brick Paved	5
Stone Paved	6

Client : National Highways & Infrastructure Development Corporation Ltd. (NHIDCL)

Voyants Solutions Pvt.Ltd. (VSPL)

VOYANTS SOLUTIONS PVT. LTD. GURGAON

Signature of Surveyor

Sheet No : /

Signature of Supervisor

Annexure-1.5

Utility Counting from 20.000 km to 70.000 km

Chainage		Electricity Department				Telephone Department			
		HT		EP		OFC		TP	
		LHS	RHS	LHS	RHS	LHS	RHS	LHS	RHS
20+000	21+000	0	0	0	0	0	0	0	0
21+000	22+000	3	0	0	0	0	0	0	0
22+000	23+000	1	0	0	0	0	0	0	0
23+000	24+000	1	0	0	0	0	0	0	0
24+000	25+000	0	0	0	0	0	0	0	0
25+000	26+000	0	0	0	0	0	0	0	0
26+000	27+000	0	0	0	0	0	0	0	0
27+000	28+000	0	0	0	0	0	0	0	0
28+000	29+000	6	0	1	0	0	0	0	0
29+000	30+000	0	0	0	0	0	0	0	0
30+000	30+500	1	0	0	0	0	0	0	0
30+500	31+000	0	0	0	0	0	0	0	0
31+000	32+000	2	0	0	0	0	0	1	0
32+000	33+000	2	1	0	2	0	0	3	0
33+000	34+000	0	0	0	0	0	0	0	0
34+000	35+000	0	0	0	0	0	0	0	0
35+000	36+000	0	0	0	0	0	0	0	0
36+000	37+000	0	0	0	0	0	0	0	0
37+000	38+000	0	0	3	1	0	0	0	0
38+000	39+000	0	0	0	1	0	0	0	0
39+000	40+000	2	1	0	0	0	0	0	0
40+000	41+000	0	2	0	0	0	0	0	0
41+000	42+000	0	0	0	0	0	0	0	0
42+000	43+000	0	0	0	0	0	0	0	0
43+000	44+000	0	0	0	0	0	0	0	0
44+000	45+000	0	0	0	0	0	0	0	0
45+000	45+500	0	0	0	0	0	0	0	0
45+500	46+000	3	0	0	0	0	0	0	0
46+000	46+500	0	0	0	0	0	0	0	0
46+500	47+000	0	0	0	0	0	0	0	0
47+000	48+000	0	0	0	0	0	0	0	0
48+000	49+000	0	1	0	0	0	0	0	2
49+000	50+000	0	0	0	0	0	0	0	0
50+000	51+000	0	0	0	0	0	0	0	0
51+000	52+000	0	0	0	0	0	0	0	0
52+000	53+000	0	0	0	0	0	0	0	0
53+000	54+000	0	0	0	0	0	0	0	0
54+000	55+000	0	0	0	0	0	0	0	0
55+000	55+500	2	0	0	0	0	0	2	0
55+500	56+000	0	0	2	1	0	0	0	0
56+000	57+000	0	0	1	2	0	0	0	0
57+000	57+500	0	1	2	2	0	0	0	0
57+500	58+500	7	1	0	0	0	0	0	0
58+500	58+716	0	0	0	0	0	0	0	0

Chainage		Electricity Department				Telephone Department			
		HT		EP		OFC		TP	
		LHS	RHS	LHS	RHS	LHS	RHS	LHS	RHS
Utility Counting from 138.000 km to 158.000 km									
138	139	0	3	0	0	0	0	0	0
139	140	3	2	0	0	0	0	0	0
140	141	0	0	1	6	0	0	0	0
141	142	0	6	0	0	0	0	0	0
142	143	0	2	0	0	0	0	0	0
143	144	0	1	0	0	0	0	0	0
144	145	0	1	12	0	0	0	0	0
145	146	0	0	2	0	0	0	0	0
146	147	0	0	0	0	0	0	0	0
147	148	2	0	0	0	0	0	0	0
148	149	4	0	0	0	0	0	0	0
149	150	6	0	0	0	0	0	0	0
150	151	6	0	0	0	0	0	0	0
151	152	3	0	0	0	0	0	1	1
152	153	0	0	0	0	0	0	0	0
153	154	4	8	0	0	0	0	3	0
154	154.036	1	0	0	0	0	0	0	0
Total		**59**	**30**	**24**	**15**	**0**	**0**	**10**	**3**

