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NATIONAL HIGHWAYS & INFRASTRUCTURE DEVELOPMENT CORPORATION LTD. (NHIDCL)

Ministry of Road, Transport & Highways

Government of India

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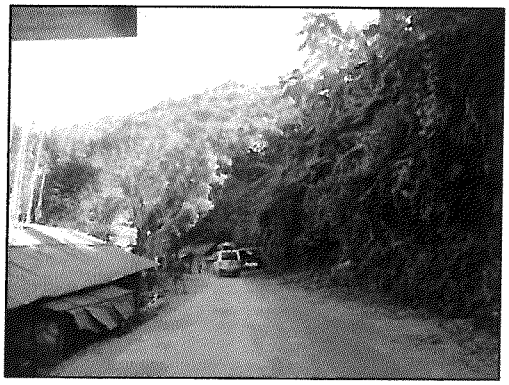
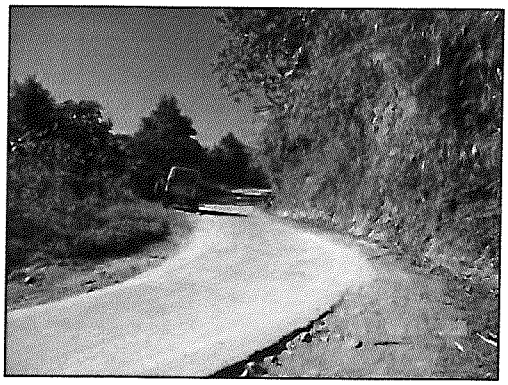

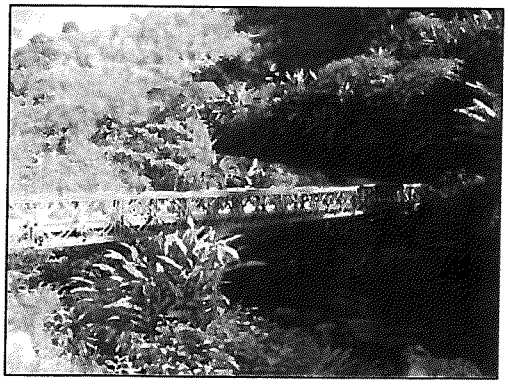

Consultancy Services for preparation of Feasibility Study and Detailed Project Report for Two laning of Joram - Koloriang Road (NH-713) from Km. 20.00 to Km. 70.00 & Km. 138.00 to Km. 158.00 (Total Length 70 Km) in the State of Arunachal Pradesh on EPC mode

DETAILED PROJECT REPORT

Volume II -Design Report

Revision : R0, September 2016

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METHODOLOGY OF SURVEY INVESTIGATION

1.0 METHODOLOGY

The project involves a series of inter related activities, both in the field and in the design office. Methodology for carrying out these activities is described in the following paragraphs.

1.1 SITE INVESTIGATIONS AND SURVEYS

1.1.1 INVENTORY AND CONDITION SURVEY OF ROAD

1.1.1.1 Road Inventory

Inventory of the existing road shall cover all existing physical features such as terrain, landuse, roadway, carriageway, type of cross section (cut or fill), utility lines passing along or crossing the highway, roadside facilities and all other features that may have influence on the project preparation.

1.1.1.2 Road Condition Survey

Inventory of the existing road shall cover all existing physical features such as terrain, landuse, roadway, carriageway, type of cross section (cut or fill), utility lines passing along or crossing the highway, roadside facilities and all other features that may have influence on the project preparation.

Detailed field study shall be carried out for road and pavement surface conditions covering the following:

i. pavement condition (surface distress type and extent);
ii. shoulder condition;
iii. embankment condition; and
iv. drainage condition

The process ensures that complete information on condition of existing pavement and shoulder is collected so that design parameters related to pavement can be established.
The information collected shall consist of the details of cracking (narrow and wide), rut depth, raveling, potholing, patching in the form of percentage area as well as edge break in terms of length and rut depth in mm. affected of the existing pavement; and paved shoulder material loss, rut depth, corrugation, edge etc. in the case of unpaved shoulders.

The study shall identify defects and road section with similar characteristics i.e. homogeneous sections.

1.1.2 TOPO, DRAINAGE AND UTILITY SURVEY

According to the TOR, detailed topographic survey is required to be carried out for capturing the essential ground features along the alignment and for working out improvements, rehabilitation and upgrading costs.
Hence, the Consultants propose to carry out detailed topographic survey for the project road. Briefly the survey work would include:

- Topographic survey true to ground realities using precision instruments like Total Stations and Auto Levels, and bringing out data in digital form (x,y,z format) for developing digital terrain model (DTM)
- Capturing all existing physical features, including utility poles, trees of girth greater than 0.3 m, oil and gas lines, hills, valley etc. within the survey corridor which should be compatible with the widening requirements subject to a minimum of 25 m on either side of the centre line of the road or road land boundary, whichever is more.
- Additional surveys at bridge sites for hydraulic calculations and for all arms of crossing roads at intersections. Also, detailed topographic surveys along approved alignment of proposed bypasses approved by NHIDCL, if required.
- Where existing road crosses the alignments, the survey will extend a minimum of 100m on either side of the road centre line to allow improvements, including at-grade intersections.
- Longitudinal sections shall be taken at 25 m interval and at the locations of curve points, small streams, and intersections and at change in elevation. Cross-sections, in general covering the full width of survey corridor at 50 m interval shall be taken and should show levels at every 2-5 m intervals also at all breaks in the profile. Cross sections shall be taken at closer interval (15-25 m depending on radius of curve) on curves.

  Fixing horizontal and vertical control points with concrete pillars. The Reference Pillars/BMs with levels drawn from GTS bench marks shall be of size 15cmX15cmX45cm, cast in RCC grade M15 with a nail fixed in the centre of the top surface. The reference pillar shall be embedded in concrete up to a depth of 30 cm with CC M 10 (5 CM wide all around). The balance 15 cm above ground shall be painted yellow. The spacing shall be 250m apart.

1.1.3 STUDY OF ALTERNATIVES FOR REALIGNMENTS/POOR GEOMETRICS

Alignment, realignment design was done on satellite images and its validity was studied at site. The poor geometrics were corrected by increasing the radii of sharp curves with radii below 60m.

The revised design was then incorporated on topographic survey finalize to report.

1.1.4 JUNCTIONS/INTERSECTIONS AT GRADE

Though there is only one major junction at km 158.000 (Koloriang)and most of the minor junctions were T/Y shaped, but they were studied at site for the purpose of improving them.

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1.1.5 PRELIMINARY SOCIAL AND ENVIRONMENTAL SCREENING.

The main objective of the Quality Assurance Plan (QAP) is to ensure that the environmental impact assessment study is carried out according to the pre-determined scope and methods, and the results produced are accurate, reproducible and verifiable.

The scope of the QA plan for the Environmental Impact Assessment has been adequately devised to include the following elements of study:

- Mobilization
- Sample collection, preservation and forwarding
- Field analysis
- Laboratory analysis
- Data reduction and validation
- Chain of custody

Environmental Specialist ensured that the selected procedures are documented and the study team members are familiar with the procedures.

1.1.6 PAVEMENT STUDIES

1.1.6.1 Subgrade Characteristics and Strength

a) Division of project road into homogeneous sections with respect to pavement condition and structural strength. The delineation of segments homogeneous with respect to roughness and strength should be done using the cumulative difference approach (AASTHO, 1993).

b) For the widening of existing road within the ROW, sampling and testing of at least 3 subgrade soil samples for each homogeneous road sections or 3 samples for each soil type encountered, whichever is more.

c) Incase of new alignments, the test pits for subgrade soil shall be @ **5** km interval or for each soil type, whichever is more. A minimum of three samples should be tested corresponding to each homogeneous segment.

d) The testing for subgrade soils shall include the following :

i) In situ density and moisture content at each test pit
ii) Field CBR using DCP at each test pit.
iii) Characterisation (Grain size and Atterberg Limit test) for each test pit sample.
iv) Laboratory moisture density characteristics (modified AASHTO compaction).
v) Laboratory CBR (unsoak and 4-day soak compacted at three energy levels) and swell.

e) Apart from the above, permeability and consolidation test shall be carried out for problematic soils along project corridor. The frequency of sampling and testing of these soils shall be finalised in consultation with NHIDCL; officials.

1.1.7 MATERIAL INVESTIGATION

The activities included

i) Identification of potential sources (including use of fly-ash/slag), quarry sites and borrow areas.
ii) Collection of samples and conducting relevant laboratory tests.
iii) Evaluation of test results and assesses the suitability thereof for incorporation in various works and making recommendation on the use of the materials from different sources based on techno-economic principles.
iv) Assess adequacy of quality and quantities of various construction materials available
v) No material shall be used from the ROW except by way of leveling the ground as required from construction point of view or for landscaping and planting of trees. Environmental restrictions, if any and feasibility of availability of these sites to perspective civil works contractors should be duly taken into account.
vi) Preparation of mass haul diagram and quarry charts indicating the location of selected borrow areas, quarries and the respective estimated quantities.
vii) Recommend on how to make good this borrow and quarry areas after the exploitation of materials for construction of works.
viii) Preparation and testing of bituminous mixes for various layers and concrete mixes of different grades using suitable materials (binders, aggregates, sand fillers etc.) as identified during material investigation to conform with latest MORT&H specifications.

1.1.8 STUDY OF LANDSLIDE AREAS

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-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.

1.1.9 TRAFFIC STUDIES

Traffic surveys primarily consist of manual classified counts at two locations namely to determine the existing volume and composition of traffic using key links and nodes within the study area. Such counts provided verification of existing counts and significant gaps in count data to be plugged.

The Consultant conducted each of the manual classified counts over seven consecutive days for 24 hours. Vehicles have been classified in three ways: by direction, time (using an hourly subdivision) and vehicle type. But importantly the methodology was based upon numbers of wheels and axles, such that distinction is drawn between two-axle four-wheeled vehicles and two-axle six-wheeled vehicles, both passenger and goods classification system as given in TOR as well as that in IRC codes was also kept in mind.

The TOR makes reference to conduct of origin-destination (OD) surveys. The survey was carried out at location of three traffic volume surveys at the two extreme ends of the stretch.

The OD survey included vehicle, cargo, journey purpose (to assist in the assessment of the value of time), vehicle information such as manufacturer, model age and usage in addition to the start and end points of the journey. This additional information was required for the economic analysis.

1.2 DELIVERABLES PRELIMINARY PROJECT REPORT STAGE

- Preliminary Design Report
  - Project Description
  - Updated Cost Estimate
  - EIA/IEE action plan
  - Procurement and Packaging
- Design Report
  - Road and Bridge Inventory
  - Proposed Design basis and proposal
  - Proposed pavement design and preliminary bridge design
- Drawings
  - Layout Plan
  - Indicative land acquisition plan
  - Road Junction Design
  - Drawing for cross drainage and other structures

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SUMMARY OF SURVEY AND INVESTIGATION

2.0 TRAFFIC SURVEYS AND ANALYSIS

3.0 IDENTIFICATION OF HOMOGENEOUS ROAD SECTIONS

The Consultants have identified homogeneous sections based on reconnaissance survey, after study of existing network, traffic intensity and major traffic generation &dispersal points along the corridor and potential bypasses for the corridor.

Homogeneous Sections

Based on above criteria, project road can be divided into two homogeneous sections exhibiting two different traffic characters. These homogeneous sections are as under.

a. Km 20+000to Km 70+000 (New Palin)
b. Km 138+000 to Km 158+000 (Koloriang)

3.0 TRAFFIC STUDIES

7 days Classified Traffic Volume Counts (CVC's) were conducted at two locations to understand traffic intensity on the two homogeneous sections of the project road. The details of survey locations are presented in **Table 2.1**

Table 2.1: location of 7 Days Classified Volume Count

Type of Survey	Survey Location	Chainage (NH-713)	Duration	Survey Dates
7 Days CVC	Near NewPalin	Km 67+500	7 days , 24 Hours	24/02/2016 – 01/03/2016
7 Days CVC	Near Koloriang	Km 155+200	7 days , 24 Hours	24/02/2016 – 01/03/2016

2..1 Average Daily Traffic

The average daily traffic of above mentioned location are presented in in **Table 2.2**

Table 2.2: Average Daily Traffic at count locations

Vehicle Types	At Km 67+500	At Km 155+200
Car/ Jeep/Van	125	122
Taxi	74	72
Two wheeler	92	80
3wh(pass)	0	0
Minibus	2	2

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Vehicle Types		At Km 67+500	At Km 155+200
School Bus		0	0
Bus (Govt)		0	0
Bus (Pvt.)		0	0
3wh (Goods)		0	0
LMV		80	71
LCV		14	11
2-Axle		17	15
3-Axle		0	0
4-Axle and 6 Axle		0	0
7 Axle Above		0	0
Tractor		0	0
Tractor with Trailer		0	0
Cycle		0	0
Cycle Rickshaw		0	0
Animal Cart		0	0
Others		6	5
Toll Exempted Vehicle	Car/Jeep	5	5
	Bus	3	2
	LCV	2	1
	Truck	8	7
Passenger Vehicles		**301**	**282**
Freight Vehicles		**126**	**109**
Total Fast Moving Vehicles		**427**	**392**
Total Slow Moving Vehicles		**0**	**0**
Total Vehicles		**427**	**392**
Total PCU		**457**	**416**

2..2 Traffic Composition

Analysis has been carried out to find out the composition traffic and the results are illustrated in **Figures 2.1and 2.2**. The composition of Cars is 90.15% whereas the composition of trucks is 9.85% at location Km 67+500 and composition of Cars is 91.08% whereas the composition of trucks is 8.92% at location Km 155+200.

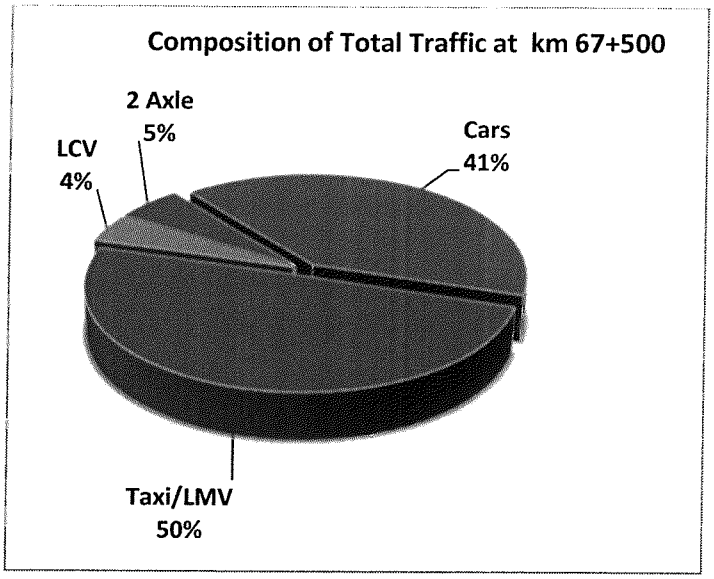

Figure 2.1: Traffic Compositions at Km 67+500

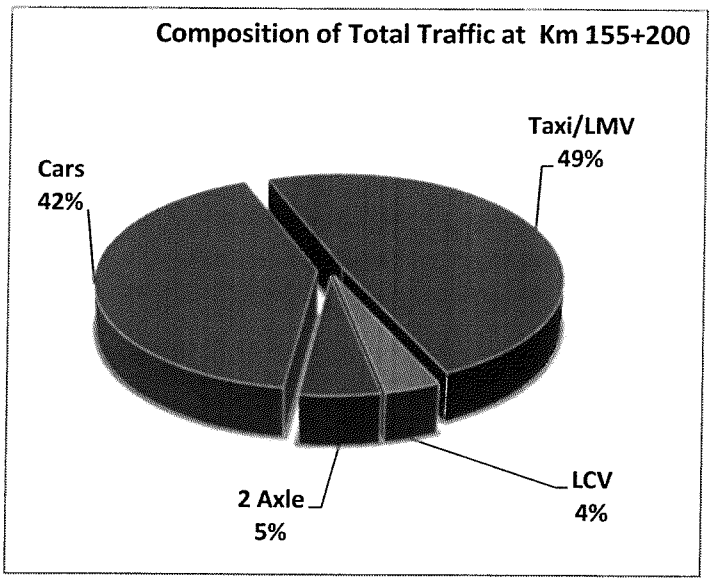

Figure 2.2:Traffic Compositions at Km 155+200

2..3 Annual Average Daily Traffic

For deriving seasonal variation and correction factors, petrol and diesel sales data has been used. Petrol and Diesel sales data have been collected from various petrol pumps for different years which are along the project corridor. SCF was worked out for the combined data of all petrol pumps which will give realistic figure by reducing the error. The SCF obtained after the analysis are as shown in **Error! Reference source not found.2.3**.The Survey is done in February 2016. So the February month SCF is taken for entire project road, which is highlighted in below table.

Table 2.3: Seasonal Factor derived from Fuel Sale Data

Month	Km 68.00	
	Petrol	Diesel
January	1.08	1.11
February	1.35	1.27
March	1.22	1.35
April	0.85	0.98
May	1.09	1.46
June	1.20	1.18
July	1.00	1.30
August	0.98	1.26
September	0.94	0.98
October	0.92	0.99
November	0.82	0.79
December	0.82	0.78

After applying the SCF, AADT derived is presented in **Table 2.4.**

Table 2.4: AADT Observed at Count Locations

Vehicle Types		At Km 67+500	At Km 155+200
Car/ Jeep/Van		169	164
Taxi		94	91
Two wheeler		124	108
3wh(pass)		0	0
Minibus		3	3
School Bus		0	0
Bus (Govt)		0	0
Bus (Pvt.)		0	0
3wh (Goods)		0	0
LMV		101	90
LCV		17	13
2-Axle		21	19
3-Axle		0	0
4-Axle and 6 Axle		0	0
7 Axle Above		0	0
Tractor		0	0
Tractor with Trailer		0	0
Cycle		0	0
Cycle Rickshaw		0	0
Animal Cart		0	0
Others		8	6
Toll Exempted Vehicle	Car/Jeep	7	6
	Bus	3	2
	LCV	2	2

Vehicle Types	At Km 67+500	At Km 155+200
Truck	10	9
Passenger Vehicles	**400**	**375**
Freight Vehicles	**160**	**139**
Total Fast Moving Vehicles	**560**	**514**
Total Slow Moving Vehicles	**0**	**0**
Total Vehicles	**560**	**514**
Total PCU	**595**	**542**

2..4 TRAFFIC FORECAST

2..5 Projected Normal/Total Traffic

The normal traffic means the traffic presently plying on the project road whereas the total traffic means normal traffic± diverted traffic if any and in this case diverted traffic is not considered. The projected traffic in design period has been calculated as the projected growth rate. The projected growth rate has been calculated in elasticity method relates traffic growth to changes in the related economic parameters.According to IRC: 108-2015, elasticity based econometric model for highway projects could be derived in the following form:

Log e (P) = A0 + A1 Log e (EI)

Where:
P = Traffic volume (of any vehicle type)
EI = Economic Indicator (GDP/NSDP/Population/PCI)
A0 = Regression constant
A1 = Regression co-efficient (Elasticity Index)

The adopted growth rate for different category of vehicles are presented in **Table 2.5**

Table 2.5: Final 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

The projected total traffic are tabulated in Table 2.6

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Table 2.6: Projected Normal/Total Traffic AADT (PCU)

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
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

Year	At km 67+500		At km 155+200	
	Nos	PCU	Nos	PCU
2056	4792	5781	4521	5866
2057	5031	6070	4747	6159
2058	5283	6374	4984	6467
2059	5547	6692	5233	6790

2.3 ENGINEERING SURVEYS AND INVESTIGATIONS

2.3.1 Reconnaissance and Alignment

The consultants made an in-depth study of the available land width (ROW), topographic survey maps of the project area and other relevant information collected.

A detailed reconnaissance survey was conducted on the total section of 70km and possible alignment changes. Detail features such as land use, habitation, intersecting roads, utilities such as electrical lines (HT/LT), etc. This enabled the Consultants to visualize the possible problems to be encountered while selecting the realignment. The detailed ground reconnaissance of project influence area was utilized for planning and programming the detailed surveys and investigations.

2.3.2 Topographic Surveys

The topographic survey was completed in the first week of March 2016. The topographic survey was commenced early so that properly informed decisions can be made and to allow the design development to be carried out with accuracy.

Basic features of the topographical survey are detailed below. The topographical survey forms the basis of almost all-subsequent highway design work and sufficient time must be allowed to ensure the survey results are accurate and can be used with confidence.

