BUILDING INFRASTRUCTURE - BUILDING THE NATION

National Highways and Infrastructure Development Corporation Ltd.

Construction to 2-Lane with Paved Shoulder of Tura Bypass starting from existing Km 57+500 of NH-127B (design chainage Km 0+000) and ending at existing Km 108+750 of NH-217 (Design chainage Km 29+030) (Length =29.030) on HAM Mode in the state of Meghalaya.

VOLUME-1
MAIN REPORT

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MAIN REPORT

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1. Introduction

The Ministry of Road Transport & Highways (MORTH), Government of India has taken up various programmes of up-gradation and development of National Highways. The National Highways of India are owned by the Ministry of Road Transport and Highways. These networks of roads are constructed and managed by various Departments like the National Highways Authority of India (NHAI), the National Highways & Infrastructure Development Corporation (NHIDCL), the Public Works Departments (PWDs) of the state Governments etc.

The National Highways and Infrastructure Development Corporation Limited (NHIDCL), Government of Meghalaya has been entrusted with the assignment of preparation of Detailed Project Report for “Construction of 2-lane with paved shoulder Tura Bypass from Km 0+000 to Km 29+030 (Length = 29.030) of NH-127B and NH-217 on HAM Mode in the state of Meghalaya.

The Construction of 2-Lane Tura Bypass between “Existing km 57+500 (NH-127 B) in Sanchonggre village **(which is 4.60 km from Goeragre {km 85.800 of NH-217(Old NH-51)})** and ends at existing km 108+750 in Jenggitchakgre Village. This NH-217 (old NH-51) is the only route which connects Guwahati to Dalu (Bangladesh International Border) via Tura and is of great importance from defence point of view.

The Project Road section from km 57+500 (NH-127 B) to km 108+750 NH-217 (Old NH-51) which passes through Dense built-up of Tura Town, which is situated in the West Garo Hills district of the Indian state of Meghalaya, one of the largest towns in Meghalaya for which a bypass of length 29.030 Kms has to be proposed.

1.1. Project overview

The Design project road section starts from NH-127 B existing Km 57+500 of (Sanchonggre village) and ends at NH-217 Km 108+750 (Jenggitchakgre Village). The road passes through **West Garo Hills and South West Garo hills** district of the Indian state of Meghalaya.

After Approval from the Competent Authority for alignment of the Tura Bypass which will bypass the existing stretch of Km 57+500 (NH-127 B) to Km 108+750 of NH-217 (Old NH-51), this section of NH-217 (Old NH-51) is heavily dense built up of Tura town.

The proposed Tura bypass will start from km 57+500 of the alignment of NH-127B and terminating at existing Km 108+750 of NH-217 (Old NH-51). Thus, the length of alignment works out to be 29.030 km.

Sl. No.	Particular	Design detail
1	Terrain	Mountainous and Steep terrain.
2.	Project Length	29.030 Km
3.	Carriageway Configuration	2 lane with paved shoulder
4.	Type of Pavement	Flexible Pavement
5.	Major Bridges	3
6.	Minor Bridges	4
7.	Culverts	56
8.	Major Junctions	3
9	Minor Junction	-
10	ROB/RUB	NIL
11	VUP/VOP	1