VOYANT SOLUTIONS PVT. LTD. GURGAON

Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

PAVEMENT CONDITION SURVEY

NAME OF ROAD: _____

DAY/DATE:

km _____ to km _____

SURVEYOR:

Chainage		Carriageway		Cracking		Ravelling	Potholing	Patching	Edge Failure		Rut Depth				Shoulder				Embankment				Remarks
									Left	Right	Left		Right		Left		Right		Left		Right		
From (m)	To (m)	Width (m)	Type	Width < 3mm (sqm)	Width > 3mm (sqm)	(sqm)	(sqm)	(sqm)	(m)	(m)	Length (mm)	Depth	Length (mm)	Depth (mm)	Type	Condition	Type	Condition	Condition	Slope	ondition	Slope	
20000	20500	3.5	B	20	50	100	800	20	300	400	400	8	500	10	E	F	E	F	-	-	-	-	-
20500	21000	3.5	B	23	47	98	900	24	400	300	350	7	465	12	E	F	E	F	-	-	-	-	-
21000	21500	3.5	B	26	45	97	950	23	400	300	350	9	465	13	E	F	E	F	-	-	-	-	-
21500	22000	3.5	B	23	45	95	950	22	400	300	350	7	465	13	E	F	E	F	-	-	-	-	-
22000	22500	3.5	B	24	45	98	940	21	400	300	350	8	465	13	E	F	E	F	-	-	-	-	-
22500	23000	3.5	B	25	45	97	930	20	400	300	350	9	465	13	E	F	E	F	-	-	-	-	-
23000	23500	3.5	B	23	45	98	920	19	400	300	350	6	465	13	E	F	E	F	-	-	-	-	-
23500	24000	3.5	B	24	46	95	910	18	400	300	350	8	465	13	E	F	E	F	-	-	-	-	-
24000	24500	3.5	B	23	45	96	900	17	400	300	350	9	465	12	E	F	E	F	-	-	-	-	-
24500	25000	3.0	B	23	43	97	890	16	400	300	350	8	480	14	E	F	E	F	-	-	-	-	-
25000	25500	3.5	B	25	48	94	880	12	300	370	340	7	495	10	E	F	E	F	-	-	-	-	-
25500	26000	3.5	B	27	53	93	870	8	350	370	340	9	490	9	E	F	E	F	-	-	-	-	-
26000	26500	3.5	B	29	40	92	860	10	350	370	340	8	485	8	E	F	E	F	-	-	-	-	-
26500	27000	3.5	B	31	46	91	850	11	350	370	340	7	480	7	E	F	E	F	-	-	-	-	-
27000	27500	3.5	B	33	42	90	840	12	350	370	340	6	475	6	E	F	E	F	-	-	-	-	-
27500	28000	3.5	B	35	45	89	830	14	350	370	340	7	470	5	E	F	E	F	-	-	-	-	-
28000	28500	3.5	B	34	48	88	820	16	350	370	340	7	465	10	E	F	E	F	-	-	-	-	-
28500	29000	3.5	B	33	51	87	810	18	350	370	340	7	460	10	E	F	E	F	-	-	-	-	-
29000	29500	3.5	B	37	54	86	890	20	350	370	340	7	455	10	E	F	E	F	-	-	-	-	-
29500	30000	3.5	B	23	45	85	900	11	350	370	340	9	450	10	E	F	E	F	-	-	-	-	-
30000	30500	3.5	B	23	45	84	910	12	350	370	340	9	445	10	E	F	E	F	-	-	-	-	-
30500	31000	3.5	B	23	45	83	920	13	350	370	340	9	440	10	E	F	E	F	-	-	-	-	-
31000	31500	3.5	B	23	45	82	930	14	350	370	340	9	435	10	E	F	E	F	-	-	-	-	-
31500	32000	2.8	B	23	45	81	940	15	350	370	340	9	430	10	E	F	E	F	-	-	-	-	-
32000	32500	2.8	B	23	45	80	950	16	350	370	340	9	425	10	E	F	E	F	-	-	-	-	-

Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

PAVEMENT CONDITION SURVEY

NAME OF ROAD: _____

DAY/DATE:

km _____ to km _____

SURVEYOR:

Chainage		Carriageway		Cracking		Ravelling	Potholing	Patching	Edge Failure		Rut Depth				Shoulder				Embankment				Remarks
											Left		Right		Left		Right		Left		Right		
From (m)	To (m)	Width (m)	Type	Width < 3mm (sqm)	Width > 3mm (sqm)	(sqm)	(sqm)	(sqm)	Left (m)	Right (m)	Length (mm)	Depth	Length (mm)	Depth (mm)	Type	Condition	Type	Condition	Condition	Slope	ondition	Slope	
32500	33000	3.5	B	23	45	79	960	17	350	370	340	9	420	10	E	F	E	F	-	-	-	-	-
33000	33500	3.5	B	23	45	78	970	10	350	370	340	8	415	10	E	F	E	F	-	-	-	-	-
33500	34000	3.5	B	23	45	77	980	9	350	370	340	8	410	10	E	F	E	F	-	-	-	-	-
34000	34500	3.5	B	23	45	76	990	8	350	370	340	8	405	10	E	F	E	F	-	-	-	-	-
34500	35000	3.5	B	23	45	12	960	12	350	370	340	8	400	10	E	F	E	F	-	-	-	-	-
35000	35500	3.0	B	23	45	15	930	8	350	370	340	8	460	10	E	F	E	F	-	-	-	-	-
35500	36000	3.0	B	23	45	15	900	8	350	360	340	8	455	10	E	F	E	F	-	-	-	-	-
36000	36500	3.5	B	23	45	15	870	8	360	360	340	8	450	10	E	F	E	F	-	-	-	-	-
36500	37000	3.5	B	23	45	15	840	8	360	360	340	8	445	10	E	F	E	F	-	-	-	-	-
37000	37500	3.5	B	23	45	15	810	8	360	360	340	9	440	10	E	F	E	F	-	-	-	-	-
37500	38000	3.5	B	23	45	15	890	8	360	360	340	7	435	10	E	F	E	F	-	-	-	-	-
38000	38500	3.5	B	23	45	15	970	8	360	360	340	8	430	10	E	F	E	F	-	-	-	-	-
38500	39000	3.5	B	23	45	15	950	8	360	360	340	8	425	10	E	F	E	F	-	-	-	-	-
39000	39500	3.5	B	23	45	15	950	8	360	360	340	8	420	10	E	F	E	F	-	-	-	-	-
39500	40000	3.5	B	23	45	15	950	8	360	360	340	8	415	10	E	F	E	F	-	-	-	-	-
40000	40500	3.5	B	23	45	15	950	8	360	360	340	8	410	10	E	F	E	F	-	-	-	-	-
40500	41000	3.5	B	23	45	15	950	8	360	360	340	8	405	10	E	F	E	F	-	-	-	-	-
41000	41500	3.5	B	23	45	15	950	8	360	360	340	8	400	10	E	F	E	F	-	-	-	-	-
41500	42000	3.2	B	23	45	15	950	8	360	360	340	8	395	10	E	F	E	F	-	-	-	-	-
42000	42500	3.2	B	23	45	15	950	8	360	360	340	8	390	10	E	F	E	F	-	-	-	-	-
42500	43000	3.5	B	23	45	15	950	8	360	360	340	8	385	10	E	F	E	F	-	-	-	-	-
43000	43500	3.5	B	23	45	15	950	8	360	360	340	8	380	10	E	F	E	F	-	-	-	-	-
43500	44000	3.5	B	23	45	15	950	8	360	360	340	8	375	10	E	F	E	F	-	-	-	-	-
44000	44500	3.5	B	23	45	15	950	8	360	360	340	8	370	10	E	F	E	F	-	-	-	-	-
44500	45000	3.5	B	23	45	15	940	8	360	360	340	8	365	10	E	F	E	F	-	-	-	-	-

Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

PAVEMENT CONDITION SURVEY

NAME OF ROAD: _____ DAY/DATE:

km _____ to km _____ SURVEYOR:

Chainage		Carriageway		Cracking		Ravelling	Potholing	Patching	Edge Failure		Rut Depth				Shoulder				Embankment				Remarks
									Left	Right	Left		Right		Left		Right		Left		Right		
From (m)	To (m)	Width (m)	Type	Width < 3mm (sqm)	Width > 3mm (sqm)	(sqm)	(sqm)	(sqm)	(m)	(m)	Length (mm)	Depth	Length (mm)	Depth (mm)	Type	Condition	Type	Condition	Condition	Slope	ondition	Slope	
45000	45500	3.5	B	23	45	15	940	8	360	360	340	8	480	10	E	F	E	F	-	-	-	-	-
45500	46000	3.5	B	23	45	15	940	8	360	360	340	8	475	10	E	F	E	F	-	-	-	-	-
46000	46500	3.5	B	23	45	15	940	8	360	360	340	8	470	10	E	F	E	F	-	-	-	-	-
46500	47000	3.5	B	23	45	15	940	8	360	360	340	8	465	10	E	F	E	F	-	-	-	-	-
47000	47500	3.5	B	23	45	15	940	8	360	360	340	8	460	10	E	F	E	F	-	-	-	-	-
47500	48000	3.5	B	23	45	15	940	8	360	360	340	8	455	10	E	F	E	F	-	-	-	-	-
48000	48500	3.5	B	23	45	15	940	8	360	360	340	8	450	10	E	F	E	F	-	-	-	-	-
48500	49000	3.5	B	23	45	15	940	8	360	360	340	8	445	10	E	F	E	F	-	-	-	-	-
49000	49500	3.5	B	23	45	15	940	8	360	360	340	8	440	10	E	F	E	F	-	-	-	-	-
49500	50000	3.5	B	23	45	15	940	8	360	360	340	8	435	11	E	F	E	F	-	-	-	-	-
50000	50500	3.5	B	23	45	15	940	8	360	360	340	8	430	12	E	F	E	F	-	-	-	-	-
50500	51000	3.5	B	23	45	15	940	8	360	360	340	8	425	13	E	F	E	F	-	-	-	-	-
51000	51500	3.5	B	23	45	15	940	8	360	360	340	8	420	14	E	F	E	F	-	-	-	-	-
51500	52000	3.5	B	23	45	15	940	8	360	360	340	8	415	12	E	F	E	F	-	-	-	-	-
52000	53000	3.5	B	23	45	15	940	8	360	360	340	8	410	8	E	F	E	F	-	-	-	-	-
53000	53500	3.5	B	23	45	15	940	8	360	360	340	8	405	9	E	F	E	F	-	-	-	-	-
53500	54000	3.5	B	23	45	15	940	8	360	360	340	8	405	9	E	F	E	F	-	-	-	-	-
54000	54500	3.5	B	29	40	92	860	10	350	370	340	8	485	8	E	F	E	F	-	-	-	-	-
54500	55000	3.5	B	31	46	91	850	11	350	370	340	7	480	7	E	F	E	F	-	-	-	-	-
55000	55500	3.5	B	33	42	90	840	12	350	370	340	6	475	6	E	F	E	F	-	-	-	-	-
55500	56000	3.5	B	35	45	89	830	14	350	370	340	7	470	5	E	F	E	F	-	-	-	-	-
56000	56500	3.5	B	34	48	88	820	16	350	370	340	7	465	10	E	F	E	F	-	-	-	-	-
56500	57000	3.5	B	33	51	87	810	18	350	370	340	7	460	10	E	F	E	F	-	-	-	-	-
57000	57500	3.5	B	37	54	86	890	20	350	370	340	7	455	10	E	F	E	F	-	-	-	-	-
57600	58000	3.5	B	23	45	85	900	11	350	370	340	9	450	10	E	F	E	F	-	-	-	-	-

Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

PAVEMENT CONDITION SURVEY

NAME OF ROAD: _____

DAY/DATE:

km _____ to km _____

SURVEYOR:

Chainage		Carriageway		Cracking		Ravelling	Potholing	Patching	Edge Failure		Rut Depth				Shoulder				Embankment				Remarks
											Left		Right		Left		Right		Left		Right		
From (m)	To (m)	Width (m)	Type	Width < 3mm (sqm)	Width > 3mm (sqm)	(sqm)	(sqm)	(sqm)	Left (m)	Right (m)	Length (mm)	Depth	Length (mm)	Depth (mm)	Type	Condition	Type	Condition	Condition	Slope	ondition	Slope	
58000	58500	3.5	B	23	45	84	910	12	350	370	340	9	445	10	E	F	E	F	-	-	-	-	-
58500	59000	3.5	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
59000	59500	3.5	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
59500	60000	3.5	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
60000	60500	3.5	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
60500	61000	3.5	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
61000	61500	3.5	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
61500	62000	3.5	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
62000	62500	3.5	B	27	44	67	980	11	340	355	345	7	450	8	E	F	E	F	-	-	-	-	-
62500	63000	3.3	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
63000	63500	3.5	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
63500	64000	3.5	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
64000	64500	3.2	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
64500	65000	3.5	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
65000	65500	3.5	B	27	44	67	980	11	340	355	345	7	450	7	E	F	E	F	-	-	-	-	-
65500	66000	3.5	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
66000	66500	3.3	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
66500	67000	3.5	B	23	45	15	940	8	360	360	340	8	405	7	E	F	E	F	-	-	-	-	-
67000	67500	3.5	B	29	40	25	860	10	350	370	340	8	485	8	E	F	E	F	-	-	-	-	-
67500	68000	3.5	B	31	46	23	850	11	350	370	340	7	480	9	E	F	E	F	-	-	-	-	-
68000	68500	3.5	B	32	43	23	850	11	350	370	340	7	480	9	E	F	E	F	-	-	-	-	-
68500	69000	3.5	B	31	46	23	850	11	350	370	340	7	480	9	E	F	E	F	-	-	-	-	-
69000	69500	3.5	B	31	46	23	850	11	350	370	340	7	480	9	E	F	E	F	-	-	-	-	-
69500	70000	3.5	B	31	46	23	850	11	350	370	340	7	480	9	E	F	E	F	-	-	-	-	-
138000	138500	4.0	B	31	46	23	850	11	350	370	340	7	480	9	E	F	E	F	-	-	-	-	-

Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

PAVEMENT CONDITION SURVEY

NAME OF ROAD: _____

DAY/DATE:

km _____ to km _____

SURVEYOR:

Chainage		Carriageway		Cracking		Ravelling	Potholing	Patching	Edge Failure		Rut Depth				Shoulder				Embankment				Remarks
											Left		Right		Left		Right		Left		Right		
From (m)	To (m)	Width (m)	Type	Width < 3mm	Width > 3mm				Left	Right	Length (mm)	Depth	Length (mm)	Depth (mm)	Type	Condition	Type	Condition	Condition	Slope	ondition	Slope	
				(sqm)	(sqm)	(sqm)	(sqm)	(sqm)	(m)	(m)													
138500	139000	4.0	B	31	46	23	850	11	350	370	340	7	480	9	E	F	E	F	-	-	-	-	-
139000	139500	4.0	B	31	46	23	850	11	350	370	340	7	480	9	E	F	E	F	-	-	-	-	-
139500	140000	4.0	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
140000	140500	4.0	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
140500	141000	4.0	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
141000	141500	4.0	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
141500	142000	4.0	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
142000	142500	4.0	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-

VOYANTS SOLUTIONS PVT. LTD. GURGAON

Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

PAVEMENT CONDITION SURVEY

NAME OF ROAD: _____

DAY/DATE:

km _____ to km _____

SURVEYOR:

Chainage		Carriageway		Cracking		Ravelling	Potholing	Patching	Edge Failure		Rut Depth				Shoulder				Embankment				Remarks
									Left	Right	Left		Right		Left		Right		Left		Right		
From (m)	To (m)	Width (m)	Type	Width < 3mm (sqm)	Width > 3mm (sqm)	(sqm)	(sqm)	(sqm)	(m)	(m)	Length (mm)	Depth	Length (mm)	Depth (mm)	Type	Condition	Type	Condition	Condition	Slope	ondition	Slope	
142500	143000	4.0	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
143000	143500	3.5	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
143500	144000	3.5	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
144000	144500	3.5	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
144500	145000	3.5	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
145000	145500	3.5	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
145500	146000	3.5	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
146000	146500	3.5	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
146500	147000	3.5	B	27	44	67	980	11	340	355	345	7	450	9	E	F	E	F	-	-	-	-	-
147000	147500	3.3	B	23	45	15	940	8	360	360	340	8	405	7	E	F	E	F	-	-	-	-	-
147500	148000	3.3	B	23	45	15	940	8	360	360	340	8	405	7	E	F	E	F	-	-	-	-	-
148000	148500	3.4	B	23	45	15	940	8	360	360	340	8	405	7	E	F	E	F	-	-	-	-	-
148500	149000	3.5	B	23	45	15	940	8	360	360	340	8	405	7	E	F	E	F	-	-	-	-	-
149000	149500	3.5	B	23	45	15	940	8	360	360	340	8	405	7	E	F	E	F	-	-	-	-	-
149500	150000	3.5	B	23	45	15	940	8	360	360	340	8	405	7	E	F	E	F	-	-	-	-	-
150000	150500	3.5	B	23	45	15	940	8	360	360	340	8	405	7	E	F	E	F	-	-	-	-	-
150500	151000	3.5	B	23	45	15	940	8	360	360	340	8	405	7	E	F	E	F	-	-	-	-	-
151000	151500	3.5	B	23	45	15	940	8	360	360	340	8	405	7	E	F	E	F	-	-	-	-	-
151500	152000	3.3	B	23	45	15	940	8	360	360	340	8	405	7	E	F	E	F	-	-	-	-	-
152000	152500	3.5	B	31	46	22	850	11	350	370	340	7	480	7	E	F	E	F	-	-	-	-	-
152500	153000	3.5	B	33	42	23	840	12	350	370	340	6	475	6	E	F	E	F	-	-	-	-	-
153000	153500	3.5	B	32	43	15	840	12	350	370	340	6	475	6	E	F	E	F	-	-	-	-	-
153500	154000	3.5	B	31	46	22	840	12	350	370	340	6	475	6	E	F	E	F	-	-	-	-	-
154000	154500	3.5	B	31	46	22	840	12	350	370	340	6	455	6	E	F	E	F	-	-	-	-	-
154500	155000	3.5	B	31	46	22	840	12	350	370	340	6	475	6	E	F	E	F	-	-	-	-	-

Preparation of Feasibility Study and Detailed Project Report for Two laning of Joram – Koloriang Road (NH – 713) from Km.20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 km) in the State of Arunachal Pradesh on EPC mode

PAVEMENT CONDITION SURVEY

NAME OF ROAD: _____

DAY/DATE:

km _____ to km _____

SURVEYOR:

Chainage		Carriageway		Cracking		Ravelling	Potholing	Patching	Edge Failure		Rut Depth				Shoulder				Embankment				Remarks
											Left		Right		Left		Right		Left		Right		
From (m)	To (m)	Width (m)	Type	Width < 3mm (sqm)	Width > 3mm (sqm)	(sqm)	(sqm)	(sqm)	Left (m)	Right (m)	Length (mm)	Depth	Length (mm)	Depth (mm)	Type	Condition	Type	Condition	Condition	Slope	ondition	Slope	
155000	155500	3.5	B	31	46	22	840	12	350	370	340	6	480	6	E	F	E	F	-	-	-	-	-
155500	156000	3.5	B	31	46	22	840	12	350	370	340	6	475	6	E	F	E	F	-	-	-	-	-
156000	156500	3.5	B	32	44	15	940	11	360	375	355	8	405	8	E	F	E	F	-	-	-	-	-
156500	157000	3.5	B	40	47	15	940	12	360	370	370	7	405	9	E	F	E	F	-	-	-	-	-
157000	157500	3.5	B	34	35	15	940	11	360	380	365	6	450	9	E	F	E	F	-	-	-	-	-
157500	158000	3.5	B	35	44	18	960	12	355	370	360	8	445	8	E	F	E	F	-	-	-	-	-

Bituminous	B
Concrete	C

For Shoulder	
Type	Condition
Earthen =	Good=G
Hard=H	Fair= F
Paved=P	Poor= P

For Embankment				
Distress	Rating	Extent	Rating	Slope
Erosion	1	None	1	ert): Y(Horz)
Failure	2	oderate	2	
Drops	3	requent	3	
		Very frequent	4	

Client : National Highways & Infrastructure Development Corporation Ltd. (NHIDCL)

Voyants Solutions Pvt.Ltd. (VSPL)

Signature of Surveyor

Sheet No. /

ignature of Supervisor

VOYANTS SOLUTIONS PVT. LTD. GURGAON