GPS survey is being carried out and GPS control points are established along the alignment, In addition, auto leveling will be carried out between SOI GTS BMs and GPS control beacons. The topographic survey will include: -

- GPS control points 5 km intervals which will be auto leveled from Survey of India (SOI) GTS BM's to GTS BM's using auto levels (in accordance with IRC SP19)
- BM pillars will be constructed at 250 m intervals on alternate sides of the road beyond the current ROW. These will be auto leveled and additional benchmarks established on permanent structures.

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- A total station traverse is being carried out with stations between 250m apart. Field checks will be carried out for mutual bearing, mutual distance and height.
- The detailed survey is being carried out using a total station instrument with a strip width of 40 m, widened at horizontal curves, junctions and realignments. All topographical features will be picked up during the survey. Points will be picked up 25 m apart and cross sections taken at same intervals. Where existing roads cross the alignment the surveys will be extended to 100 m either side of the alignment proposed. Culvert location will be surveyed as part of the detailed survey.
- Pairs of reference pillars will be established at 2.5 km intervals along the alignment outside the ROW to facilitate the setting out of the proposed centre line following the horizontal alignment design.
- Hard copies of the survey will be made and will be used by VSL's senior surveyor and the survey teams to verify the accuracy in the field of the detailed survey.
- The survey will be received in digital format in XYZ format compatible with Mx software together with hard copies.

2.5 ROAD AND PAVEMENT INVESTIGATIONS

2.5.2 Road Inventory Survey

A detailed road inventory survey was carried out at 1000m intervals mainly for alternative alignments and visual inventory survey for other road network. Detail information was collected and utilized for planning, design and cost estimate.

An inventory of the project road has been carried out through dimensional measurement and visual inspection. Features like kilometerage, terrain and land-use, height of fill or depth of cut, width of pavement and shoulders, important road junctions and geometric deficiencies, utilities etc., were recorded. These surveys were carried out by visual observation supplemented with sample measurements using tape etc. The road inventory has been referenced to the existing km posts established along the roadside. Following were recorded during the road inventory survey.

- terrain (flat, rolling, mountainous)
- land-use (agricultural, commercial, forest, residential etc.) @ every kilometer
- carriageway width, surfacing type @ every 500m and every change of feature whichever is earlier
- shoulder surfacing type and width @ every 500m and every change of feature whichever is earlier
- sub-grade/local soil type (textural classification) @ every 1000m and every change of feature whichever is earlier.
- horizontal curve; vertical curve
- road intersection type and details, at every occurrence
- retaining structures and details, at every occurrence
- location of water bodies (lakes and reservoirs), at every occurrence; and,

- height of embankment or depth of cut @ every 200m and every change of feature whichever is earlier
- land width i.e. ROW
- culverts, bridges and other structures (type, size, span arrangement and location)
- roadside arboriculture
- existing utility services on either side within ROW
- general drainage conditions
- Design speed of existing road
- Inventory of all road side facilities for the public including educational, health, communication facilities and road user based facilities such as tea shops, dhaba, vehicle service shops etc.

The proposed project alignment starts from km 20.00 and ends at km 70.00. This constitutes the first 50km of the project road. The last 20km of the project stretch starts from km 138.00 and ends at km 158.00. The terrain varies from mountainous to steep. The existing alignment is a winding one and efforts are being made to reduce the sharp curves and escarpments. The detailed road inventory data are presented in **Annexure 2.1 to 2.5**

2.5.2 Pavement Condition Survey

From the result of the survey, the following inference could be drawn.

- The pavement is generally in a poor shape.
- There is appreciable rutting throughout the section.
- Alignment is generally full of potholes and some sections are completely failed in all respects.
- Alligator cracks are also present.
- The structural strength of the pavement is generally in bad condition.
- Pavement drainage system is inadequate.
- The earthen shoulders are poor except for few locations.
- The sub-grade soils are mostly clayey sand.

Existing pavement condition has been given in **Table 2.7.**

Table2.7: Existing Pavement Condition

Sl.No.	Chainage as per NH 713		Pavement Condition
	From	To	
1	20.000	70.000	Poor - Fair
2	138.000	158.000	Poor - Fair

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The information was collected in the form of percentage area cracking, pot-holed and ravelled pavements, and pavement edge fretting by length (m). The severity of pavement deterioration had been recorded as follows:

Visual Riding Quality	Average riding quality is poor
Surface Type	Bituminous
Cracking Area	Road is severally cracked in about 75 % of length
Pot-Holed and Ravelled	At an average 70 % of each km are having pot holes.
Pavement Edge Fretting	In almost 80 % of road length on both sides
Shoulder Condition	Earthen shoulders on both sides

The data collected in the condition survey had been processed and road segments of more or less equal performance identified using the criteria given in IRC 81-1999.

2.5 SUB-GRADE INVESTIGATION

The basic objective of the investigation was to form a database for characterization of existing pavement. The investigation was carried out by digging trial pits staggered left/right.

2.5.1 Large Pits (1m x 1m x 1m)

Trial pits of size 1m x 1m x 1m were dug at the pavement shoulder interface, extending through the pavement layers down to the subgrade level. Pits were at least 300 mm within the carriageway. Pits were made in such a way that half of the pit remains within the carriageway and the other half (in the shoulder), ensuring minimum damage to the original pavement and disruption to the traffic. Large test pits are done on both sides of the project road were dug at the pavement shoulder interface extending through the pavement layers down to the sub-grade level

The following sequence of operation was followed for each large test pit:

- Manual excavation of 1.0 m x 1.0 m and pit down to subgrade level .The thickness of the different pavement layers were measured and type of material examined and logged from three sides.
- Field (in-situ) dry density using sand replacement method as per IS 2720: Part 28 was carried out at the subgrade level.
- Adequate sample in sealed polythene bag were collected for classification tests as per IS: 2720 (relevant parts)
  - Field moisture content
  - Grain size analysis
  - Atterberg limits

One sample of 40 kg was collected from the top 400 mm of subgrade for the following laboratory tests (as per IS:2720)

- Free swell index
- Moisture-Density test (heavy compaction)
- CBR (4 days soaked at three energy levels of 10, 35 and 65 blows)

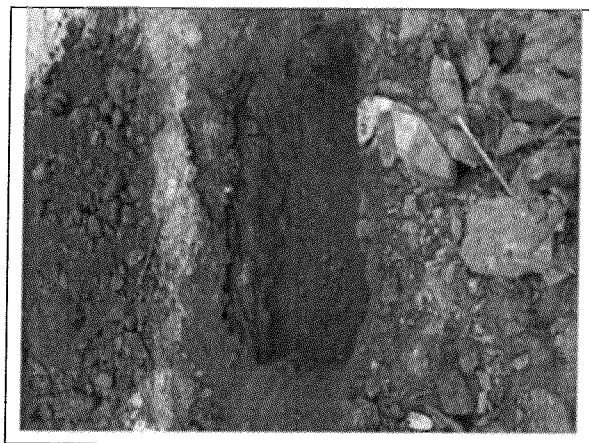
After the completion of field tests and collection of samples, the pits were backfilled with the excavated materials and compacted suitably so as not to jeopardize the smooth movement of traffic of the existing road.

The existing pavement structure mostly comprises of three layers, namely bituminous layer, base course and sub-base course. During the present investigation the surfacing course is reported, on the whole, as bituminous course (BC). The base course comprises of gravel, mix with stone & stone dust only and present in WBM mix The thickness of the bituminous surfacing layer varies from 60 mm to 78 mm. The thickness of the base and sub-base layer ranges from 120 to 200 mm.

The existing pavement compositions are tabulated in **Table 2.8** below:

Table 2.8: Existing Pavement Composition

Sl. No.	Chainage(Km)	Side	Layer Thickness (mm)		
			Bituminous Course	Base Course & Sub-base Course	Sub Grade Soil
1	21+000	RHS	69	150	500
2	29+700	LHS	75	140	400
3	40+000	RHS	70	160	500
4	50+500	RHS	78	170	500
5	56+800	LHS	69	190	450
6	68+100	RHS	72	200	550
7	145+300	LHS	60	120	430
8	152+000	LHS	68	130	500



Existing Pavement Composition

Existing Pavement Composition

The existing pavement composition for different chainages are presented in bar chart form below in **Fig. 2.3.**

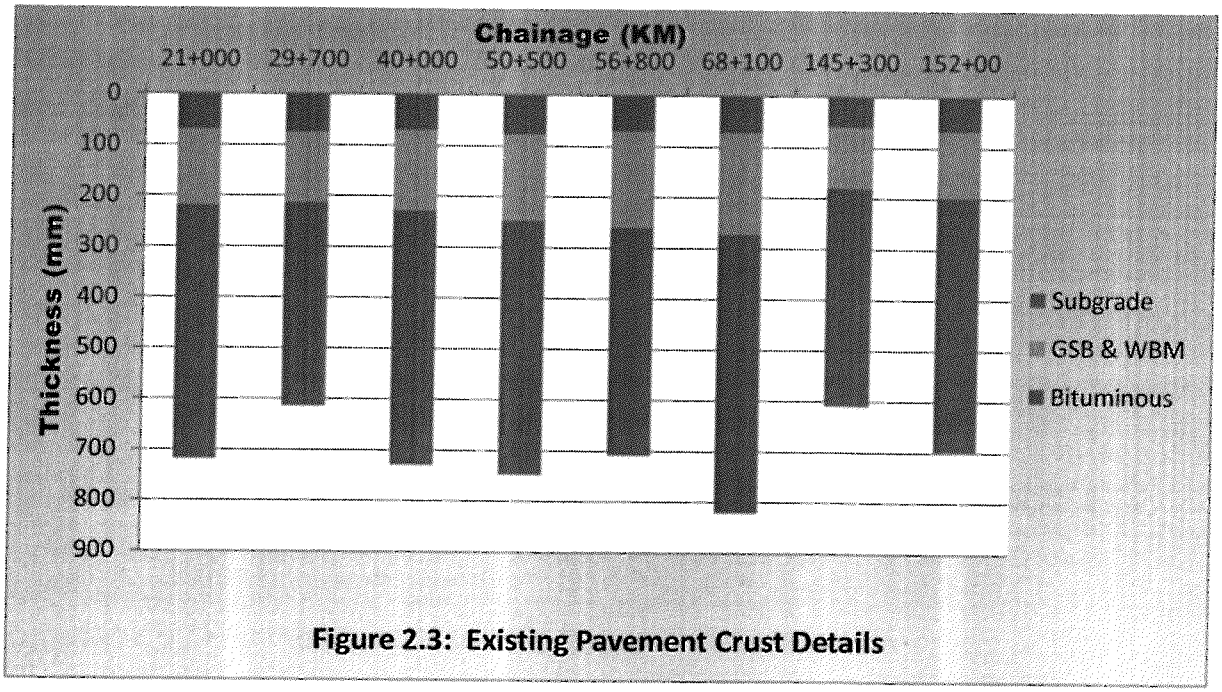


Figure 2.3: Existing Pavement Crust Details

2.5.2 CBR of existing sub-grade soil

California Bearing Ratio (CBR) tests were carried out on the pit samples in the laboratory as per standard procedures. At optimum moisture content (OMC) soil samples were compacted at three different energy levels corresponding to 10 blows, 35 blows, 65 blows as per IS:2720 (Part 8). These compacted soils at different compaction levels were tested after immersion in water for four days. Soaked CBR at 97% maximum dry density (MDD) has been interpolated from CBR-dry density curve.

The soaked CBR values at 97% MDU is tabulated in the table and varies from 10 % to 14 %.

2.5.2 Laboratory Properties of Sub-grade Soil

The laboratory test results consist of gradation, Atterberg limits, field moisture content, Field dry density (FDD), compaction characteristics (maximum dry density and optimum moisture content relationship as per heavy compaction), CBR (soaked) etc. for the subgrade soils underneath the existing pavement.

2.5.3.1 Grain Size

The fraction of the materials of the sub-grade soils passing 75μ sieve is 14.06% on an average, indicating higher sand content in the sub-grade soil and that the soils are predominantly silty sand mixed with moorum.

2.5.3.2 Atterberg Limit

The liquid limits for existing pavement of the soil are 46 to 26. Plasticity index for existing pavement soils are 15 to 05 (%).

The laboratory test results are given in **Annexure 2.8.**

2.5.3.3 Moisture Content vs. Dry Unit Weight Relationship (Heavy Compaction)

Soil samples obtained by test pits have been compacted in the laboratory at various moisture contents to derive moisture content vs. dry unit weight relationship. The method of heavy compaction in accordance with IS 2720 (Part 8) has been used. The results of heavy compaction test carried out on sub-grade samples of existing pavement to determine the maximum dry density (MDD) and optimum moisture content (OMC) relationship is given below.

Table 2.9: Test Results of Existing Subgrade Soil

Sample No.	Location of Sample (km)	Sample No	Atterberg Limits			MDD	OMC	CBR at 97% of MDD
1	21+000	BA1	46	31	15	1.78	16	07
2	29+700	1	26	21	05	1.97	10	14
3	40+000	2	30	23	07	1.95	11	14
4	50+500	3	31	24	07	1.79	17	07
5	56+800	4	32	24	08	1.96	10	13
6	68+100	5	33	27	06	1.95	11	13
7	145+300	6	30	24	06	1.91	12	13
8	152+000	7	32	26	06	1.95	10	11

For existing sub-grade soil the maximum dry density (MDD) of ranges between 17.8kN/ m3 and 19.7 kN/m3. The optimum moisture content varies between 16 % and 10 %. The result indicates that the maximum dry density of existing sub-grade soil is greater than 17.5 kN/ m3 at all

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chainages which satisfies the unit weight requirement of sub-grade soil as specified by MORT&H. A graphical representation of the existing CBR(%) and MDD(g/cc) is done in **Fig 2.4.**

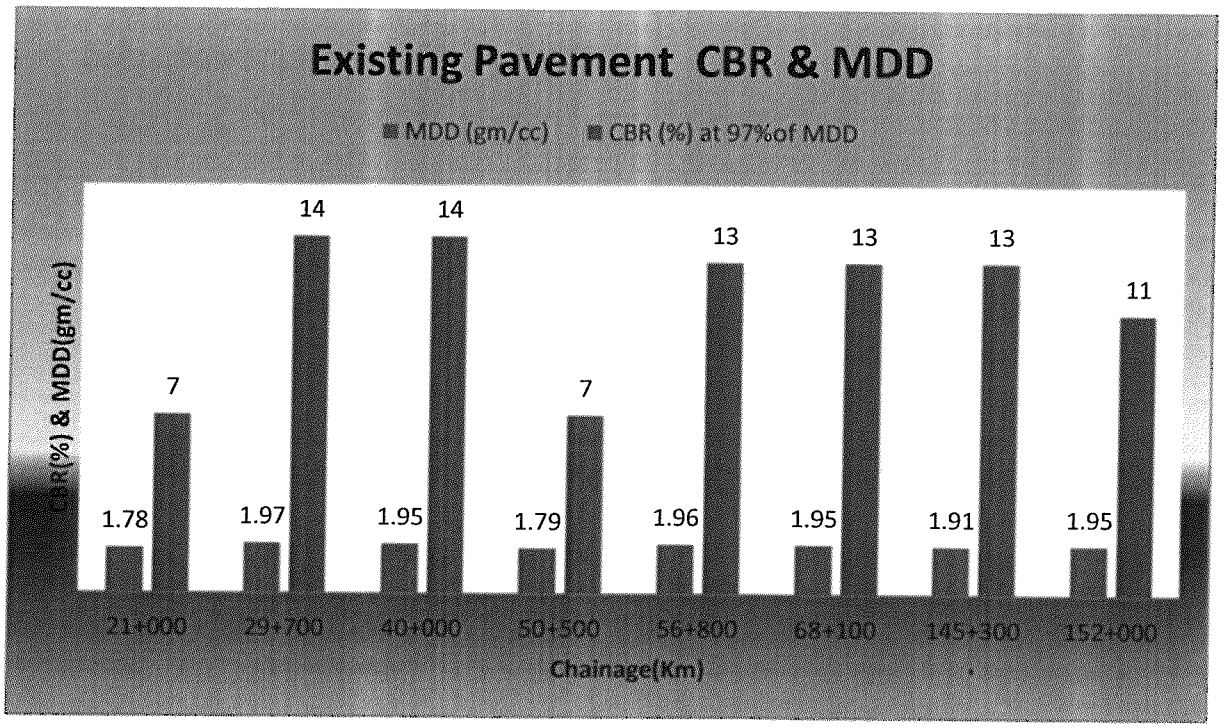

Figure 2.4: Existing pavement CBR & MDD

2.6 ENVIRONMENTAL AND SOCIAL SCREENING

2.6.1 Environmental Screening

An Environmental Impact Assessment (EIA) was undertaken. An Environmental Assessment Report (EAR) was prepared which includes a Mitigation Plan that sets out feasible and cost effective measures that will reduce potentially significant adverse environmental effects, if any, to an acceptable level.

A Preliminary Environmental Desk Study focuses on the Environmental Assessment of key impacts, issues and alternatives, including information necessary for proposed development.

The following issues were identified:

- The information necessary for decision making;
- The important environmental issues and concerns;
- The significant effects and factors and alternatives to be considered; and
- The appropriate content and boundaries of an EIA study

The program included:

- Field surveys;

- Consultation exercises with official and non-official sources; identifying existing relevant baseline data;
- Identifying the scope of baseline surveys required;
- Identifying key issues to be addressed within the EIA,
- Providing a technical brief for the EIA

The approach and methodology to be adopted for environmental assessment would conform to the requirement of the Environmental Impact Assessment notification, MOEF, 1994, Environmental Guidelines for Rail/Road/Highway Project, MOEF, 1989 and relevant World Bank Operational Directives, Source Book and Hand Book.

2.6.2 Secondary Data Collection

Secondary data collection including relevant maps for all the corridors was collected from various government/ semi-government departments/ agencies, research institutions/ universities and NGOs regarding:

- Physical resources
- Flora and fauna
- Critical natural habitats
- Built-up areas
- Water bodies
- Other critical environmental indicators
- Policy, legal and administrative framework etc.

The available data was used for environmental screening. The results of this screening was plotted on strip maps and presented in tabular formats.

The results of the preliminary screening will lead to identification of the nature and extent of environmental issues needing more detailed examination, which may be dealt as a full EA.

2.6.3 Social Screening

The preliminary site visit reveals that land acquisition problem would be very crucial throughout the study stretch as the project passes through forest land in about 95% of total length but this shall not be a concern for project as under the NHDP program all NH are exempted from environmental and forest clearance..

2.6.4 Secondary Data Collection

Available information was collected from various agencies that have worked in the state. The information will include constitutional provision, conventions and protocols on human rights and indigenous people, status of social related legislation and policies of the Central

Government and the state of Arunachal Pradesh, key factors in RAR planning, guidelines for entitlement framework and community, social, ethnic and economic indicators of the population.

2.6.5 Social Impact Screening

During this preliminary screening stage, the Consultants made an initial visit to the site under consideration. This helped in developing a clear understanding of the proposed road changes that may be undertaken and to identify the impact on housing, business and agricultural activities expected to arise out of the changes to be adopted. The social impact screening concentrated on the areas where there is likely to be the greatest impact on the population.

The data was analyzed and screening was done initially through a reconnaissance survey. The various indicators considered are:

- Community Life and Economic Activities
- Severance of community
- Encroachment on local community facilities
- Encroachment on local economic activities
- Encroachment on the access to and rights of resources
- Cultural heritage/property
- Social structure, institution and customs
- Cultural shock
- Road safety
- Public health
- Waste
- Land acquisition and resettlement
- Expropriation of resources
- Involuntary resettlement
- Conflict between target population and host population
- Indigenous or traditional population

The results of the screening will be plotted on maps and tabulated to identify any major conflicts and extent of conflicts.

2.7 MATERIAL INVESTIGATIONS

2.7.1 General

Suitable soil conforming to MORT&H specifications in huge quantities will be required to construct embankment, sub-grade and earthen shoulder. An investigation to identify potential

soil borrow sources have confirmed the availability of suitable soil at number of locations along the project road corridor. The soil can be imported from the land near to the project road which is tested in the laboratory for the suitability and nature of the type of the soil. The identification of borrow soil were done mainly through local inquiries and contacting the Villagers and Local bodies.

Borrow soil is available in Hill cut material throughout the road.

The Consultant has conducted necessary survey to find out the general characteristics of earth materials available in the area. The objective of this investigation is mainly to assess the general availability of soil required for construction of sub-grade and embankment as per design CBR recommended for design of new pavement.