***** Key features of project**

Table 1: Key features of project

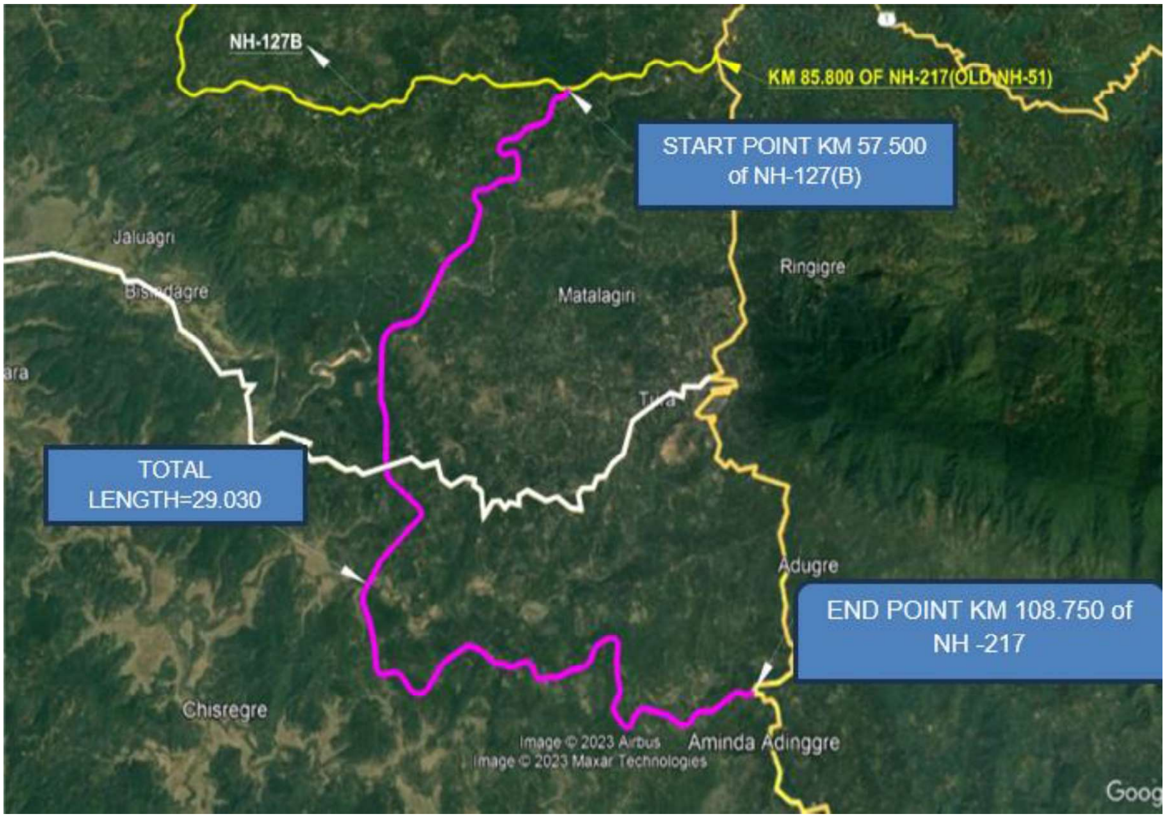
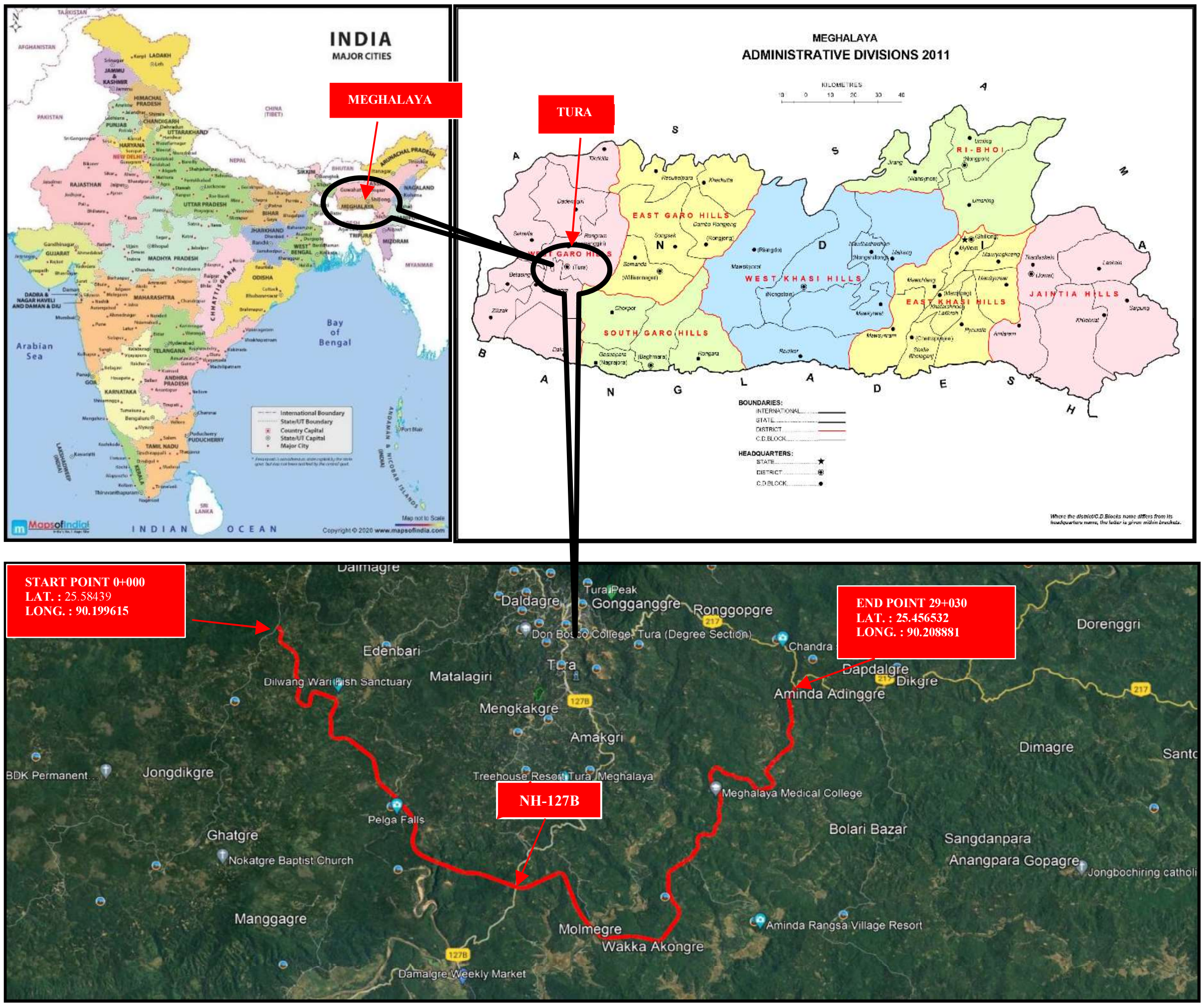