2.7.2 Objectives

The following are the basic objective to make material investigation

- *Source locations indicating places, kilometerage, availability and the status whether in operation or new source.*
- *Access to source, indicating the direction and nature of the access road i.e. left/ right of project road, approximate lead distance from the gravity centre and type of access road.*
- *Test results, indicating the quality of materials with respect to their suitability in construction.*

During the process of investigation due consideration has been given to the locally available materials for reducing the cost of construction. The samples from various identified sources have been collected for laboratory testing as per IRC/MOST/BIS standards.

The following types of soil are observed in the Hill slope and are given in **Table 2.10**

Table 2.10: Material along hill slope

Hill slope observation Report			
Sl. No	**Chainage (km)**	**Type of soil**	**Use in**
1	25- 31	Moorum soil& soft rock	Sub grade, GSB
2	32-33	Hard Rock	GSB, WMM
3	34-38	Hard Rock mix with moorum& clay	GSB, WMM
4	39 -69	Soft rock mix with hard moorum with sand and clay	Sub grade, GSB
5	70- 79	Hard Rock mix with moorum& clay	GSB, WMM
6	138- 145	Hard Rock mix with moorum& clay	GSB, WMM
7	146-153	Sandy soil mix with soft rock & gravel moorum with clay	Sub grade, GSB

8	154-156	Hard Rock mix with moorum& clay	GSB, WMM
9	157-158	Sandy soil mix with soft rock & gravel moorum with clay	Sub grade, GSB

2.7.3 Soil Borrow Sources

Laboratory Tests

Grain size analyses	IS:2720 (Part-4)
Atterberg Limit Test	IS:2720 (Part-5)
Maximum Dry Density (MDD) & Optimum Moisture Content (OMC)	IS:2720 (Part-8)
California Bearing Ratio Tests (4 days soaked)	IS:2720 (Part-16)

2.7.4 Quarry materials for construction (Aggregates)

Quarry Material Survey

The material investigation for road construction has been carried out to identify the potential sources of construction materials and to assess their general availability, engineering properties and quantities. This is one of the most important factors for stable, economic and successful implementation of the road program within the stipulated time. The material investigation is quite representative, but more exhaustive search may surely be explored by the contractors at the time of construction. For improvement work as well as for new construction the list of materials includes the following:

- Granular materials for sub-base works
- Crushed stone aggregates for base , bituminous surfacing and cement concrete works
- Sand for bituminous and cement concrete works, sub-base, filter materials and filling materials etc.
- Borrow earth/River Bed materials for embankment, sub-grade and filling

Objective

The following are the basic objective to make material investigation:

- Source locations indicating places, kilometerage, availability and the status whether in operation or new source.
- Access to source, indicating the direction and nature of the access road i.e. left/ right of project road, approximate lead distance from the gravity center and type of access road.
- Ownership of land/ quarries, either government or private.
- Test results, indicating the quality of materials with respect to their suitability in

construction.

- Probable use indicating the likely use of materials at various stages of construction work i.e. fill material, sub-grade, sub-base, base, bituminous surfacing and cross drainage structures.

The potential sources of construction materials were selected from consideration of the availability and suitability of the materials, easy access to the source and minimum hauling distance from the source in order to make the construction economical and feasible as far as possible. The samples from various identified sources have been collected for laboratory testing as per IRC/MORT&H/BIS standards.

A) Coarse Aggregate

Coarse aggregates such as trap rocks consisting of mainly basalt, black and grey in colour, are available in the vicinity of the project road.

stone quarries have been primarily identified as stone aggregate source for construction of various components of road, namely, Bituminous Concrete, Semi dense Bituminous concrete (SDBC), Dense Bituminous Macadam (DBM), Wet Mix Macadam (WMM),Granular sub-Base (GSB) as well as for the cement concrete works. The sources identified including their location details, lead distance to gravity center and availability of the stones are tabulated in **Table 2.11**

Table 2.11: Details of coarse Aggregate Sources

Sl. No	Quarry Location	Material	Lead distance CG of the project For PKG –I (Km)	Probable purpose of use of material
1	Sangram	Coarse Aggregate	84	GSB, WMM, Bituminous and concrete works
2	Yazali	Coarse Aggregate	105	GSB, WMM, Bituminous and concrete works
Sl. No	**Quarry Location**	**Material**	**Lead distance CG of the project For PKG –II (Km)**	**Probable purpose of use of material**
1	Sangram	Coarse Aggregate	38	GSB, WMM, Bituminous and concrete works
2	Yazali	Coarse Aggregate	188	GSB, WMM, Bituminous and concrete works

Laboratory Test Results of Coarse Aggregate Samples

Laboratory tests carried out for the above mentioned samples are presented in **Table 2.12** and **Table 2.13** respectively.

Table 2.12: Test results of Aggregate samples of size 40mm

Description	Sangram Quarry Sample	Yazali Quarry Sample
Passing through 63MM	100	100
Passing through 40MM	95.5	100
Passing through 20MM	6.0	3.0
Passing through 10MM	1.5	1.0
Specific Gravity	2.9	2.89
water Absorption %	0.50	0.35
Impact Value	17.3	18.6
Crushing Value	18.6	12.3
Abrasion Value	20.3	20.6
Striping Value	>95	>95

Table 2.13: Test results of Aggregate samples of size 20 mm

Description	Sangram Quarry Sample	Yajali Quarry Sample
Passing through 40MM	100	100
Passing through 20MM	33	31.5
Passing through 10MM	11	2
Passing through 4.75MM	2	1
Specific Gravity	2.89	2.80
water Absorption %	0.35	0.42
Impact Value	17.3	18.6
Crushing Value	18.6	12.3
Abrasion Value	20.3	20.6
Striping Value	>95	>95

Laboratory test results summary of coarse aggregates has been presented in **Table 2.14**

Table 2.14: Summary of Laboratory Test Result

Sl. No	Test	Average Value of Test Results	Specification
1	Aggregate Impact Value	17.95 %	Not more than 30% for non- bituminous work, 27% & 24% for DBM and BC work respectively
2	Los Angeles Abrasion value	20.45%	Max. 40% for non- bituminous work,35% and 30% for DBM and BC work respectively
3	Combined Flakiness and Elongation	34.3 %	Not more than 35%
4	Bituminous stripping value	>95 %	Minimum retained coating 95%
5	Water absorption	0.38 %	Not more than 2%

The results from **Table 2.13 and 2.14** indicate that all the quarry samples are of approved standard and can be used for Road construction.

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B) Fine Aggregate

Two sources have been identified are Ranga& Palin river bed for collection of Sand.

Laboratory tests were conducted on the sand samples collected from the river bed and are summarized below in **Table 2.15**

Table 2.15: Details of Fine Aggregate Sources

Sl. No.	Sample No	Name of Quarry	Village Name	River Name	Lead distance CG of the project for PKG I (Km)
PACKAGE I					
1	FA-1	Palin River Bed Ch 70 Km	Palin	Palin	25
2	FA-2	Ranga River Bed	Yazali	Ranga	85
PACKAGE II					
1	FA-3	Palin River Bed Ch 70 Km	Palin	Palin	79
2	FA-4	Ranga River Bed	Yazali	Ranga	188

Laboratory Test Results of Fine Aggregate Samples

Laboratory tests were conducted on the sand samples collected from the river bed and are summarized below in **Table 2.16**shows that medium coarse sand is available from the above river bed. The grading zone and fineness modulus of above river sand is Zone III (IS 383 1970) and 2.57 respectively, indicating that it is suitable for road pavement and structural concreting works.

Table 2.16: Laboratory test result for Fine aggregate samples

Sl. No.	Sieve Size (mm)	% of Passing (Ranga River sand)	% of Passing (Palin River sand)	FA Zone I	FA Zone II	FA Zone III	FA ZONE IV
1	10	100	100	100	100	100	100
2	4.75	98	98	90 - 100	90 - 100	90 - 100	95-100
3	2.36	89	88	60 - 95	75 - 100	85 - 100	95-100
4	1.18	76.92	75.69	30 - 70	55 - 90	75 - 100	90-100
5	600 mic	61.64	60.89	15 - 34	35 - 59	60 - 79	80-100
6	300 mic	19.78	20.72	5 - 20	8 - 30	12 - 40	15-50
7	150 mic	1.1	0.00	0 - 10	0 - 10	0 - 10	0-15
8	Fineness Modulus (F.M) of FA	2.55	2.56				
9	Specific Gravity	1.14	1.2				
10	Water absorption	2.57	2.5				

Indicative location maps for borrow materials are presented in **Figs 2.5** and **Fig. 2.6**

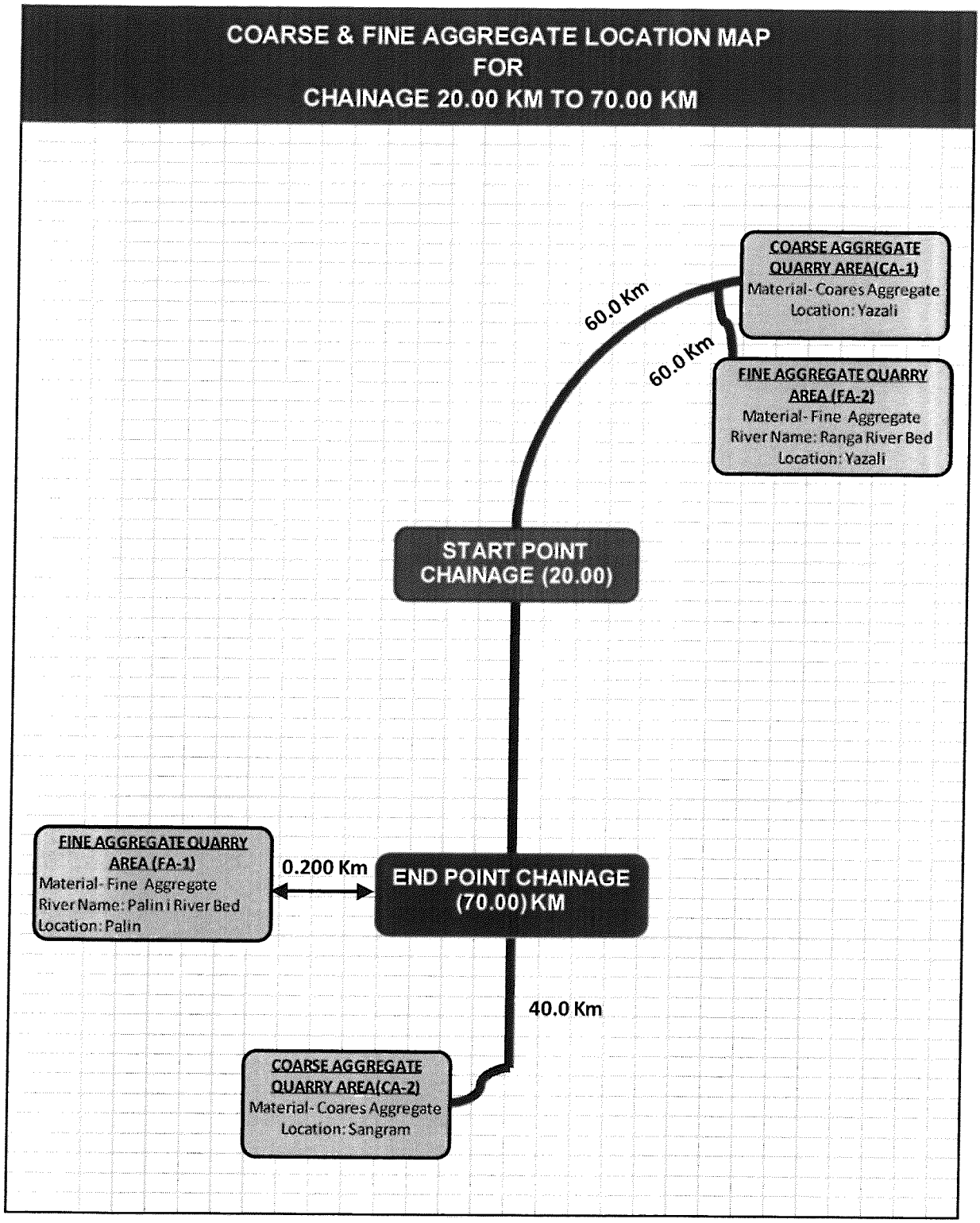

Fig 2.5: QUARRY MAP KM 20 TO KM 70

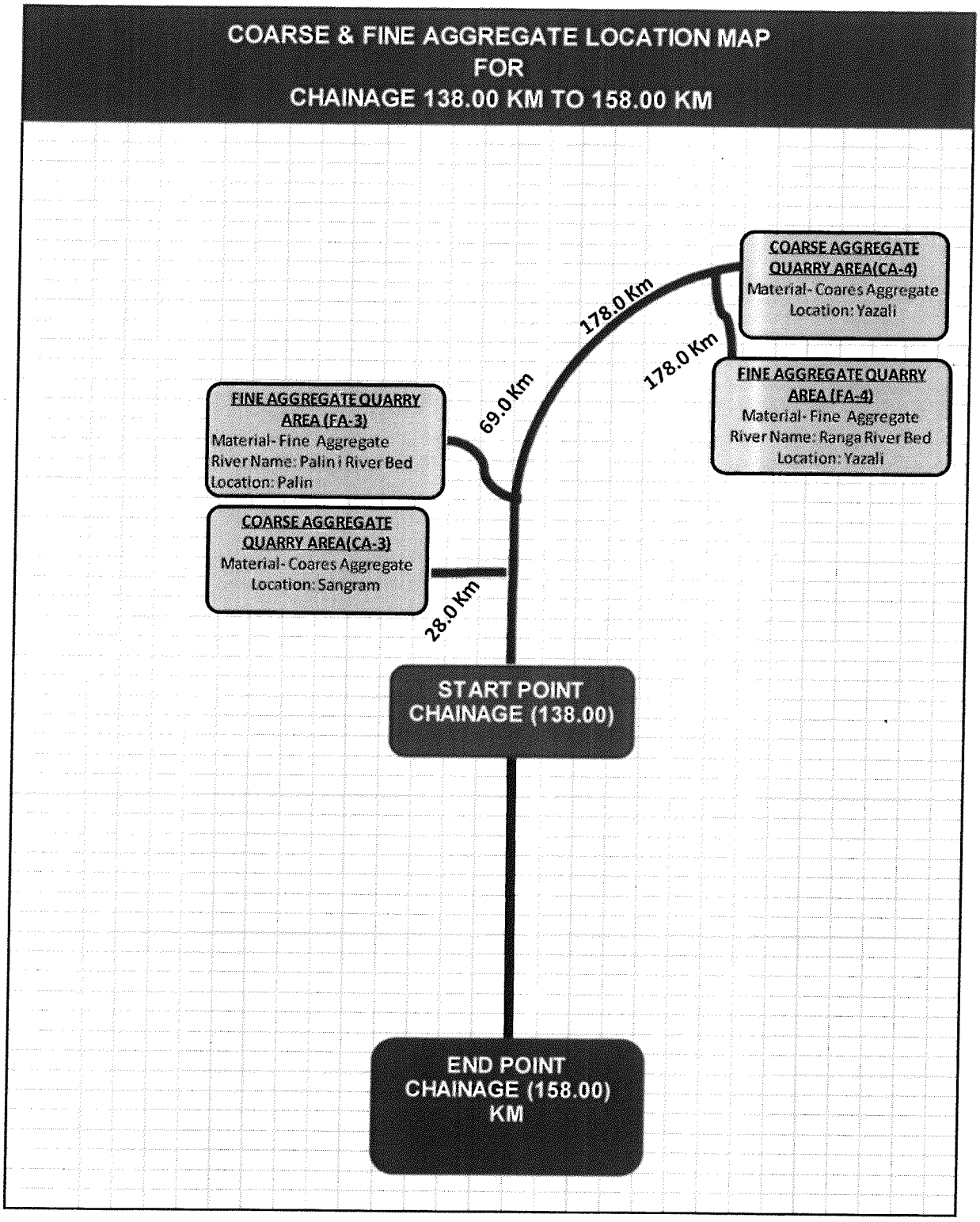

Fig 2.6: QUARRY MAP FOR KM 138 TO KM 158

2.8 MANUFACTURED MATERIALS

2.8.1 General

Cement, bitumen, steel are the manufactured materials. Cement and steel with I.S. certification are indigenously available in abundance from the manufacturers. Bitumen of VG-10,VG-20,VG-30&VG-40 viscosity grade and emulsion are available from Haldia IOCL. The regular supply of bitumen and cement can be satisfactorily met by advance agreements with the manufacturers. The grades of bitumen should be selected as per the guidelines of the MORT&H Specifications for Road and Bridge Works.

2.8.2 Cement

Cement to be used in the construction work shall be any of the following types with the prior approval of the Engineer:

- Ordinary Portland cement, 33 Grade, conforming to IS: 269
- Rapid Hardening Portland Cement, conforming to IS: 8041
- Ordinary Portland cement, 43 Grade, conforming to IS: 8112
- Ordinary Portland cement, 53 Grade, conforming to IS: 12269
- Sulphate Resistance Cement, Conforming to IS: 12330

The chloride content in cement shall in no case exceed 0.05 percent by mass of cement. Also, total sulphur content calculated as sulphuric anhydride (SO3) shall in no case exceed 2.5 percent and 3.0 percent when tri-calcium aluminates present by mass is upto 5 or greater than 5 respectively. Bulk amount of cement is available from Nagaon, recommended in NHIDCL/Inampro/2015.

2.8.3 Steel

For plain and reinforced concrete (PCC and RCC) or pre-stressed concrete (PSC) works, the reinforcement/un-tensioned steel as the case may be shall consists of the following grades of reinforcing bars as shown in **Table 2.17.** Steel is available indigenously from TISCO and SAIL at Guwahati.

Table 2.17: Characteristic strength of reinforcement steel

Grade Designation	Bar Type conforming to governing IS Specification	Characteristic Strength fy(MPa)	Elastic Modulus GPa
S 240	IS:432 Part I, Mild Steel Bar	240	200
S 415	IS:1786 High Yield Strength Deformed Bars (HYSD)	415	200

2.8.4 Bitumen

Bitumen of viscosity grade VG-10 and VG-30 is available from HaldiaIOCL ,either in bulk tanker or in drums.

INVENTORY AND CONDITION SURVEY OF BRIDGES

3.0 Inventory and Condition of Bridges

There are no major bridges along the entire project corridor. Only 10 numbers minor bridges exist along the project road. The details of which are given in **Table 3.1**.

Table 3.1: Inventory and Condition Survey 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
1	36+500	Bailey bridge	HL	1	30.5	30.5	3.5	5.3	Poor	-	~7.3	R-L	New Bridge
2	56+400	RCC Slab	HL	1	7.0	7.0	6.1	6.6	Fair	-	~3.0	R-L	New Bridge
3	56+600	RCC Slab	HL	1	6.75	6.75	5.0	5.5	Fair	-	~3.2	R-L	New Bridge
4	62+900	Bailey bridge	HL	1	15.5	15.5	3.5	5.0	Fair	-	~5.3	L-R	New Bridge
5	69+975	Bailey bridge	HL	1	33.0	33.0	3.3	4.5	Fair	-	~8.6	L-R	New Bridge
6	140+975	Bailey bridge	HL	1	34.0	34.0	3. 5	5.5	Fair	-	~8.5	L-R	New Bridge
7	142+500	RCC Slab	HL	1	10.0	10.0	5.5	6.0	Fair	-	~4.0	L-R	New Bridge
8	145+500	Bailey bridge	HL	1	39.0	39.0	3.5	5.5	Fair	Pape	~17.0	L-R	New Bridge
9	147+500	RCC Slab	HL	1	6.5	6.5	5.3	5.75	Fair	-	~6.0	R-L	New Bridge
10	153+500	Bailey bridge	HL	1	25.0	25.0	3.5	5.5	Fair	-	~8.5	L-R	New Bridge

3.1 Inventory and Condition of Culverts

There are 326 culverts along the project road the summary of which is as given below:

Type of Culvert	No. of Culverts
Slab	291
Hume Pipe	21
Unidentified/choked	14

Detailed existing culvert inventory are presented in **Table 2.19**

Table 3.2: Detailed Culvert Inventory

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Type of Structures (Pipe, Slab, Box, Arch)	No. of span x Span length(m)	Width of Culvert(m)	Overall Condition
1	20+025	20+010	Pipe	1x0.6	6.0	Poor
2	20+294	20+220	Slab	Not visible	5.4	Poor
3	20+595	20+400	Slab	Not visible	6.0	Poor
4	20+848	20+470	Pipe	Not visible	5.7	Poor
5	21+005	20+580	Not visible	Not visible	5.8	Poor
6	21+025	20+600	Pipe	1x0.6	6.3	Fair
7	21+125	20+690	Slab	1x1.4	5.4	Poor
8	21+296	20+800	Slab	1x1.0	6.0	Poor
9	22+050	21+480	Slab	1x1.8	6.3	Poor
10	22+100	21+530	Pipe	1x0.6	4.8	Poor
11	22+300	21+710	Not visible	Not visible	5.7	Poor
12	22+450	21+810	Slab	1x1.5	6.3	Poor
13	22+470	21+840	Pipe	1x0.6	5.8	Poor
14	22+560	21+920	Slab	1x1.0	6.0	Fair
15	22+700	22+050	Slab	1x1.0	5.7	Poor
16	22+800	22+140	Pipe	1x0.6	5.8	Poor
17	22+950	22+250	Slab	1x1.0	6.0	Poor
18	23+020	22+320	Slab	1x1.0	5.8	Poor
19	23+150	22+400	Slab	1x1.0	6.0	Poor
20	23+200	22+460	Slab	1x1.0	5.7	Poor
21	24+180	23+350	Slab	1x1.0	5.9	Poor
22	24+345	23+490	Slab	Not visible	5.1	Poor
23	24+565	23+650	Slab	1x1.0	5.8	Fair
24	25+350	23+870	Slab	1x1.0	5.5	Poor
25	25+590	23+930	Slab	1x1.5	5.0	Poor
26	25+800	24+060	Slab	1x1.0	5.3	Poor
27	25+850	24+120	Slab	1x1.0	5.3	Poor
28	26+025	24+300	Slab	1x1.5	5.3	Poor
29	26+310	24+500	Slab	1x1.0	5.0	Poor
30	26+380	24+580	Slab	1x1.0	6.0	Poor
31	26+625	24+680	Pipe	1x0.6	6.0	Poor
32	26+900	25+050	Slab	1x1.0	5.7	Poor
33	26+980	25+100	Slab	1x1.0	5.4	Poor

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Type of Structures (Pipe, Slab, Box, Arch)	No. of span x Span length(m)	Width of Culvert(m)	Overall Condition
34	27+200	25+230	Slab	1x0.9	5.5	Poor
35	27+430	25+547	Slab	1x1.0	5.3	Poor
36	27+600	25+550	Slab	1x1.0	5.4	Poor
37	27+650	25+600	Slab	1x1.0	6.0	Poor
38	27+740	25+680	Slab	1x1.4	5.3	Poor
39	27+850	25+800	Slab	1x1.0	6.0	Poor
40	28+080	25+870	Slab	1x1.0	5.7	Fair
41	28+300	26+030	Slab	1x3.0	5.5	Poor
42	28+380	26+090	Pipe	1x0.6	5.5	Poor
43	28+480	26+170	Slab	1x1.0	6.0	Poor
44	28+550	26+250	Not visible	Not visible	6.0	Poor
45	28+610	26+310	Slab	1x1.0	6.0	Poor
46	28+910	26+580	Not visible	Not visible	5.0	Poor
47	28+950	26+600	Slab	1x1.0	5.0	Poor
48	28+990	26+630	Slab	1x1.0	5.0	Fair
49	29+120	26+720	Not visible	Not visible	5.5	Poor
50	29+355	26+900	Slab	1x1.0	5.5	Poor
51	29+560	27+030	Slab	1x1.0	5.8	Fair
52	29+740	27+210	Slab	1x1.0	6.0	Fair
53	30+070	27+470	Slab	1x1.0	4.9	Poor
54	30+420	27+790	Slab	1x0.9	5.8	Poor
55	30+880	28+100	Slab	1x1.0	6.0	Poor
56	31+200	28+400	Slab	1x1.0	6.0	Poor
57	33+830	30+820	Slab	Not visible	5.8	Poor
58	33+910	30+900	Not visible	Not visible	6.0	Poor
59	33+970	30+980	Pipe	1x0.6	5.5	Poor
60	34+140	31+140	Slab	1x1.0	5.5	Poor
61	34+620	31+540	Slab	1x1.0	6.0	Poor
62	34+900	31+790	Slab	1x1.0	5.9	Fair
63	35+010	31+900	Pipe	Not visible	5.5	Poor
64	35+150	32+020	Slab	1x1.0	6.0	Poor
65	35+270	32+130	Slab	1x1.0	5.6	Fair
66	35+330	32+190	Slab	1x1.0	5.8	Fair
67	35+460	32+310	Slab	1x1.0	6.0	Poor
68	35+700	32+350	Slab	1x1.0	6.0	Fair
69	35+970	32+810	Slab	1x1.0	6.5	Poor
70	36+175	33+010	Slab	1x1.0	5.9	Poor
71	36+300	33+150	Slab	1x1.0	6.0	Poor
72	36+490	33+320	Slab	1x1.0	5.9	Poor
73	36+890	33+560	Slab	1x1.0	5.9	Poor
74	37+100	33+730	Slab	1x1.0	6.0	Poor
75	37+370	33+990	Slab	1x1.0	5.9	Poor
76	37+490	34+080	Slab	1x1.0	5.9	Poor
77	37+790	34+370	Slab	1x1.0	6.0	Fair
78	37+880	34+470	Slab	1x1.0	6.0	Fair
79	38+360	34+860	Slab	1x1.0	5.9	Poor
80	38+420	34+920	Slab	1x1.0	5.9	Fair
81	38+500	34+950	Slab	1x1.0	6.0	Fair
82	38+640	35+080	Slab	1x1.0	5.9	Fair
83	38+710	35+150	Slab	1x1.0	5.9	Fair
84	38+940	35+370	Slab	1x1.0	5.9	Fair
85	39+125	35+485	Slab	1x1.0	5.9	Fair

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Type of Structures (Pipe, Slab, Box, Arch)	No. of span x Span length(m)	Width of Culvert(m)	Overall Condition
86	39+450	35+760	Slab	1x1.0	5.8	Fair
87	39+640	35+880	Slab	1x1.0	5.4	Fair
88	40+260	36+260	Slab	1x1.0	5.9	Fair
89	40+500	36+510	Slab	1x1.0	6.3	Poor
90	40+700	36+680	Slab	1x1.0	6.0	Poor
91	40+840	36+760	Slab	1x1.0	5.8	Poor
92	40+950	36+880	Slab	1x8.0	5.7	Fair
93	41+210	37+060	Slab	1x1.2	5.9	Poor
94	41+550	37+170	Slab	1x1.0	6.3	Poor
95	41+730	37+310	Slab	1x1.0	6.3	Poor
96	41+810	37+390	Slab	1x1.0	6.3	Poor
97	42+160	37+560	Slab	1x1.0	6.0	Poor
98	42+340	37+860	Slab	1x1.2	6.0	Poor
99	42+560	37+930	Slab	1x1.0	5.7	Poor
100	42+925	38+260	Slab	1x1.0	5.7	Poor
101	43+150	38+470	Slab	1x1.0	6.0	Poor
102	43+300	38+600	Slab	1x1.0	5.8	Poor
103	43+390	38+670	Slab	1x1.0	6.0	Poor
104	43+400	38+690	Slab	1x1.5	6.0	Poor
105	43+580	38+810	Slab	1x1.0	6.0	Poor
106	44+075	39+130	Slab	1x1.0	5.6	Poor
107	44+150	39+215	Slab	1x1.0	6.0	Poor
108	44+330	39+390	Slab	1x1.0	5.7	Poor
109	44+500	39+540	Slab	1x1.0	6.0	Poor
110	44+700	39+700	Slab	1x1.0	6.0	Poor
111	44+925	39+830	Slab	1x1.0	6.0	Poor
112	45+050	39+940	Slab	1x1.0	6.0	Poor
113	45+270	40+050	Slab	1x1.0	6.0	Poor
114	45+520	40+170	Slab	1x1.0	6.0	Poor
115	45+675	40+270	Pipe	1x0.6	5.9	Poor
116	45+740	40+300	Slab	1x1.0	6.0	Poor
117	46+210	40+680	Slab	1x1.0	6.0	Poor
118	46+940	41+320	Slab	1x1.0	5.8	Fair
119	47+050	41+430	Pipe	1x0.6	5.9	Poor
120	47+300	41+710	Slab	1x1.0	5.7	Poor
121	47+350	41+780	Slab	1x1.5	5.2	Poor
122	47+900	42+160	Slab	1x1.0	5.5	Poor
123	48+050	42+260	Slab	1x1.0	5.9	Poor
124	48+330	42+500	Slab	1x1.0	6.0	Poor
125	48+500	42+670	Slab	1x1.0	6.0	Poor
126	48+700	42+820	Slab	1x1.0	6.0	Poor
127	48+900	42+980	Slab	1x1.5	5.9	Poor
128	49+150	43+240	Slab	1x1.5	5.8	Poor
129	49+200	43+300	Slab	1x5.8	5.6	Poor
130	49+270	43+370	Slab	1x1.0	6.0	Poor
131	49+600	43+670	Slab	1x1.0	6.0	Poor
132	49+850	43+820	Slab	1x3.0	6.0	Fair
133	49+950	43+910	Slab	1x1.0	6.0	Poor
134	49+990	43+940	Slab	1x1.0	6.0	Poor
135	50+050	44+000	Pipe	1x0.9	6.0	Poor
136	50+160	44+080	Slab	1x1.0	5.0	Poor

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Type of Structures (Pipe, Slab, Box, Arch)	No. of span x Span length(m)	Width of Culvert(m)	Overall Condition
137	50+290	44+160	Not visible	Not visible	5.0	Poor
138	50+360	44+230	Slab	1x1.0	5.0	Poor
139	50+500	44+370	Slab	1x1.0	5.5	Poor
140	50+830	44+640	Slab	1x1.0	5.0	Poor
141	51+450	45+130	Pipe	Not visible	5.5	Poor
142	51+500	45+170	Slab	Not visible	5.0	Poor
143	51+860	45+330	Slab	1x1.0	5.5	Poor
144	52+255	45+640	Pipe	1x0.6	5.0	Poor
145	52+475	45+810	Pipe	1x0.6	5.5	Poor
146	52+710	45+980	Slab	1x1.0	5.0	Poor
147	53+475	46+690	Slab	1x1.0	5.0	Poor
148	53+550	46+800	Pipe	1x0.6	5.0	Poor
149	53+870	46+890	Slab	1x1.0	5.2	Poor
150	53+920	46+930	Slab	1x1.0	5.0	Poor
151	54+020	47+030	Pipe	1x0.35	5.2	Poor
152	54+050	47+070	Slab	1x1.0	5.0	Poor
153	54+620	47+410	Pipe	1x0.9	5.3	Poor
154	55+550	47+740	Not visible	Not visible	5.0	Poor
155	55+610	48+080	Slab	1x1.0	5.0	Poor
156	55+700	48+150	Slab	1x1.0	5.0	Poor
157	56+270	48+230	Slab	1x1.0	5.0	Poor
158	56+570	48+890	Slab	1x1.0	5.0	Poor
159	56+895	49+190	Slab	1x1.0	5.0	Poor
160	57+030	49+280	Slab	1x1.0	5.0	Poor
161	57+160	49+400	Not visible	Not visible	5.0	Poor
162	57+260	49+490	Slab	1x1.0	5.0	Poor
163	57+320	49+530	Slab	1x1.0	5.5	Poor
164	57+450	49+570	Slab	1x1.0	5.3	Poor
165	57+600	49+690	Slab	1x1.0	5.0	Poor
166	57+650	49+750	Slab	1x3.0	5.0	Poor
167	57+750	49+860	Pipe	1x0.9	5.0	Poor
168	57+900	49+980	Slab	1x1.5	5.5	Poor
169	58+320	50+250	Slab	1x2.0	5.3	Poor
170	58+325	50+310	Slab	1x1.0	5.5	Poor
171	58+500	50+360	Slab	1x1.0	5.0	Poor
172	58+625	50+500	Slab	1x1.0	5.0	Poor
173	58+750	50+600	Not visible	Not visible	5.4	Poor
174	59+000	50+850	Slab	1x1.0	6.0	Poor
175	59+150	50+980	Slab	1x1.0	5.0	Poor
176	59+270	51+090	Slab	1x1.0	5.0	Poor
177	59+494	51+280	Slab	1x1.5	5.5	Poor
178	59+550	51+330	Pipe	1x0.9	5.3	Poor
179	59+640	51+400	Slab	1x1.0	5.0	Poor
180	59+825	51+570	Slab	1x1.0	5.0	Poor
181	60+160	51+910	Slab	1x1.0	5.0	Poor
182	60+350	52+110	Slab	1x1.0	5.0	Poor
183	60+600	52+280	Slab	1x1.0	5.0	Poor
184	61+080	52+680	Slab	1x1.0	5.0	Poor
185	61+190	52+790	Slab	1x1.0	5.0	Poor
186	61+330	52+910	Slab	1x6.0	6.0	Poor
187	61+510	52+980	Slab	1x1.0	5.0	Poor
188	61+700	53+140	Slab	1x1.0	5.0	Poor

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Type of Structures (Pipe, Slab, Box, Arch)	No. of span x Span length(m)	Width of Culvert(m)	Overall Condition
189	61+810	53+270	Not visible	Not visible	5.0	Poor
190	61+950	53+370	Slab	1x1.0	6.0	Poor
191	62+280	53+700	Slab	1x1.5	5.0	Poor
192	62+410	53+810	Slab	1x1.0	5.0	Poor
193	62+510	53+920	Slab	1x1.0	5.0	Poor
194	62+650	54+050	Slab	1x1.0	5.0	Poor
195	62+745	54+150	Slab	1x1.0	5.0	Poor
196	62+810	54+210	Slab	1x1.0	5.0	Poor
197	63+125	54+410	Slab	1x1.0	5.0	Poor
198	63+260	54+440	Slab	1x1.5	5.5	Poor
199	63+280	54+570	Slab	1x1.5	5.3	Poor
200	63+560	54+740	Slab	1x1.0	5.0	Poor
201	63+650	54+820	Slab	1x1.0	5.0	Poor
202	63+750	54+910	Slab	1x1.0	5.0	Poor
203	63+820	54+970	Slab	1x1.0	5.0	Poor
204	64+125	55+190	Slab	1x1.0	5.0	Poor
205	64+355	55+270	Slab	1x1.0	5.0	Poor
206	64+455	55+330	Slab	1x1.0	5.0	Poor
207	64+560	55+460	Slab	1x1.0	5.0	Poor
208	64+610	55+500	Slab	1x1.0	5.0	Poor
209	64+740	55+600	Slab	1x1.0	5.0	Poor
210	64+800	55+640	Slab	1x1.0	5.0	Poor
211	64+990	55+710	Slab	1x1.0	5.0	Poor
212	65+300	55+900	Slab	1x1.0	5.0	Poor
213	65+575	56+150	Slab	1x1.0	5.0	Poor
214	65+740	56+320	Slab	1x1.0	5.0	Poor
215	65+810	56+390	Slab	1x1.5	5.2	Poor
216	65+950	56+490	Slab	1x1.5	5.3	Poor
217	66+150	56+640	Not visible	Not visible	5.2	Poor
218	66+350	56+790	Slab	1x1.0	5.0	Poor
219	66+400	56+850	Slab	1x1.0	5.0	Poor
220	66+480	56+930	Slab	1x1.5	5.4	Poor
221	66+790	57+200	Slab	1x2.2	5.3	Poor
222	67+480	57+760	Slab	1x3.0	5.2	Poor
223	67+660	57+920	Slab	1x2.0	5.6	Poor
224	68+000	58+160	Slab	1x1.0	5.0	Poor
225	68+440	58+600	Slab	1x1.5	5.5	Poor
226	68+680	58+820	Slab	1x1.5	5.1	Poor
227	68+870	59+000	Slab	1x1.5	5.4	Poor
228	69+110	59+250	Slab	1x1.0	5.0	Poor
229	138+020	138+028	Slab	1x2.6	6.7	Poor
230	138+760	138+700	Slab	1x1.5	7.0	Poor
231	138+800	138+730	Slab	1x1.0	6.2	Poor
232	138+900	138+810	Slab	1x1.5	6.3	Poor
233	139+090	138+960	Slab	1x1.6	6.1	Poor
234	139+125	138+980	Slab	1x1.5	6.3	Poor
235	139+310	139+170	Slab	1x1.6	6.5	Poor
236	139+490	139+320	Slab	1x1.5	6.3	Poor
237	139+540	139+360	Slab	1x1.5	5.9	Poor
238	139+910	139+720	Slab	1x1.5	6.3	Poor
239	140+970	140+720	Slab	1x3.0	6.3	Fair
240	141+000	140+750	Not visible	Not visible	6.5	Fair

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Sl. No.	Existing Chainage (km)	Design Chainage (km)	Type of Structures (Pipe, Slab, Box, Arch)	No. of span x Span length(m)	Width of Culvert(m)	Overall Condition
241	141+135	140+880	Slab	1x1.5	6.1	Poor
242	141+300	141+040	Slab	1x2.8	8.2	Poor
243	141+450	141+180	Slab	1x2.0	6.4	Poor
244	141+500	141+230	Slab	1x1.8	6.0	Poor
245	141+770	141+455	Slab	1x3.0	6.6	Poor
246	142+045	141+680	Slab	1x1.8	6.0	Poor
247	142+100	141+740	Slab	1x1.8	6.0	Poor
248	142+320	141+960	Slab	1x2.0	6.0	Poor
249	142+590	142+200	Slab	1x2.5	6.0	Poor
250	142+640	142+270	Slab	1x2.0	6.0	Poor
251	142+695	142+315	Slab	1x2.0	6.0	Poor
252	142+795	142+405	Slab	1x2.0	6.0	Poor
253	143+020	142+640	Slab	1x2.0	6.0	Poor
254	143+120	142+740	Slab	1x1.5	6.2	Poor
255	143+455	143+000	Slab	1x1.8	5.8	Poor
256	143+820	143+230	Slab	1x2.0	6.0	Poor
257	144+010	143+410	Slab	1x1.8	6.0	Poor
258	144+150	143+550	Slab	1x2.0	6.0	Poor
259	144+315	143+710	Not visible	Not visible	6.2	Poor
260	144+840	144+210	Slab	1x3.0	5.9	Poor
261	145+090	144+470	Slab	1x1.5	6.3	Fair
262	145+445	144+810	Slab	1x2.8	6.0	Fair
263	145+495	145+000	Slab	1x1.0	6.8	Poor
264	146+165	145+350	Slab	1x1.0	6.0	Poor
265	146+440	145+610	Slab	1x1.5	6.0	Fair
266	146+520	145+680	Slab	1x3.4	6.0	Poor
267	146+930	145+900	Slab	1x6.0	6.0	Poor
268	147+280	146+200	Slab	1x4.3	6.0	Poor
269	147+400	146+450	Slab	1x5.0	5.9	Poor
270	147+590	146+650	Slab	1x1.6	5.9	Poor
271	147+820	146+980	Slab	1x1.6	5.9	Poor
272	148+155	147+410	Slab	1x3.5	6.0	Poor
273	148+730	147+700	Slab	1x1.5	5.8	Fair
274	149+175	147+790	Slab	1x3.9	6.0	Poor
275	149+240	147+800	Slab	1x6.0	6.0	Poor
276	149+290	147+850	Slab	1x2.1	6.0	Poor
277	149+405	147+940	Slab	1x3.0	6.0	Poor
278	149+500	147+985	Slab	1x2.8	6.0	Poor
279	149+575	148+060	Slab	1x2.0	6.0	Poor
280	149+720	148+200	Slab	1x4.5	6.0	Poor
281	149+960	148+430	Slab	1x2.7	6.0	Poor
282	150+180	148+630	Slab	1x2.7	6.0	Poor
283	150+420	148+830	Slab	1x2.5	6.0	Poor
284	150+455	148+870	Slab	1x3.8	6.0	Poor
285	150+520	148+920	Slab	1x2.2	6.0	Poor
286	150+585	148+970	Slab	1x2.3	6.0	Poor
287	150+650	149+030	Slab	1x2.0	6.0	Poor
288	150+750	149+130	Slab	1x1.5	6.0	Poor
289	150+775	149+160	Slab	1x2.0	6.0	Poor
290	150+850	149+220	Slab	1x1.6	5.8	Fair
291	151+070	149+440	Slab	1x2.7	6.0	Poor
292	151+100	149+480	Slab	1x1.5	5.8	Fair

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Sl. No.	Existing Chainage (km)	Design Chainage (km)	Type of Structures (Pipe, Slab, Box, Arch)	No. of span x Span length(m)	Width of Culvert(m)	Overall Condition
293	151+350	149+650	Slab	1x2.7	6.0	Poor
294	151+410	149+720	Slab	1x3.0	6.0	Poor
295	151+490	149+840	Slab	1x1.5	6.0	Poor
296	151+580	149+925	Slab	1x2.8	6.0	Poor
297	151+720	150+010	Slab	1x1.5	6.0	Poor
298	151+765	150+050	Slab	1x3.0	6.0	Poor
299	151+810	150+090	Slab	1x2.3	6.0	Poor
300	151+870	150+152	Slab	1x2.0	6.0	Poor
301	152+080	150+320	Slab	1x2.7	6.0	Poor
302	152+205	150+430	Slab	1x2.6	6.0	Poor
303	152+260	150+490	Slab	1x2.4	6.0	Poor
304	152+305	150+530	Slab	1x3.2	6.0	Poor
305	152+890	151+060	Slab	1x2.7	6.0	Poor
306	153+070	151+290	Slab	1x5.7	6.0	Poor
307	153+180	151+390	Slab	1x3.7	6.0	Poor
308	153+310	151+510	Slab	1x3.7	6.0	Poor
309	153+450	151+640	Slab	1x4.0	6.0	Poor
310	153+775	151+820	Slab	1x4.6	6.0	Poor
311	153+960	151+920	Slab	1x5.7	6.0	Poor
312	154+020	151+980	Slab	1x2.4	6.0	Poor
313	154+085	152+040	Slab	1x3.8	6.0	Poor
314	154+205	152+110	Slab	1x3.7	6.0	Poor
315	154+340	152+190	Slab	1x2.5	6.0	Poor
316	154+400	152+260	Slab	1x2.4	6.0	Poor
317	154+575	152+420	Slab	1x2.3	6.0	Poor
318	154+760	152+590	Slab	1x4.0	6.0	Poor
319	154+900	152+690	Slab	1x2.5	6.0	Poor
320	155+100	152+850	Slab	1x6.0	6.0	Poor
321	155+420	152+920	Slab	1x2.0	6.0	Poor
322	155+370	152+990	Slab	1x2.1	6.0	Poor
323	155+600	153+260	Slab	1x2.1	6.0	Poor
324	155+850	153+285	Slab	1x2.1	6.0	Fair
325	156+180	153+530	Slab	1x5.9	6.0	Fair
326	156+400	153+910	Slab	Not visible	5.8	Poor

DEVELOPMENT PROPOSALS

4.0 DEVELOPMENT PROPOSALS

4.1 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 4.1.**
- 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.

4.2 Geometric Design Standards

The design standards proposed to be adopted are indicated in **Table 4.1**.

Table 4.1: 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	
1	Design Speed			
	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			

Sl No.	Attributes	Geometric Design Standards		Adopted in Design
		Two lane Manual	Hill Manual	
		IRC:SP-73: 2015	IRC:SP-48-1998	
	a) Paved Shoulder	2 x 1.5 m	2 x 1.25m	2 x 1.5 m
	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 4.1** to **4.5**, these are included in Volume-III, also.

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4.3 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.

4.4 Extra Widening for curves with small radii

A table for extra widening has been provided as **Annexure 4.1.**
This will be incorporated in the plan during the DPR stage after approval of the alignment.

4.5 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 4.2.**

Table 4.2: List of Minor Realignments

Sl.NO.	DESIGN CHAINAGE		EXISTING CHAINAGE		LENGTH
	FROM	TO	FROM	TO	(m)
1	20200	20600	20280	21018	400
2	20600	20610	21018	21050	10
3	20610	20690	21050	21100	80
4	20690	20700	21100	21145	10
5	20700	21000	21145	21510	300
6	21130	21140	21650	21660	10
7	21240	21270	21760	21790	30
8	21270	21840	21790	22460	570
9	21840	21850	22460	22480	10
10	21850	21940	22480	22570	90
11	21940	21990	22570	22630	50
12	21990	22000	22630	22640	10
13	22200	22220	22870	22890	20
14	22220	22230	22890	22900	10
15	22230	22300	22900	23000	70
16	22300	22310	23000	23010	10
17	22310	22700	23010	23460	390
18	22850	23000	23610	23805	150
19	23500	24000	24350	25700	500
20	24500	24700	26300	26510	200
21	24700	24710	26510	26520	10
22	24710	25010	26520	26860	300
23	25010	25090	26860	26950	80

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Sl.NO.	DESIGN CHAINAGE		EXISTING CHAINAGE		LENGTH
	FROM	TO	FROM	TO	(m)
24	25090	25500	26950	27550	410
25	25800	27400	27860	29990	1600
26	27600	27630	30195	30225	30
27	27630	27650	30225	30250	20
28	27650	28310	30250	31080	660
29	28310	28350	31080	31140	40
30	28350	28400	31140	31180	50
31	28680	28720	31465	31510	40
32	28720	28920	31510	31710	200
33	28920	28970	31710	31760	50
34	29600	29790	32410	32680	190
35	29790	29820	32680	32722	30
36	29820	30200	32722	33160	380
37	30400	30600	33360	33595	200
38	30800	31300	33803	34335	500
39	31480	31600	34515	34700	120
1	33400	33950	36562	37310	550
2	33950	33970	37310	37350	20
3	33970	34280	37350	37690	310
4	34280	34290	37690	37700	10
5	34290	35145	37700	38710	855
6	35145	35155	38710	38720	10
7	35155	35175	38720	38740	20
8	35175	35185	38740	38750	10
9	35185	35215	38750	38765	30
10	35215	35235	38765	38785	20
11	35235	35265	38785	38815	30
12	35265	35285	38815	38840	20
13	35285	35530	38840	39190	245
14	35530	35540	39190	39195	10
15	35540	35600	39195	39260	60

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16	35600	35610	39260	39270	10
17	35610	35890	39270	39650	280
18	35890	35900	39650	39660	10
19	35900	36030	39660	39823	130
20	36030	36040	39823	39840	10
21	36040	36080	39840	39900	40
22	36080	36090	39900	39910	10
23	36090	36480	39910	40460	390
24	36480	36500	40460	40490	20
25	36500	36790	40490	40860	290
26	36790	36825	40860	40900	35
27	36825	36845	40900	40920	20
28	36845	36855	40920	40930	10
29	36855	36890	40930	40970	35
30	36890	36920	40970	41000	30
31	36920	37005	41000	41112	85
32	37005	37025	41112	41135	20
33	37025	37715	41135	42160	690
34	37715	37725	42160	42170	10
35	37725	37830	42170	42300	105
36	37830	37850	42300	42320	20
37	37850	38000	42320	42615	150
39	38200	38590	42860	43295	390

S.NO.	DESIGN CHAINAGE		EXISTING CHAINAGE		LENGTH
	FROM	TO	FROM	TO	(m)
1	44000	44080	50050	50180	80
2	44100	44180	50190	50300	80
3	44200	44230	50330	50360	30
4	44340	44420	50485	50610	80
5	44540	44580	50725	50760	40

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S.NO.	DESIGN CHAINAGE		EXISTING CHAINAGE		LENGTH
	FROM	TO	FROM	TO	(m)
6	44640	44720	50830	50950	80
7	44790	44960	51010	51270	170
8	45070	45310	51370	51850	240
9	45430	45510	51970	52130	80
10	45590	45620	52200	52225	30
11	45730	45800	52375	52440	70
12	45830	45920	52490	52675	90
13	46000	46110	52745	52850	110
14	46190	46230	52930	52975	40
15	46360	46560	53100	53305	200
16	46580	46900	53350	53890	320
17	46960	47780	53950	55150	820
18	47880	48000	55330	55460	120
19	48500	48850	56160	56550	350
20	48880	48950	56580	56640	70
21	49230	49250	56930	57000	20
22	49370	49390	57110	57150	20
23	49420	49650	57200	57550	230
24	49690	49980	57595	57900	290
25	50000	50230	57920	58330	230
26	50270	50290	58350	58370	20
27	50310	50340	58400	58480	30
28	50460	50580	58590	58700	120
29	50630	50670	58800	58820	40
30	50960	51080	59150	59250	120
31	51180	51270	59350	59450	90
32	51390	51460	59630	59700	70
33	51630	52310	59900	60650	680
34	52360	52675	60705	61060	315
35	52685	52840	61070	61250	155
36	52870	52950	61270	61400	80
37	53020	53070	61510	61600	50
38	53346	53500	61910	62070	154
39	53700	55250	62270	64350	1550
40	55400	57200	64505	66790	1800

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Sl. No.	DESIGN CHAINAGE		EXISTING CHAINAGE		LENGTH
	FROM	TO	FROM	TO	(m)
1	138150	138160	138165	138175	10
2	138160	138200	138175	138220	40
3	138200	138300	138220	138320	100
4	138300	138350	138320	138370	50
5	138400	138410	138420	138430	10
6	138410	138500	138430	138530	90
7	138550	138700	138580	138750	150
8	138700	138710	138750	138760	10
9	138710	138910	138760	139020	200
10	138910	138940	139020	139060	30
11	138940	138990	139060	139115	50
12	138990	139000	139115	139125	10
13	139000	139040	139125	139180	40
14	139040	139160	139180	139305	120
15	139160	139210	139305	139360	50
16	139210	139500	139360	139690	290
17	139500	139620	139690	139800	120
18	139620	140450	139800	140685	830
19	140450	140510	140685	140750	60
20	140510	140550	140750	140800	40
21	140800	140960	140060	141215	160
22	140960	141010	141215	141270	50
23	141010	141090	141270	141350	80
24	141090	141100	141350	141360	10
25	141200	141240	141470	141520	40
26	141240	141500	141520	141830	260
27	141650	142350	142005	142730	700
28	142400	142500	142780	142885	100
29	142500	142550	142885	142935	50
30	142550	143210	142935	143803	660
31	143210	143220	143803	143813	10
32	143220	143400	143813	144000	180
33	143650	143700	144253	144305	50
34	143700	143770	144305	144380	70
35	143770	143870	144380	144475	100
36	143870	144100	144475	144710	230
37	144500	144550	145120	145170	50
38	144550	144660	145170	145280	110
39	144660	144720	145280	145340	60
40	144720	144840	145340	145450	120

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Sl. No.	DESIGN CHAINAGE		EXISTING CHAINAGE		LENGTH
	FROM	TO	FROM	TO	(m)
41	144840	144900	145450	145660	60
42	145000	145020	145790	145810	20
43	145020	145120	145810	145910	100
44	145120	145220	145910	146030	100
45	145220	145250	146030	146060	30
46	145250	145340	146060	146150	90
47	145340	145360	146150	146170	20
48	145360	145550	146170	146370	190
49	145550	145610	146370	146440	60
50	145610	145670	146440	146660	60
51	145670	145710	146660	146560	40
52	145710	146200	146560	147290	490
53	146250	146450	147350	147600	200
54	146450	146460	147600	147610	10
55	146460	146900	147610	148100	440
56	147000	147090	148190	148410	90
57	147090	147170	148410	148480	80
58	147170	147230	148480	148550	60
59	147230	147250	148550	148570	20
60	147250	147370	148570	148690	120
61	147370	147410	148690	148730	40
62	147410	148400	148730	149940	990
63	148400	148440	149940	149970	40
64	148440	148550	149970	150100	110
65	148550	148570	150100	150115	20
66	148570	148830	150115	150405	260
67	148830	148860	150405	150435	30
68	148860	148940	150435	150550	80
69	148940	149000	150550	150615	60
70	149000	149100	150615	150720	100
71	149100	149180	150720	150805	80
72	149180	149250	150805	150880	70
73	149250	149270	150880	150900	20
74	149270	149310	150900	150940	40
75	149310	149350	150940	150980	40
76	149350	149430	150980	151050	80
77	149430	149450	151050	151070	20
78	149450	149720	151070	151405	270
79	149720	149770	151405	151455	50
80	149770	149800	151455	151500	30
81	149800	149810	151500	151510	10

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Sl. No.	DESIGN CHAINAGE		EXISTING CHAINAGE		LENGTH
	FROM	TO	FROM	TO	(m)
82	149810	149990	151510	151700	180
83	149990	150010	151700	151720	20
84	150010	150080	151720	151795	70
85	150080	150100	151795	151820	20
86	150100	150300	151820	151060	200
87	150400	150410	152170	152180	10
88	150410	150470	152180	152245	60
89	150470	150490	152245	152265	20
90	150490	150750	152265	152550	260
91	150850	151300	152660	153100	450
92	151400	151620	153200	153420	220
93	151620	151640	153420	153450	20
94	151640	151800	153450	153750	160
95	151800	151810	153750	153760	10
96	151810	152100	153760	154195	290
97	152100	152110	154195	154200	10
98	152110	152220	154200	154370	110
99	152220	152260	154370	154410	40
100	152260	152300	154410	154455	40
101	152300	152340	154455	154495	40
102	152340	152540	154495	154715	200
103	152540	152570	154715	154745	30
104	152570	152670	154745	154870	100
105	152670	152690	154870	154900	20
106	152690	153323	154900	155810	633
107	153323	154036	155810	156535	713

4.6 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 4.3**

Table 4.3: 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

Design Chainage(m)		Length(m)	Side	Remarks
From	To			
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
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

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Design Chainage(m)		Length(m)	Side	Remarks
From	To			
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

Design Chainage(m)		Length(m)	Side	Remarks
From	To			
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
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

Design Chainage(m)		Length(m)	Side	Remarks
From	To			
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
39460	39480	20	One	Widening
39480	39515	70	Both	Realignment
39515	39525	10	One	Widening

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Design Chainage(m)		Length(m)	Side	Remarks
From	To			
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

Design Chainage(m)		Length(m)	Side	Remarks
From	To			
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
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

Design Chainage(m)		Length(m)	Side	Remarks
From	To			
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

Design Chainage(m)		Length(m)	Side	Remarks
From	To			
55250	55400	150	One	Widening
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

Design Chainage(m)		Length(m)	Side	Remarks
From	To			
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
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

Design Chainage(m)		Length(m)	Side	Remarks
From	To			
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

Design Chainage(m)		Length(m)	Side	Remarks
From	To			
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
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

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Design Chainage(m)		Length(m)	Side	Remarks
From	To			
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

4.7 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 4.4**. List of minor junctions are attached in **Annexure 4.2**.

Table 4.4 :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	

4.8 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 howeverdoes not qualify these settlements as congested. No separate proposals are made for these areas.

4.9 Bus Shelters

Provision of bus shelters have been made at all towns and settlements. The list of proposed bus shelters is given in **Table 4.5.**

Table 4.5: 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

4.10 Truck Lay Bye

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

4.11 Passing Places

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

4.12 Cattle Crossing

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

4.13 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.

4.14 Pedestrian Crossings

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

4.15 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

4.15.1 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.

4.15.2 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".

4.15.3 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

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intersections.

4.15.4 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).

4.15.5 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.

4.15.6 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.

4.15.7 Hard Topping

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

4.15.8 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.

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

4.16 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 4.6.**

Table 4.6: Land Acquisition

JoramKoloriang Land Acquisition Plan (km 20 TO km70)			
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

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JoramKoloriang Land Acquisition Plan (km 20 TO km70)			
Proposed Chainage	**LA Area (sqm)**	**Area Hec.**	**Area Acre.**
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
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**

4.17 SLOPE PROTECTION AND EROSION CONTROL

4.17.1 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.

4.17.2 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 rainfall and runoff. 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.

4.17.3 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.

4.17.4 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.

4.17.5 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 entomass 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:

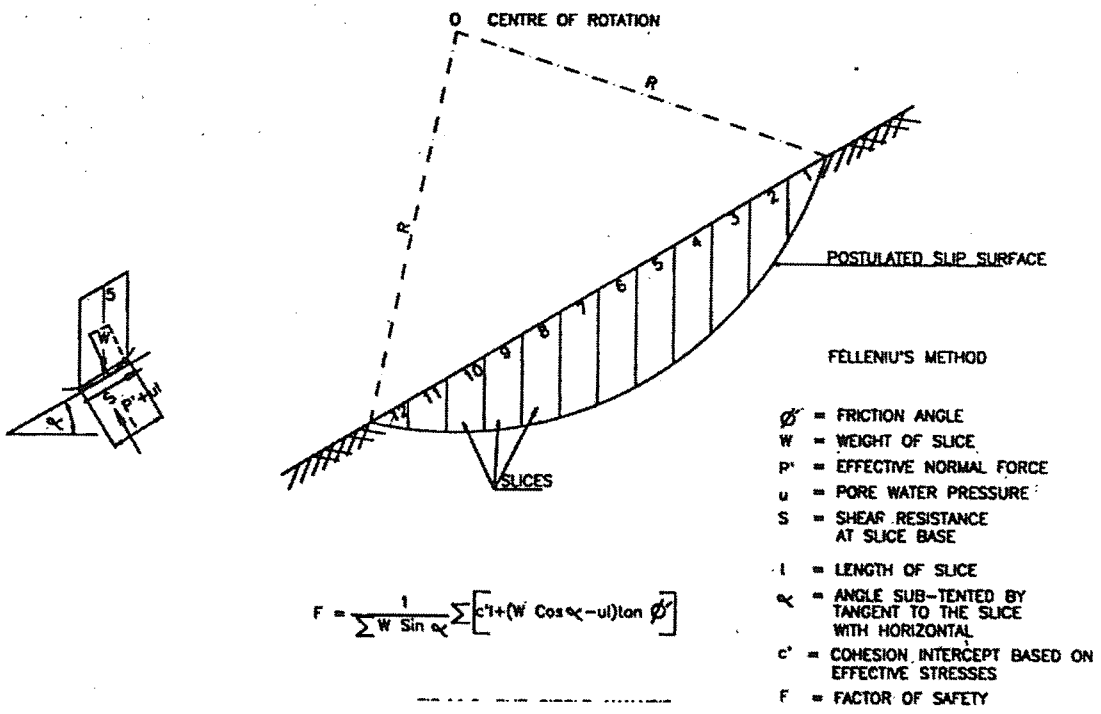

Fig1 : SLIP CIRCLE ANALYSIS

4.17.6 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

PAVEMENT AND PRELIMINARY BRIDGE DESIGN

5.0 Pavement Design

5.1 Introduction:

Pavement is the one of the most important components of any road because it supports the load from the traffic, which the road is meant to carry throughout the design period. The pavement is the portion of the highway which is most obvious to the motorist and pavement for an expressway demands two major criteria, viz, traffic safety and driving comfort. Effective pavement design is one of the more important aspects of project design. The condition and adequacy of the highway is often judged by the smoothness or roughness of the pavement. Deficient pavement conditions can result in increased user costs and travel delays, braking and fuel consumption, vehicle maintenance repairs and probability of increased crashes. The pavement life is substantially affected by the number of heavy load repetitions applied, such as single, tandem, axle trucks, buses and other commercial vehicles. A properly designed pavement structure will take into account the applied loading.

5.2 Design Consideration:

The design has been done for homogeneous sections of the project road classified on the basis of traffic generation and dispersal nodes located along the project road, as given below:

Homogeneous Section	From(km)	To(km)	Length
Section-I	20.000	70.000/59.363	39.363
Section-II	138.000	158.000/154.036	16.036

Pavement design is required for the following cases:

- New carriageway (eccentric widening, realignment and bypass sections)
- Strengthening overlay for existing pavement: The existing pavement condition is poor and due to geometric improvement it is not possible to follow the existing pavement, hence the project corridor under reconstruction stretch.

The new pavement will be designed primarily as per IRC guidelines (IRC 37-2012 for flexible pavement and IRC: SP:73-2015). However, the design shall be done using the recommendations given in widely used international practices in case of non-availability of directions in the relevant code of IRC.

5.3 Design Life

The design life adopted in the analysis is 15 years for flexible pavement. Traffic, both in terms of volume and ESA, have been analysed for a period of 30 years for future assessment.

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After 15 years the residual strength of the pavement as well as the traffic has to be reassessed for pavement rehabilitation design and improving serviceability of the pavement.

5.4 Traffic and Traffic Loading

Traffic survey comprising classified traffic volume counts (CTV) were conducted under the survey program for this project.

Design Traffic

a) Traffic Distribution Factors

Directional distribution factor and lane distribution factor have been calculated based on existing traffic.

For two lane single carriageway configuration, the combined distribution factor is 0.5as per IRC guidelines.

b) Vehicle Damage Factor:

The design traffic in number is 588 in design life, so VDF is 1.5 for hilly terrain as recommended in IRC 37, 2015.

Computation of design traffic in msa for flexible and rigid pavement is 3.3msa and 16.97 msa respectively but as recommended in IRC:SP73:2015 the design traffic shall not be less than 20msa.The adopted pavement thicknesses for new and widened pavement are given in **Table 5.1.**

Table 5.1: 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 the pavement design. The values of existing CBR are presented in **Annexure 2.8.**

5.5 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. VOC costs and residual life of materials have not been considered to compare different alternatives / options of pavement composition. Net Present Value (NPV) has been determined considering discount rate of 12%. 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 5.2**and the details of the calculations are given in **Annexure 5.1**

Table 5.2: Comparison of Cost (in Rs) of Rigid/ Flexible Pavement

Particulars	Options		Ratio of Rigid to Flexible Option
	Flexible	Rigid	
Initial Construction Cost (Rs.)	**24388329**	**35416515**	**1.453**
Net Present value considering all cost(Rs.)	**32473519**	**37322237**	**1.15**

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 = 280mm, 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 Rs2.96L (on Flexible pavement)

Overlay of 40mm BC has been considered at 15th year at flexible pavement- present BC rate has been escalated @5% per annum to arrive 15th year cost

Routine maintenance of Rs50000/- per year and escalation @5% per annum has been taken for Rigid pavement

It has been observed through life cycle cost analysis the NPV value of flexible pavement slightly lower than the NPV value of rigid pavement but considering low traffic road, use of rigid pavement will not be economical. The detail calculation for Life Cycle Cost Analysis is presented in **Annexure 5.1.**

5.6 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 5.3.** Tentative sub soil investigation schedule for these structures has been presented in **Table 5.4.**

Table 5.3 : 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

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Table 5.4 : 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

5.7 Culverts

There are 326 culverts existing at project road. A summary of the improvement proposals of culverts are given below:

Improvement Type	Nos. of culverts
Reconstruction	315
New Proposal	6
Repair and replacement	5

Table 5.5: Proposal of Culvert

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Type of Structures (Pipe, Slab, Box, Arch)	Recommendation	Improvement proposal	Proposed Type of Structures	Proposed Span Arrangement (m)
1	20+025	20+010	Pipe	Reconstruction	New 2- Lane	Box	1x2.0x2.0
2	20+294	20+220	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
3	20+595	20+400	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
4	20+848	20+470	Pipe	Reconstruction	New 2- Lane	Box	1x2.0x2.0
5	21+005	20+580	Not visible	Reconstruction	New 2- Lane	Box	1x2.0x2.0
6	21+025	20+600	Pipe	Reconstruction	New 2- Lane	Box	1x2.0x2.0
7	21+125	20+690	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
8	21+296	20+800	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
9	22+050	21+480	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
10	22+100	21+530	Pipe	Reconstruction	New 2- Lane	Box	1x2.0x2.0
11	22+300	21+710	Not visible	Reconstruction	New 2- Lane	Box	1x2.0x2.0
12	22+450	21+810	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
13	22+470	21+840	Pipe	Reconstruction	New 2- Lane	Box	1x2.0x2.0
14	22+560	21+920	Slab	Reconstruction	Widening to 2-Lane	Box	1x2.0x2.0
15	22+700	22+050	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
16	22+800	22+140	Pipe	Reconstruction	New 2- Lane	Box	1x2.0x2.0
17	22+950	22+250	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
18	23+020	22+320	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
19	23+150	22+400	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
20	23+200	222+460	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
21	24+180	23+350	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
22	24+345	23+490	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
23	24+565	23+650	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
24	25+350	23+870	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
25	25+590	23+930	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
26	25+800	24+060	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
27	25+850	24+120	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
28	26+025	24+300	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
29	26+310	24+500	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
30	26+380	24+580	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
31	26+625	24+680	Pipe	Reconstruction	New 2- Lane	Box	1x2.0x2.0

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Type of Structures (Pipe, Slab, Box, Arch)	Recommendation	Improvement proposal	Proposed Type of Structures	Proposed Span Arrangement (m)
32	26+900	25+050	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
33	26+980	25+100	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
34	27+200	25+230	Slab	Reconstruction	New 2- Lane	Box	1x2.5x2.0
35	27+430	25+547	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
36	27+600	25+550	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
37	27+650	25+600	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
38	27+740	25+680	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
39	27+850	25+800	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
40	28+080	25+870	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
41	28+300	26+030	Slab	Reconstruction	New 2- Lane	Box	1x3.0x3.0
42	28+380	26+090	Pipe	Reconstruction	New 2- Lane	Box	1x2.0x2.0
43	28+480	26+170	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
44	28+550	26+250	Not visible	New Construction	New 2- Lane	Box	1x2.0x2.0
45	28+610	26+310	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
46	28+910	26+580	Not visible	New Construction	New 2- Lane	Box	1x2.0x2.0
47	28+950	26+600	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
48	28+990	26+630	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
49	29+120	26+720	Not visible	Reconstruction	New 2- Lane	Box	1x2.0x2.0
50	29+355	26+900	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
51	29+560	27+030	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
52	29+740	27+210	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
53	30+070	27+470	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
54	30+420	27+790	Slab	Reconstruction	New 2- Lane	Box	1x2.5x2.0
55	30+880	28+100	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
56	31+200	28+400	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
57	33+830	30+820	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
58	33+910	30+900	Not visible	Reconstruction	New 2- Lane	Box	1x2.0x2.0
59	33+970	30+980	Pipe	Reconstruction	New 2- Lane	Box	1x2.0x2.0
60	34+140	31+140	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
61	34+620	31+540	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
62	34+900	31+790	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
63	35+010	31+900	Pipe	Reconstruction	New 2- Lane	Box	1x2.0x2.0
64	35+150	32+020	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
65	35+270	32+130	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
66	35+330	32+190	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
67	35+460	32+310	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
68	35+700	32+350	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
69	35+970	32+810	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
70	36+175	33+010	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
71	36+300	33+150	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
72	36+490	33+320	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
73	36+890	33+560	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
74	37+100	33+730	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
75	37+370	33+990	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
76	37+490	34+080	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
77	37+790	34+370	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
78	37+880	34+470	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
80	38+360	34+860	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
81	38+420	34+920	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
82	38+500	34+950	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0

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Sl. No.	Existing Chainage (km)	Design Chainage (km)	Type of Structures (Pipe, Slab, Box, Arch)	Recommendation	Improvement proposal	Proposed Type of Structures	Proposed Span Arrangement (m)
83	38+640	35+080	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
84	38+710	35+150	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
85	38+940	35+370	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
86	39+125	35+485	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
87	39+450	35+760	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
88	39+640	35+880	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
89	40+260	36+260	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
90	40+500	36+510	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
91	40+700	36+680	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
92	40+840	36+760	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
93	40+950	36+880	Slab	Reconstruction	New 2- Lane	Box	1x6.0x4.0
94	41+210	37+060	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
95	41+550	37+170	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
96	41+730	37+310	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
97	41+810	37+390	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
98	42+160	37+560	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
99	42+340	37+860	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
100	42+560	37+930	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
101	42+925	38+260	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
102	43+150	38+470	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
103	43+300	38+600	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
104	43+390	38+670	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
105	43+400	38+690	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
106	43+580	38+810	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
107	44+075	39+130	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
108	44+150	39+215	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
109	44+330	39+390	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
110	44+500	39+540	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
111	44+700	39+700	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
112	44+925	39+830	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
113	45+050	39+940	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
114	45+270	40+050	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
115	45+520	40+170	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
116	45+675	40+270	Pipe	Reconstruction	New 2- Lane	Box	1x2.0x2.0
117	45+740	40+300	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
118	46+210	40+680	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
119	46+940	41+320	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
120	47+050	41+430	Pipe	Reconstruction	New 2- Lane	Box	1x2.0x2.0
121	47+300	41+710	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
122	47+350	41+780	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
123	47+900	42+160	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
124	48+050	42+260	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
125	48+330	42+500	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
126	48+500	42+670	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
127	48+700	42+820	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
128	48+900	42+980	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
129	49+150	43+240	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
130	49+200	43+300	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
131	49+270	43+370	Slab	Reconstruction	New 2- Lane	Box	1x6.0x4.0
132	49+600	43+670	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
133	49+850	43+820	Slab	Retain & Repair	Widening to 2-Lane	Box	1x3.0x3.0

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Type of Structures (Pipe, Slab, Box, Arch)	Recommendation	Improvement proposal	Proposed Type of Structures	Proposed Span Arrangement (m)
134	49+950	43+910	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
135	49+990	43+940	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
136	50+050	44+000	Pipe	Reconstruction	New 2- Lane	Box	1x2.0x2.0
137	50+160	44+080	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
138	50+290	44+160	Not visible	New Construction	New 2- Lane	Box	1x2.0x2.0
139	50+360	44+230	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
140	50+500	44+370	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
141	50+830	44+640	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
142	51+450	45+130	Pipe	Reconstruction	New 2- Lane	Box	1x2.0x2.0
143	51+500	45+170	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
144	51+860	45+330	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
145	52+255	45+640	Pipe	Reconstruction	New 2- Lane	Box	1x2.0x2.0
146	52+475	45+810	Pipe	Reconstruction	New 2- Lane	Box	1x2.0x2.0
147	52+710	45+980	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
148	53+475	46+690	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
149	53+550	46+800	Pipe	Reconstruction	New 2- Lane	Box	1x2.0x2.0
150	53+870	46+890	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
151	53+920	46+930	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
152	54+020	47+030	Pipe	Reconstruction	New 2- Lane	Box	1x2.0x2.0
153	54+050	47+070	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
154	54+620	47+410	Pipe	Reconstruction	New 2- Lane	Box	1x2.0x2.0
155	55+550	47+740	Not visible	Reconstruction	New 2- Lane	Box	1x2.0x2.0
156	55+610	48+080	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
157	55+700	48+150	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
158	56+270	48+230	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
161	56+570	48+890	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
162	56+895	49+190	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
163	57+030	49+280	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
164	57+160	49+400	Not visible	New Construction	New 2- Lane	Box	1x2.0x2.0
165	57+260	49+490	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
166	57+320	49+530	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
167	57+450	49+570	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
168	57+600	49+690	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
169	57+650	49+750	Slab	Retain & Repair	New 2- Lane	Box	1x3.0x3.0
170	57+750	49+860	Pipe	Reconstruction	New 2- Lane	Box	1x2.0x2.0
171	57+900	49+980	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
172	58+320	50+250	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
173	58+325	50+310	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
174	58+500	50+360	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
175	58+625	50+500	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
176	58+750	50+600	Not visible	Reconstruction	New 2- Lane	Box	1x2.0x2.0
177	59+000	50+850	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
178	59+150	50+980	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
179	59+270	51+090	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
180	59+494	51+280	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
181	59+550	51+330	Pipe	Reconstruction	New 2- Lane	Box	1x2.0x2.0
182	59+640	51+400	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
183	59+825	51+570	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
184	60+160	51+910	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
185	60+350	52+110	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Type of Structures (Pipe, Slab, Box, Arch)	Recommendation	Improvement proposal	Proposed Type of Structures	Proposed Span Arrangement (m)
186	60+600	52+280	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
187	61+080	52+680	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
188	61+190	52+790	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
189	61+330	52+910	Slab	Reconstruction	New 2- Lane	Box	1x6.0x4.0
190	61+510	52+980	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
191	61+700	53+140	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
192	61+810	53+270	Not visible	Reconstruction	New 2- Lane	Box	1x2.0x2.0
193	61+950	53+370	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
195	62+280	53+700	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
196	62+410	53+810	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
197	62+510	53+920	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
198	62+650	54+050	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
199	62+745	54+150	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
200	62+810	54+210	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
201	63+125	54+410	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
202	63+260	54+440	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
203	63+280	54+570	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
204	63+560	54+740	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
205	63+650	54+820	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
206	63+750	54+910	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
207	63+820	54+970	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
208	64+125	55+190	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
209	64+355	55+270	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
210	64+455	55+330	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
211	64+560	55+460	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
212	64+610	55+500	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
213	64+740	55+600	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
214	64+800	55+640	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
215	64+990	55+710	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
216	65+300	55+900	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
217	65+575	56+150	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
218	65+740	56+320	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
219	65+810	56+390	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
220	65+950	56+490	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
221	66+150	56+640	Not visible	Reconstruction	New 2- Lane	Box	1x2.0x2.0
222	66+350	56+790	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
223	66+400	56+850	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
224	66+480	56+930	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
225	66+790	57+200	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
226	67+480	57+760	Slab	Reconstruction	New 2- Lane	Box	1x3.0x2.5
227	67+660	57+920	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
228	68+000	58+160	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
229	68+440	58+600	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
230	68+680	58+820	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
231	68+870	59+000	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
232	69+110	59+250	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
234	138+020	138+028	Slab	Reconstruction	New 2- Lane	Box	1x3.0x3.0
235	138+760	138+700	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
236	138+800	138+730	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
237	138+900	138+810	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
238	139+090	138+960	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
239	139+125	138+980	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Type of Structures (Pipe, Slab, Box, Arch)	Recommendation	Improvement proposal	Proposed Type of Structures	Proposed Span Arrangement (m)
240	139+310	139+170	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
241	139+490	139+320	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
242	139+540	139+360	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
243	139+910	139+720	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
245	140+970	140+720	Slab	Retain & Repair	New 2- Lane	Box	1x3.0x3.0
246	141+000	140+750	Not visible	Reconstruction	New 2- Lane	Box	1x2.0x2.0
247	141+135	140+880	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
248	141+300	141+040	Slab	Reconstruction	New 2- Lane	Box	1x3.0x3.0
249	141+450	141+180	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
250	141+500	141+230	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
251	141+770	141+455	Slab	Reconstruction	New 2- Lane	Box	1x3.0x3.0
252	142+045	141+680	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
253	142+100	141+740	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
254	142+320	141+960	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
255	142+590	142+200	Slab	Reconstruction	New 2- Lane	Box	1x2.5x2.0
256	142+640	142+270	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
257	142+695	142+315	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
258	142+795	142+405	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
259	143+020	142+640	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
260	143+120	142+740	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
262	143+455	143+000	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
263	143+820	143+230	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
264	144+010	143+410	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
265	144+150	143+550	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
266	144+315	143+710	Not visible	New Construction	New 2- Lane	Box	1x2.0x2.0
268	144+840	144+210	Slab	Reconstruction	New 2- Lane	Box	1x3.0x3.0
269	145+090	144+470	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
270	145+445	144+810	Slab	Reconstruction	New 2- Lane	Box	1x3.0x3.0
271	145+495	145+000	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
272	146+165	145+350	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
273	146+440	145+610	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
274	146+520	145+680	Slab	Reconstruction	New 2- Lane	Box	1x3.5x3.0
275	146+930	145+900	Slab	Reconstruction	New 2- Lane	Box	1x6.0x4.0
277	147+280	146+200	Slab	Reconstruction	New 2- Lane	Box	1x4.5x3.0
278	147+400	146+450	Slab	Reconstruction	New 2- Lane	Box	1x5.0x4.0
279	147+590	146+650	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
280	147+820	146+980	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
281	148+155	147+410	Slab	Reconstruction	New 2- Lane	Box	1x3.5x3.0
282	148+730	147+700	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
283	149+175	147+790	Slab	Reconstruction	New 2- Lane	Box	1x4.0x3.0
284	149+240	147+800	Slab	Reconstruction	New 2- Lane	Box	1x6.0x4.0
285	149+290	147+850	Slab	Reconstruction	New 2- Lane	Box	1x2.5x2.0
286	149+405	147+940	Slab	Reconstruction	New 2- Lane	Box	1x3.0x3.0
287	149+500	147+985	Slab	Reconstruction	New 2- Lane	Box	1x3.0x3.0
288	149+575	148+060	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
289	149+720	148+200	Slab	Reconstruction	New 2- Lane	Box	1x4.5x3.0
290	149+960	148+430	Slab	Reconstruction	New 2- Lane	Box	1x3.0x3.0
291	150+180	148+630	Slab	Reconstruction	New 2- Lane	Box	1x3.0x3.0
292	150+420	148+830	Slab	Reconstruction	New 2- Lane	Box	1x2.5x2.0
293	150+455	148+870	Slab	Reconstruction	New 2- Lane	Box	1x4.0x3.0
294	150+520	148+920	Slab	Reconstruction	New 2- Lane	Box	1x2.5x2.0

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Type of Structures (Pipe, Slab, Box, Arch)	Recommendation	Improvement proposal	Proposed Type of Structures	Proposed Span Arrangement (m)
295	150+585	148+970	Slab	Reconstruction	New 2- Lane	Box	1x2.5x2.0
296	150+650	149+030	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
297	150+750	149+130	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
298	150+775	149+160	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
299	150+850	149+220	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
300	151+070	149+440	Slab	Reconstruction	New 2- Lane	Box	1x3.0x3.0
301	151+100	149+480	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
302	151+350	149+650	Slab	Reconstruction	New 2- Lane	Box	1x3.0x3.0
303	151+410	149+720	Slab	Reconstruction	New 2- Lane	Box	1x3.0x3.0
304	151+490	149+840	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
305	151+580	149+925	Slab	Reconstruction	New 2- Lane	Box	1x3.0x3.0
306	151+720	150+010	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
307	151+765	150+050	Slab	Reconstruction	New 2- Lane	Box	1x3.0x3.0
308	151+810	150+090	Slab	Reconstruction	New 2- Lane	Box	1x2.5x2.0
309	151+870	150+152	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
310	152+080	150+320	Slab	Reconstruction	New 2- Lane	Box	1x3.0x3.0
311	152+205	150+430	Slab	Reconstruction	New 2- Lane	Box	1x3.0x3.0
312	152+260	150+490	Slab	Reconstruction	New 2- Lane	Box	1x2.5x2.0
313	152+305	150+530	Slab	Reconstruction	New 2- Lane	Box	1x3.5x3.0
315	152+890	151+060	Slab	Reconstruction	New 2- Lane	Box	1x3.0x3.0
316	153+070	151+290	Slab	Reconstruction	New 2- Lane	Box	1x6.0x4.0
317	153+180	151+390	Slab	Reconstruction	New 2- Lane	Box	1x4.0x3.0
318	153+310	151+510	Slab	Reconstruction	New 2- Lane	Box	1x4.0x3.0
319	153+450	151+640	Slab	Reconstruction	New 2- Lane	Box	1x4.0x3.0
320	153+775	151+820	Slab	Reconstruction	New 2- Lane	Box	1x5.0x4.0
321	153+960	151+920	Slab	Reconstruction	New 2- Lane	Box	1x6.0x4.0
322	154+020	151+980	Slab	Reconstruction	New 2- Lane	Box	1x2.5x2.0
323	154+085	152+040	Slab	Reconstruction	New 2- Lane	Box	1x4.0x3.0
324	154+205	152+110	Slab	Reconstruction	New 2- Lane	Box	1x4.0x3.0
325	154+340	152+190	Slab	Reconstruction	New 2- Lane	Box	1x2.5x2.0
326	154+400	152+260	Slab	Reconstruction	New 2- Lane	Box	1x2.5x2.0
327	154+575	152+420	Slab	Reconstruction	New 2- Lane	Box	1x2.5x2.0
328	154+760	152+590	Slab	Reconstruction	New 2- Lane	Box	1x4.0x3.0
329	154+900	152+690	Slab	Reconstruction	New 2- Lane	Box	1x2.5x2.0
330	155+100	152+850	Slab	Reconstruction	New 2- Lane	Box	1x6.0x4.0
331	155+420	152+920	Slab	Reconstruction	New 2- Lane	Box	1x2.0x2.0
332	155+370	152+990	Slab	Reconstruction	New 2- Lane	Box	1x2.5x2.0
333	155+600	153+260	Slab	Reconstruction	New 2- Lane	Box	1x2.5x2.0
334	155+850	153+285	Slab	Retain & Repair	Widening to 2-Lane	Box	1x2.1x2.0
335	156+180	153+530	Slab	Retain & Repair	Widening to 2-Lane	Box	1x5.9x4.5
336	156+400	153+910	Slab	New Construction	New 2- Lane	Box	1x2.0x2.0

5.8 Hydrological and Hydraulic Investigations

General

Generally, design discharges for bridges and culverts are computed by using various methods as recommended by IRC: 5 -2015 & IRC–SP: 13 – 2004. Methods adopted in any

particular case vary depending on available data. Various methods which can be used for calculating the design discharge (as per IRC: 5 -2015 & IRC: SP: 13 – 2004) are given below:

Hydrological Design Methodology

Empirical Formula (Dicken's and Ryve's Formula)

Dicken's and Ryve's formula are commonly used in India for computation of flood discharge based on catchment area of the stream.

(i) Dicken's Formula:

$$Q=C_1A^{0.75} \quad (1)$$

(ii) Ryve's Formula:

$$Q=C_2A^{0.67} \quad (2)$$

Where:

A=CatchmentareainSq.km.

C_1 and C_2 = Run –off co-efficient which depends on the topography, type of soil, vegetation, ground slope, climate of the region, etc. Because of the varying topography, C1 and C_2 values will vary appreciably and since these formula as do not take rainfall into account ,discharges Computed are not reliable.

(iii) Rational Formula

$$Q=0.028PfAI_C \quad (3)$$

Where:

Q =	Maximum run off in cumecs
A =	Catchment area in hectares
Ic =	Critical intensity of rainfall in cm/ hr.
P =	Coefficient of run off for the given catchment characteristics.
f =	Spread factor for converting point rainfall into areal mean rainfall.
Ic=	F/T[(T+1)/(Tc+1)]
F =	Total Rainfall of T hours duration (24 hrs.) in cm corresponding to either 25 yrs (for culverts) or 50 yrs (for bridges) return period.
T =	Duration of total rainfall (F) in hours= 24 hrs.
Tc =	Time of concentration in hour.

(iv) Slope- Area Method

This method is based on conveyance factor (K) and the slope (S) of stream. For calculation of the conveyance factor, several cross-sections have been used. These are at bridge site, upstream of bridge site and downstream of bridge site at specified

locations. The discharge Is calculated by the Manning's formula given below:

$Q = KS^{1/2}$ (4)

K =Mean conveyance rate = (K1, K2...Kn)1/n

Kn =1/NnAn $Rn^{2/3}$ (n = 1, 2, 3...n) (5)

Where:

Q = Discharge in m3/sec.

A = Cross-sectional area of flow in sq. m.

R = Hydraulic mean depth in m = A/P

P = Wetted perimeter in m.

S = Mean longitudinal slope of the channel.

K = Conveyance factor and n refers no. of cross-section

N = Rugosity coefficient as per IRC: SP –13 as given below:

Rugosity coefficient. Used in slope area method is given in **Table 4.11**.

Table5.6: RugosityCo-efficient Used in Slope Area Method

Sl. No.	Surface (Natural Streams)	Manning's N-values.			
		Perfect	Good	Fair	Bad
1	Clean, straight bank, full stage, no rifts or deep pools	0.025	0.0275	0.030	0.033
2	Same as (1), but some weeds and stones	0.030	0.033	0.035	0.040
3	Winding, some pools and shoals, clean	0.035	0.040	0.045	0.050
4	Same as (3), lower stages, more ineffective slope and sections	0.040	0.045	0.050	0.055
5	Same as (3), some weeds and stones	0.033	0.035	0.040	0.045
6	Same as (4), stony sections	0.045	0.050	0.055	0.060
7	Sluggish river reaches, rather weedy or with very deep pools	0.050	0.060	0.070	0.080
8	Very weedy reaches	0.075	0.100	0.125	0.150

If the shape of the cross-section is irregular as it happens quite often in streams with flood plains with deep water in main channel and shallow over flows in the flood plains as shown in figure below, it is necessary to subdivide the channel in to various subsections. Then 'A'and'P'of each subsection are computed and summed up to get total area and perimeter. These are used in determining conveyance factor(K) for each section with varying n-value. Discharge passing through each section is found as

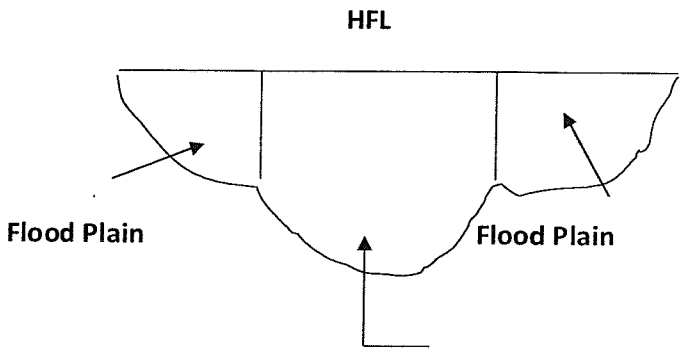
Qn =K nVs(n=1,2,3....)

Where 'S' is the longitudinal bed slope. Total discharge is found by adding discharge passing through each section.

n=n

$Q=\xi Q_n$

n=1



It may be noted that the discharge found from slope-area method is on the basis of flood marks obtained at the site from local enquiry. Hence such discharge cannot be assigned any return period unless year wise records of HFL area available. However, these are extremely useful to assess accuracy of HFL corresponding to design discharge.

(v) Water Current Force

HFL, velocity of flow, scour depth has been taken as per past data received and hydraulic calculations. The water current forces on substructure and foundation have been calculated as per IRC: 6-2014.

On piers parallel to the direction of water current, the intensity of pressure is given by following equation.

$p = 52 K V^2$

Where,

p= intensity of pressure in kg/m2

K= a constant, value depends on shape of pier

V= velocity of current at point where pressure intensity is to be determined in m/s. (which is zero at the point of deepest scour and sqrt (2) times maximum mean velocity at the free surface).

(vi) Buoyancy Forces

Full buoyancy (100%) has been considered for checking the stability of foundations. For checking stresses of the substructure components, 15% pore pressure uplift is considered in the design.

The preliminary design of bridges are presented in **Annexure 5.2**

5.9 GEO-TECHNICAL INVESTIGATION FOR BRIDGES

5.10 GENERAL

Geo-technical investigation shall be carried out at individual bridge foundation locations after finalization of bridge sites as per road alignment. The work shall be planned to included mobilization of men and machinery to the proposed site, setting up and shifting of the equipment and conducting the field investigations and demobilization after field work is completed satisfactorily.

The field activities to be carried out at the site shall comprise of:

i) Drilling 150mm dia. bore hole as specified through gravel, sand, silt, clay and all soils other than rock or boulders by Rotary method up to a maximum depth as per code or refusal strata whichever is earlier (Refusal means when N> 100 for 30cm penetration).

ii) Rotary drilling with NX size drill using suitable core drill bit using Tungsten carbide bit and diamond bit wherever required with single/ double tube barrel, depending upon type of Rock/ boulder beyond refusal strata /through Rocky strata upto maximum depth of 3 m. If refusal / Rocky strata encountered at surface or at the shallow depths of 3.0m, the bore hole shall be advanced sufficiently into refusal / rocky strata. Casing will be provided up-to a suitable depth to prevent side collapse.

iii) Conducting standard penetration test in bore hole in soil strata encountered during boring activity at 1.5m depth interval.

iv) Collecting undisturbed soil samples at 3.0 m depth intervals.

v) Collecting representative disturbed samples from the bore hole at 1.5m depth interval for soil classification.

vi) Storing the rock core samples lengthwise in a Core Box of suitable size, and collecting wash samples in case of nil core recovery.

vii) Recording the depth of ground water table on its full stabilisation in the bore hole in case of its occurrence.

viii) Testing the representative soil/rock samples in the laboratory as per relevant IS codes.

(A) SOIL SAMPLES

a) Natural Moisture content
b) Bulk & dry density
c) Atterberg's Limit (Liquid limit, plastic limit & Plasticity index)
d) Specific gravity.
e) Unconsolidated undrained Triaxial compression test
f) Particle size distribution by
   i)Sieve analysis for sandy soils
   ii)Hydrometer analysis for silty to clayey soil
g) Direct shear test

(B) ROCK SAMPLES

a) Uniaxial compressive strength

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b) Rock Quality Designation
c) Physical properties of rock (density, specific gravity etc.)

(C) DEFINITIONS OF SOFT AND HARD ROCK

For the above the following definition will be used.

- Soft rock : SPT "N" > 100, Core recovery up to 50%
- Hard rock : SPT "N" > 100, Core recovery > 50%

Sub-soil/rock strata and preparation of bore/drill log will be done.
Preparation and Submission of soil report in triplicate incorporating recommendations for proposed type of foundation and safe bearing capacity/allowable bearing pressure along with bore/drill log table and graph in accordance with relevant IS codes.

Earth Pressure

Lateral forces due to earth pressure for the design of abutments and retaining walls have been calculated as per IRC: 6-2010. Properties of backfill material are adopted as per IRC: 78-2000, Appendix-6.

Live load surcharge equivalent height of 1.2 m has been considered for the design of abutment as well as for return/retaining wall.

5.11 Material Specifications

General design requirements adopted in detail designs are as follows.
Concrete

In accordance with IRC: 21-2000 Table -5, following minimum grade of concrete has been used for moderate and severe conditions of exposure for different components:

Member	Major/Minor Bridge	Culverts
Moderate Conditions of Exposure		
PCC Members	M 25	M 15
RCC Members	M 30	M 20
PSC Members	M35	
Severe Conditions of Exposure		
PCC Members	M 30	M 20
RCC Members	M35	M 25
PSC Members	M40	


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		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)
20000	20500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
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								
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
																					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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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								
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	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					K	0.250m		
37500	38000	H	F	F				B	3.5m	P	E	1.0m	E	1.5m								
38000	38500	H	F	F				B	3.5m	P	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								
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	1.0m	E	1.5m					K	0.250m		
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								
41500	42000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
42000	42500	H	F	F			DEM	B	3.2m	P	E	1.5m	E	1.0m							K	0.250m
42500	43000	H	F	F			DEM	B	3.2m	P	E	1.5m	E	1.0m							K	0.250m
								B	3.5m	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

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								
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							K	0.250m
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	1.5m	E	1.0m								
46500	47000	H	F	F				B	3.5m	F	E	1.0m	E	1.5m					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							K	0.250m
48000	48500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m								
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	1.5m	E	1.0m							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					K	0.250m		
53000	53500	H	F	F				B	3.5m	F	E	1.0m	E	1.5m								
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	1.0m	E	1.5m					K	0.250m		
54500	55000	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
								B	3.5m	F	E	1.0m	E	1.5m					K	0.250m		

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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	F	E	1.5m	E	1.0m								
62000	62500	H	F	F				B	3.5m	P	E	1.5m	E	1.0m								
62500	63000	H	F	F				B	3.5m	P	E	1.5m	E	1.0m							K	0.250m
63000	63500	H	F	F				B	3.3m	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	3.5m	F	E	1.5m	E	1.0m							K	0.250m
64500	65000	H	F	F				B	3.2m	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	66500	H	F	F				B	3.5m	F	E	1.5m	E	1.0m							K	0.250m
								B	3.3m	F	E	1.5m	E	1.0m							K	0.250m

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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)
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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											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. /

ignature of Superviso

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 : 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

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)			
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

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

VOYANTS SOLUTIONS PVT. LTD. GURGAON

Annexure- 2.3

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

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)
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	Neulibar	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

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 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

Sheet No : /

Signature of Surveyor

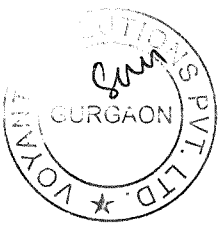
Signature of Supervisor

Annexure-2.5

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**



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		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	
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	-	-	-	-	-
57500	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		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	
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	8	E	F	E	F	-	-	-	-	-
62000	62500	3.5	B	27	44	67	980	11	340	355	345	7	450	9	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	7	E	F	E	F	-	-	-	-	-
65000	65500	3.5	B	27	44	67	980	11	340	355	345	7	450	9	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 (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	
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	-	-	-	-	-

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 freque nt	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

ROAD INVENTORY: Extra Widening For Curves

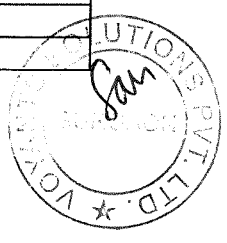
NAME OF ROAD: NH-713 - JORAM - KOLORIANG

DAY/DATE:

SURVEYOR:

DISTRICT: LOWER SUBANSIRI, KRA DAADI, KURUNG KUMEY

Sl. No.	Location		Length of Curve	Inner Edge of Curve		Radius			Turn (Left/ Right)
	From	To		Length of Chord	Versine				
	(km)	(km)	(m)	(m)	(m)	(m)	(m)	(m)	
1	20+037.178	20+039.551	02.37			-	-	60	
2	20+153.705	20+345.832	192.13			85	-	-	
3	20+387.690	20+410.476	22.79			-	-	60	
4	20+489.719	20+496.692	06.97			-	250	-	
5	20+580.281	20+603.590	23.31			-	300	-	
6	20+674.181	20+699.387	25.21			-	-	50	
7	20+749.700	20+777.486	27.79			-	-	45	
8	20+862.006	20+873.883	11.88			-	-	60	
9	20+951.339	21+005.538	54.20			-	-	60	
10	21+058.354	21+069.160	10.81			90	-	-	
11	21+127.102	21+137.124	10.02			-	-	60	
12	21+237.646	21+297.938	60.29			-	-	60	
13	21+329.603	21+362.927	33.32			80	-	-	
14	21+407.353	21+411.748	04.40			-	-	60	
15	21+477.824	21+484.813	06.99			80	-	-	
16	21+567.689	21+568.270	00.58			80	-	-	
17	21+707.601	21+721.387	13.79			-	-	40	
18	21+784.831	21+792.985	08.15			-	-	40	
19	21+839.263	21+940.007	100.74			-	-	60	
20	21+975.562	22+029.790	54.23			-	200	-	
21	22+081.441	22+167.257	85.82			-	-	50	
22	22+220.623	22+346.658	126.04			-	-	60	
23	22+415.321	22+529.770	114.45			-	-	56	
24	22+601.252	22+664.284	63.03			-	-	50	
25	22+782.299	22+813.795	31.50			-	-	60	
26	22+847.609	23+004.167	156.56			80	-	-	
27	23+062.815	23+066.225	03.41			-	200	-	
28	23+128.022	23+136.587	08.56			-	-	60	
29	23+193.117	23+204.112	11.00			-	150	-	
30	23+369.816	23+435.932	66.12			-	-	60	
31	23+612.688	23+626.652	13.96			-	-	60	
32	23+868.983	23+897.139	28.16			-	-	60	
33	23+938.236	23+964.908	26.67			-	-	60	
34	24+038.816	24+161.250	122.43			75	-	-	
35	24+359.951	24+370.865	10.91			70	-	-	
36	24+555.022	24+586.084	31.06			-	-	60	
37	25+081.050	25+104.357	23.31			-	-	40	
38	25+418.730	25+532.977	114.25			-	-	60	
39	25+671.986	25+674.072	02.09			80	-	-	
40	25+708.090	25+731.980	23.89			-	-	60	
41	25+769.977	25+785.543	15.57			-	150	-	
42	25+838.783	25+868.565	29.78			-	-	45	
43	25+969.350	26+002.287	32.94			-	-	40	
44	26+168.356	26+226.720	58.36			-	-	60	
45	26+323.066	26+452.944	129.88			70	-	-	
46	26+517.834	26+598.464	80.63			-	-	60	
47	26+652.669	26+667.366	14.70			-	-	40	
48	26+807.270	26+823.408	16.14			-	120	-	
49	26+864.487	26+873.390	08.90			-	-	45	



ROAD INVENTORY: Extra Widening For Curves

NAME OF ROAD: NH-713 - JORAM - KOLORIANG

DAY/DATE:

SURVEYOR:

DISTRICT: LOWER SUBANSIRI, KRA DAADI, KURUNG KUMEY

Sl. No.	Location		Length of Curve	Inner Edge of Curve		Radius			Turn (Left/ Right)
	From	To		Length of Chord	Versine				
	(km)	(km)	(m)	(m)	(m)	(m)	(m)	(m)	
50	26+929.084	26+958.418	29.33			-	-	60	
51	27+008.227	27+085.206	76.98			80	-	-	
52	27+225.676	27+321.497	95.82			-	-	60	
53	27+398.276	27+474.209	75.93			-	-	60	
54	27+543.830	27+609.959	66.13			80	-	-	
55	27+738.410	27+779.837	41.43			-	-	60	
56	27+872.194	27+962.301	90.11			-	-	60	
57	28+028.627	28+101.333	72.71			-	-	40	
58	28+168.776	28+243.494	74.72			-	150	-	
59	28+301.330	28+441.364	140.03			-	120	-	
60	28+574.879	28+632.942	58.06			-	120	-	
61	28+916.087	29+015.159	99.07			-	-	60	
62	29+203.305	29+246.137	42.83			-	150	-	
63	29+338.059	29+353.274	15.22			-	-	60	
64	29+391.178	29+412.805	21.63			-	-	60	
65	29+497.165	29+560.291	63.13			-	-	60	
66	29+595.135	29+636.953	41.82			-	-	60	
67	29+683.569	29+742.079	58.51			-	-	40	
68	29+811.740	29+826.511	14.77			-	-	60	
69	29+920.284	29+933.738	13.45			-	-	60	
70	30+089.767	30+165.539	75.77			-	-	60	
71	30+226.267	30+249.166	22.90			-	-	60	
72	30+424.078	30+501.819	77.74			-	-	40	
73	30+627.179	30+636.334	09.15			-	-	60	
74	30+714.272	30+885.959	171.69			-	-	55	
75	30+997.379	31+053.375	56.00			-	-	60	
76	31+090.993	31+122.228	31.24			-	-	60	
77	31+338.900	31+378.578	39.68			80	-	-	
78	31+449.817	31+478.655	28.84			-	-	60	
79	31+542.058	31+583.658	41.60			-	-	60	
80	31+630.258	31+655.280	25.02			-	-	60	
81	31+711.209	31+800.862	89.65			-	-	60	
82	31+960.919	31+994.335	33.42			-	-	60	
83	32+205.961	32+251.041	45.08			-	-	60	
84	32+394.660	32+407.007	12.35			80	-	-	
85	32+601.986	32+713.448	111.46			90	-	-	
86	32+760.278	32+777.312	17.03			80	-	-	
87	33+166.320	33+183.582	17.26			80	-	-	
88	33+223.445	33+224.701	01.26			-	-	60	
89	33+270.561	33+294.895	24.33			-	-	60	
90	33+328.014	33+345.848	17.83			-	200	-	
91	33+402.809	33+438.037	35.23			80	-	-	
92	33+534.745	33+541.906	07.16			80	-	-	
93	33+591.525	33+692.969	101.44			-	-	60	
94	33+697.924	33+739.892	41.97			-	-	60	
95	33+765.202	33+770.075	04.87			90	-	-	
96	33+973.473	34+022.179	48.71			80	-	-	
97	34+094.328	34+111.969	17.64			-	-	60	
98	34+353.463	34+374.884	21.42			-	150	-	
99	34+691.698	34+742.109	50.41			-	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: Extra Widening For Curves

NAME OF ROAD: NH-713 - JORAM - KOLORIANG

DAY/DATE:

SURVEYOR:

DISTRICT: LOWER SUBANSIRI, KRA DAADI, KURUNG KUMEY

Sl. No.	Location		Length of Curve	Inner Edge of Curve		Radius			Turn (Left/ Right)
	From	To		Length of Chord	Versine				
	(km)	(km)	(m)	(m)	(m)	(m)	(m)	(m)	
100	34+897.464	34+963.982	66.52			-	-	60	
101	35+048.656	35+202.844	154.19			-	-	60	
102	35+265.060	35+316.404	51.34			-	-	60	
103	35+431.775	35+471.072	39.30			-	-	60	
104	35+558.111	35+614.175	56.06			-	-	60	
105	35+783.272	35+914.664	131.39			-	-	47	
106	36+245.885	36+301.078	55.19			80	-	-	
107	36+571.682	36+637.256	65.57			-	-	60	
108	36+656.817	36+758.222	101.40			-	-	60	
109	36+804.400	36+818.908	14.51			-	-	60	
110	36+935.807	37+000.802	65.00			-	-	60	
111	37+046.572	37+133.773	87.20			-	-	60	
112	37+217.224	37+283.619	66.39			-	-	45	
113	37+574.006	37+650.061	76.06			80	-	-	
114	37+721.459	37+729.963	08.50			-	120	-	
115	37+766.839	37+812.890	46.05			-	-	60	
116	37+934.804	37+998.625	63.82			-	-	60	
117	38+077.392	38+156.811	79.42			-	-	60	
118	38+162.511	38+227.459	64.95			-	-	60	
119	38+330.485	38+340.194	09.71			-	-	60	
120	38+406.227	38+426.978	20.75			-	-	60	
121	38+553.749	38+558.240	04.49			-	-	60	
122	38+602.368	38+608.828	06.46			-	-	60	
123	38+668.347	38+718.041	49.69			-	-	60	
124	38+731.260	38+792.792	61.53			-	-	60	
125	38+866.147	38+899.422	33.28			-	-	60	
126	38+944.851	38+968.692	23.84			-	-	60	
127	39+037.009	39+184.090	147.08			-	-	60	
128	39+205.028	39+266.406	61.38			-	-	60	
129	39+318.924	39+338.346	19.42			-	-	60	
130	39+425.147	39+438.451	13.30			-	-	60	
131	39+485.281	39+645.966	160.68			-	-	60	
132	39+686.095	39+733.252	47.16			-	-	60	
133	39+827.325	39+837.045	09.72			-	-	60	
134	39+932.717	39+962.504	29.79			-	-	60	
135	40+060.143	40+140.477	80.33			-	-	60	
136	40+312.614	40+330.018	17.40			-	-	60	
137	40+418.348	40+459.051	40.70			-	-	60	
138	40+593.928	40+598.434	04.51			-	-	60	
139	40+682.291	40+699.197	16.91			-	-	60	
140	40+763.129	40+776.636	13.51			-	-	60	
141	40+829.714	40+831.799	02.08			-	-	60	
142	40+912.144	40+973.748	61.60			-	-	60	
143	41+046.789	41+102.101	55.31			-	-	60	
144	41+207.805	41+227.758	19.95			-	-	60	
145	41+245.537	41+327.436	81.90			90	-	-	
146	41+354.560	41+384.168	29.61			-	-	60	
147	41+577.227	41+586.164	08.94			-	120	-	
148	41+631.448	41+653.506	22.06			-	-	60	
149	41+695.528	41+778.213	82.69			-	-	60	

ROAD INVENTORY: Extra Widening For Curves

NAME OF ROAD: NH-713 - JORAM - KOLORIANG

DAY/DATE:

SURVEYOR:

DISTRICT: LOWER SUBANSIRI, KRA DAADI, KURUNG KUMEY

Sl. No.	Location		Length of Curve	Inner Edge of Curve		Radius			Turn (Left/ Right)
	From	To		Length of Chord	Versine				
	(km)	(km)	(m)	(m)	(m)	(m)	(m)	(m)	
150	41+865.679	41+932.430	66.75			-	-	60	
151	41+997.108	42+020.458	23.35			-	-	40	
152	42+368.990	42+468.942	99.95			-	-	60	
153	42+528.508	42+637.849	109.34			-	-	60	
154	42+718.057	42+756.507	38.45			-	-	60	
155	42+858.864	42+870.637	11.77			90	-	-	
156	42+918.354	42+926.417	08.06			-	-	60	
157	42+981.684	42+985.785	04.10			80	-	-	
158	43+137.964	43+154.135	16.17			-	250	-	
159	43+278.353	43+311.484	33.13			90	-	-	
160	43+393.308	43+408.617	15.31			-	-	60	
161	43+506.249	43+554.303	48.05			-	-	60	
162	43+616.628	43+781.770	165.14			-	110	-	
163	43+929.644	43+964.166	34.52			-	-	60	
164	44+051.935	44+073.767	21.83			-	120	-	
165	44+416.098	44+418.401	02.30			80	-	-	
166	44+494.462	44+496.453	01.99			-	-	60	
167	44+627.873	44+700.472	72.60			-	300	-	
168	44+865.704	44+922.997	57.29			-	150	-	
169	45+054.176	45+061.945	07.77			-	-	60	
170	45+116.610	45+388.887	272.28			97	-	-	
171	45+600.351	45+744.950	144.60			70	-	-	
172	45+803.918	45+820.887	16.97			90	-	-	
173	45+945.545	45+957.870	12.33			-	-	60	
174	46+038.854	46+261.710	222.86			-	-	60	
175	46+333.750	46+365.868	32.12			-	-	60	
176	46+439.359	46+512.559	73.20			-	150	-	
177	46+583.952	46+620.103	36.15			-	150	-	
178	46+762.252	46+845.550	83.30			-	-	60	
179	46+992.731	47+034.304	41.57			-	-	60	
180	47+195.257	47+216.697	21.44			-	-	60	
181	47+319.166	47+362.793	43.63			-	150	-	
182	47+440.372	47+481.175	40.80			-	-	60	
183	47+588.173	47+602.319	14.15			-	300	-	
184	47+707.991	47+860.556	152.56			-	-	52	
185	47+969.991	48+043.245	73.25			-	-	60	
186	48+152.301	48+190.465	38.16			-	150	-	
187	48+292.963	48+330.984	38.02			-	-	60	
188	48+404.716	48+426.534	21.82			-	-	60	
189	48+493.047	48+499.370	06.32			-	-	40	
190	48+646.294	48+655.202	08.91			-	150	-	
191	48+845.362	48+858.560	13.20			-	-	60	
192	48+920.674	48+982.233	61.56			-	-	60	
193	49+058.405	49+214.279	155.87			-	-	60	
194	49+264.489	49+297.811	33.32			-	-	60	
195	49+479.784	49+508.122	28.34			-	200	-	
196	49+611.920	49+613.019	01.10			70	-	-	
197	49+726.742	49+730.563	03.82			75	-	-	
198	49+951.298	49+970.980	19.68			-	-	40	
199	50+012.938	50+018.722	05.78			-	-	60	

ROAD INVENTORY: Extra Widening For Curves

NAME OF ROAD: NH-713 - JORAM - KOLORIANG

DAY/DATE:

SURVEYOR:

DISTRICT: LOWER SUBANSIRI, KRA DAADI, KURUNG KUMEY

Sl. No.	Location		Length of Curve	Inner Edge of Curve		Radius			Turn (Left/ Right)
	From	To		Length of Chord	Versine				
	(km)	(km)	(m)	(m)	(m)	(m)	(m)	(m)	
200	50+090.384	50+107.606	17.22			-	-	60	
201	50+167.691	50+257.177	89.49			-	-	60	
202	50+355.729	50+408.361	52.63			-	-	60	
203	50+475.076	50+503.111	28.03			-	-	60	
204	50+588.928	50+730.554	141.63			-	-	60	
205	50+844.870	50+861.598	16.73			-	-	60	
206	50+933.471	50+960.881	27.41			-	-	60	
207	51+055.293	51+178.211	122.92			-	-	60	
208	51+236.079	51+240.196	04.12			90	-	-	
209	51+318.890	51+353.597	34.71			90	-	-	
210	51+426.875	51+449.333	22.46			-	-	60	
211	51+581.921	51+608.274	26.35			-	-	60	
212	51+659.131	51+700.996	41.86			-	-	60	
213	51+776.737	51+798.148	21.41			-	-	60	
214	51+855.048	51+892.041	36.99			-	-	60	
215	51+962.566	51+972.589	10.02			90	-	-	
216	52+070.918	52+073.296	02.38			-	-	60	
217	52+155.528	52+158.609	03.08			-	-	60	
218	52+286.155	52+292.783	06.63			90	-	-	
219	52+336.215	52+351.699	15.48			-	-	60	
220	52+383.617	52+419.043	35.43			-	-	60	
221	52+477.663	52+483.116	05.45			90	-	-	
222	52+558.930	52+582.359	23.43			-	-	60	
223	52+646.647	52+662.344	15.70			-	-	60	
224	52+732.641	52+743.225	10.58			-	-	60	
225	52+807.137	52+850.579	43.44			90	-	-	
226	53+089.239	53+101.634	12.39			-	-	60	
227	53+283.432	53+396.166	112.73			-	110	-	
228	53+480.514	53+512.802	32.29			-	-	60	
229	53+625.359	53+641.155	15.80			-	-	60	
230	53+748.282	53+868.088	119.81			90	-	-	
231	54+042.876	54+049.363	06.49			-	150	-	
232	54+294.758	54+325.996	31.24			-	120	-	
233	54+404.778	54+449.960	45.18			-	-	60	
234	54+481.691	54+498.586	16.90			70	-	-	
235	54+584.061	54+628.058	44.00			-	-	60	
236	54+718.454	54+780.872	62.42			-	-	60	
237	54+874.078	54+885.037	10.96			-	-	60	
238	54+929.833	54+949.569	19.74			90	-	-	
239	54+993.152	55+041.864	48.71			-	-	60	
240	55+075.223	55+152.896	77.67			-	-	60	
241	55+242.454	55+301.515	59.06			-	-	60	
242	55+479.230	55+497.833	18.60			-	-	60	
243	55+566.486	55+598.650	32.16			-	250	-	
244	55+634.142	55+696.470	62.33			-	250	-	
245	55+759.982	55+789.503	29.52			-	-	60	
246	55+995.608	55+997.804	02.20			80	-	-	
247	56+078.264	56+140.683	62.42			-	-	60	
248	56+218.857	56+297.862	79.00			-	-	50	
249	56+545.377	56+634.775	89.40			-	-	49	

ROAD INVENTORY: Extra Widening For Curves

NAME OF ROAD: NH-713 - JORAM - KOLORIANG

DAY/DATE:

SURVEYOR:

DISTRICT: LOWER SUBANSIRI, KRA DAADI, KURUNG KUMEY

Sl. No.	Location		Length of Curve	Inner Edge of Curve		Radius			Turn (Left/ Right)
	From	To		Length of Chord	Versine				
	(km)	(km)	(m)	(m)	(m)	(m)	(m)	(m)	
250	56+872.316	56+975.984	103.67			70	-	-	
251	57+366.656	57+399.879	33.22			-	-	60	
252	57+856.278	57+884.964	28.69			-	-	40	
253	57+981.144	58+070.569	89.43			70	-	-	
254	58+130.081	58+148.896	18.82			-	-	60	
255	58+210.963	58+221.769	10.81			-	120	-	
256	58+279.262	58+305.610	26.35			70	-	-	
257	58+595.493	58+621.347	25.85			-	-	60	
km 138.000-154.000									
258	138+020.195	138+034.986	14.79			-	-	60	
259	138+126.065	138+163.706	37.64			-	-	60	
260	138+254.693	138+279.680	24.99			-	150	-	
261	138+451.636	138+481.587	29.95			-	-	60	
262	138+596.789	138+609.150	12.36			100	-	-	
263	138+708.464	138+748.462	40.00			-	-	60	
264	138+829.641	138+894.983	65.34			-	-	60	
265	138+957.407	138+992.053	34.65			-	-	40	
266	139+209.046	139+219.875	10.83			-	300	-	
267	139+327.934	139+370.009	42.07			-	250	-	
268	139+484.383	139+533.162	48.78			-	250	-	
269	139+659.123	139+685.426	26.30			-	250	-	
270	139+817.276	139+867.796	50.52			-	-	60	
271	139+953.995	139+967.054	13.06			80	-	-	
272	140+175.767	140+221.612	45.85			-	-	40	
273	140+327.663	140+355.873	28.21			-	200	-	
274	140+509.579	140+549.913	40.33			-	-	60	
275	140+637.245	140+686.938	49.69			-	250	-	
276	141+002.912	141+024.734	21.82			-	250	-	
277	141+105.713	141+118.252	12.54			-	-	60	
278	141+229.713	141+240.254	10.54			-	150	-	
279	141+340.959	141+388.702	47.74			-	-	60	
280	141+473.531	141+514.553	41.02			-	-	60	
281	141+773.635	141+800.936	27.30			-	200	-	
282	141+861.954	141+888.646	26.69			80	-	-	
283	142+156.723	142+217.551	60.83			-	250	-	
284	142+310.279	142+340.412	30.13			-	150	-	
285	142+504.672	142+572.828	68.16			-	120	-	
286	142+672.427	142+748.212	75.79			-	-	60	
287	142+798.988	142+929.075	130.09			-	-	60	
288	142+983.788	143+065.603	81.82			-	-	60	
289	143+095.417	143+166.579	71.16			-	200	-	
290	143+325.739	143+346.325	20.59			-	250	-	
291	143+438.312	143+527.970	89.66			-	300	-	
292	144+197.338	144+418.557	221.22			-	300	-	
293	144+539.968	144+580.466	40.50			-	250	-	
294	144+712.038	144+744.648	32.61			-	150	-	
295	145+056.859	145+135.794	78.93			-	-	60	
296	145+235.440	145+257.738	22.30			90	-	-	
297	145+349.606	145+389.309	39.70			-	-	60	
298	145+467.866	145+605.235	137.37			90	-	-	

ROAD INVENTORY: Extra Widening For Curves

NAME OF ROAD: NH-713 - JORAM - KOLORIANG

DAY/DATE:

SURVEYOR:

DISTRICT: LOWER SUBANSIRI, KRA DAADI, KURUNG KUMEY

Sl. No.	Location		Length of Curve	Inner Edge of Curve		Radius			Turn (Left/ Right)
	From	To		Length of Chord	Versine				
	(km)	(km)	(m)	(m)	(m)	(m)	(m)	(m)	
299	145+656.347	145+715.392	59.04			-	-	60	
300	145+799.600	145+833.728	34.13			-	-	60	
301	145+899.444	145+906.740	07.30			-	120	-	
302	146+890.748	146+939.379	48.63			-	-	60	
303	147+170.621	147+187.801	17.18			-	200	-	
304	147+361.716	147+465.259	103.54			-	-	60	
305	147+649.573	147+789.314	139.74			-	-	60	
306	147+841.346	147+930.554	89.21			-	200	-	
307	148+008.761	148+065.674	56.91			90	-	-	
308	148+141.872	148+150.194	08.32			-	-	60	
309	148+227.461	148+256.853	29.39			-	150	-	
310	148+333.591	148+349.562	15.97			-	-	60	
311	148+407.344	148+418.295	10.95			-	120	-	
312	148+590.392	148+596.579	06.19			-	150	-	
313	148+744.248	148+754.003	09.76			-	-	60	
314	148+868.995	148+890.351	21.36			90	-	-	
315	149+065.496	149+071.198	05.70			-	-	60	
316	149+189.667	149+234.098	44.43			-	-	60	
317	149+310.931	149+413.500	102.57			-	-	60	
318	149+501.317	149+556.886	55.57			-	-	60	
319	149+643.043	149+680.717	37.67			-	-	60	
320	149+834.017	149+862.094	28.08			-	-	60	
321	150+032.296	150+081.529	49.23			-	300	-	
322	150+398.511	150+423.681	25.17			-	-	60	
323	150+499.143	150+556.825	57.68			-	-	60	
324	150+626.984	150+634.003	07.02			80	-	-	
325	150+685.255	150+712.991	27.74			-	-	40	
326	150+766.145	150+828.650	62.51			-	-	40	
327	150+900.268	150+916.455	16.19			-	120	-	
328	150+969.582	150+979.342	09.76			-	-	60	
329	151+026.608	151+049.796	23.19			-	-	50	
330	151+107.013	151+226.876	119.86			-	-	43	
331	151+228.063	151+262.101	34.04			-	-	60	
332	151+342.705	151+357.772	15.07			-	-	60	
333	151+533.453	151+561.714	28.26			-	-	60	
334	151+656.326	151+729.117	72.79			-	150	-	
335	151+832.955	151+909.706	76.75			-	-	60	
336	151+964.457	151+992.180	27.72			-	-	60	

VOYANTA SOLUTIONS PVT. LTD. GURGAON

ROAD INVENTORY: Extra Widening For Curves

NAME OF ROAD: NH-713 - JORAM - KOLORIANG

DAY/DATE:

SURVEYOR:

DISTRICT: LOWER SUBANSIRI, KRA DAADI, KURUNG KUMEY

Sl. No.	Location		Length of Curve	Inner Edge of Curve		Radius			Turn (Left/ Right)
	From	To		Length of Chord	Versine				
	(km)	(km)	(m)	(m)	(m)	(m)	(m)	(m)	
337	152+107.225	152+177.658	70.43			90	-	-	
338	152+285.211	152+361.607	76.40			-	-	50	
339	152+417.194	152+450.703	33.51			-	-	60	
340	152+533.850	152+607.245	73.39			-	150	-	
341	152+690.221	152+705.349	15.13			-	-	60	
342	152+782.914	152+887.980	105.07			-	-	48	
343	152+964.953	153+031.938	66.98			-	-	60	
344	153+087.909	153+168.660	80.75			-	-	60	
345	153+201.935	153+278.699	76.76			70	-	-	
346	153+348.403	153+379.192	30.79			-	250	-	
347	153+435.886	153+459.322	23.44			90	-	-	
348	153+622.316	153+648.131	25.82			-	-	60	
349	153+774.027	153+782.684	08.66			90	-	-	
350	153+854.831	153+884.543	29.71			-	150	-	
351	153+925.682	153+931.151	05.47			80	-	-	

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

Voyants Solutions Pvt.Ltd. (VSPL)

Signature of Surveyor

Sheet No :

Signature of Supervisor

VOYANTS SOLUTIONS PVT. LTD. GURGAON

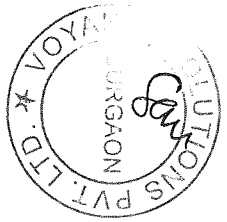
Annexure 5.1

Item	Description	Unit	No	Length (m)	Breadth (m)	Height (m)	Area (sqm)	Quantity	Rate	Amount
					Flexible Pavement					
1	GSB	cum	1	1000	13.88	0.2		2776	1479.00	4105704
2	WMM	cum	1	1000	10.5	0.25		2625	1861.00	4885125
3	DBM	cum	1	1000	10	0.08		800	12706.00	10164800
4	BC	cum	1	1000	10	0.04		400	11293.00	4517200
5	Tack coat	sqm	2	1000	10			20000	13.00	260000
6	Prime Coat	sqm	1	1000	10			10000	34.00	340000
										24272829
					Rigid Pavement					
1	GSB	cum	1	1000	13.9	0.15		2085	1479.00	3083715
2	DLC	cum	1	1000	10	0.15		1500	4716.00	7074000
3	PQC	cum	1	1000	10	0.28		2800	9021.00	25258800
										35416515

Routine Maintenance		
Flexible pavement		
	100000	
Rigid Pavement		
	50000	
Depriciation Value	5%	

Periodic Maintanence			
Flexible Pavement			
Tackcoat	130000		
25mm BC	2823250		
Total	***2953250***		
Rigid pavement	**0**		

Rehabilitation Cost			
Flexible Pavement			
Tackcoat	52000		
40mm BC	4517200		
Total	***4569200***		
Rigid pavement			
100mm PQC	***9021000***		
Civil cost Rigid/Civilcost Flexible =			1.459



Flexible Pavement			
Year	Maintanance Cost	Maintenance Worth Factor	Maintenance Present Worth
0	0	1	0
1	100000	0.8929	89286
2	105000	0.7972	83705
3	110250	0.7118	78474
4	115762.5	0.6355	73569
5	3769179	0.5674	2138733
6	127339	0.5066	64514
7	133706	0.4523	60482
8	140391	0.4039	56702
9	147411	0.3606	53158
10	4810533	0.3220	1548863
11	162152	0.2875	46615
12	170259	0.2567	43701
13	178772	0.2292	40970
14	187711	0.2046	38409
15	6139595	0.1827	1121681
16	206482	0.1631	33682
17	216806	0.1456	31577
18	227646	0.1300	29603
19	239028	0.1161	27753
20	12123448	0.1037	1256799
21	262931	0.0926	24337
22	276078	0.0826	22816
23	289882	0.0738	21390
24	304376	0.0659	20053
25	10000753	0.0588	588277
26	334813	0.0525	17585
27	351554	0.0469	16486
28	369132	0.0419	15455
29	387588	0.0374	14489
30	12763776	0.0334	426028
			80,85,190
		Total	***32358019***

Rigid Pavement			
Year	Maintanance Cost	Maintenance Worth Factor	Maintenance Present Worth
0	0	1.0000	0
1	50000	0.8929	44642.85714
2	52500	0.7972	41852.67857
3	55125	0.7118	39236.88616
4	57881	0.6355	36784.58078
5	60775	0.5674	34485.54448
6	63814	0.5066	32330.19795
7	67005	0.4523	30309.56058
8	70355	0.4039	28415.21304
9	73873	0.3606	26639.26222
10	77566	0.3220	24974.30834
11	81445	0.2875	23413.41406
12	85517	0.2567	21950.07569
13	89793	0.2292	20578.19596
14	94282	0.2046	19292.05871
15	98997	0.1827	18086.30504
16	103946	0.1631	16955.91097
17	109144	0.1456	15896.16654
18	114601	0.1300	14902.65613
19	120331	0.1161	13971.24012
20	126348	0.1037	13098.03761
21	132665	0.0926	12279.41026
22	139298	0.0826	11511.94712
23	146263	0.0738	10792.45043
24	153576	0.0659	10117.92227
25	161255	0.0588	9485.552133
26	169318	0.0525	8892.705124
27	177784	0.0469	8336.911054
28	186673	0.0419	7815.854113
29	196006	0.0374	7327.363231
30	38988242	0.0334	1301346.579
			19,05,722
		Total	***37322237***
		Rigid/Flexible =	1.153