Figure 1: Location of project road

Description of Point	Easting	Northing	Remarks
UTM ZONE 46R			
START POINT	218694.39	2832622.58	**25.58439 , 90.199615**
END POINT	219328.18	2818440.53	**25.456532 , 90.208881**

1.2. Key plan of existing project stretch



Details of Road

Sl. No.	Category of Road	Section	Proposed Tura Bypass Design Length (Km)
1	NH-127B and NH-217	From Km 57+500 (NH-127 B) to Km 108+750 (NH-217) in the state of Meghalaya	29.030

2. Traffic demands on project road

2.1. Traffic volume surveys

Traffic surveys have been carried out on the project corridor in order to identify present and likely future scenarios to device suitable remedial measures and to evolve appropriate design method. The primary objectives of these traffic surveys are to determine the characteristics of traffic movement on the project corridor, determine the travel pattern a well as type and weight of commodity carried by trucks, determine the spectrum of axle loads and vehicle damage factors for different types of commercial vehicles, determine the turning movement pattern of traffic at road intersections and determine traffic bottlenecks.

2.2. Survey Methodology

All these traffic surveys have been carried out in accordance with the guidelines specified by IRC: 9-1972 and IRC: 102-1988. The methodology adopted for the traffic study is detailed below.

- The project road corridor is divided into traffic homogeneous sections based on change in traffic flow pattern.
- The traffic surveys including classified traffic volume count is carried out for each traffic homogeneous section.
- Origin Destination survey and axle load survey is carried out along the complete project road corridor to identify the major OD pairs, commodity pattern and lead load characteristics along the project road.
- 24 hour turning Moment survey is carried out at all major crossings and as per the critical locations identified and discussed with the client.

Based on the homogenous sections proposed above, traffic survey has been performed at the following location as mentioned in **Table 2.1**

Table 2.1: The traffic surveys conducted for this project includes

Sl. No	Type of Survey	Duration	Location	Period	
				From	To
1	Classified Volume Count	7 Days	Km. 85+000 of NH-217	04-10-2021	11-10-2021
2	Classified Volume Count	7 Days	Km. 12+250 of SH-02	06-10-2021	13-10-2021
3	Axle Load Survey	1 Day	Km. 85+000 of NH-217	06-10-2021	07-10-2021
4	Axle Load Survey	1 Day	Km. 12+250 of SH-02	08-10-2021	09-10-2021
5	Origin-Destination (O-D) Survey	1 Day	Km. 85+000 of NH-217	06-10-2021	07-10-2021
6	Origin-Destination (O-D) Survey	1 Day	Km. 12+250 of SH-02	08-10-2021	09-10-2021
7	Turning Movement Survey (TMC)	1 Day	Km. 85+000 of NH-217	07-10-2021	08-10-2021
8	Turning Movement Survey (TMC)	1 Day	Km. 12+250 of SH-02	07-10-2021	08-10-2021

Table 2.2. Count ADT at traffic count survey locations

Sl. No.	Vehicle Type	ADT (In Nos.) AT Km. 85+000	ADT (In Nos.) AT Km. 12+250
	Tollable Vehicle		
1	Car	3121	1558
2	Mini LCV	372	359
3	Mini-Bus	38	109
4	Bus	94	31
5	LCV-4	43	97
6	LCV-6	16	47
7	2 Axle	52	44
8	3 Axle	24	38
9	4-6 Axle	8	4
10	Others (specify)	5	4
	Non- Tollable Traffic		
11	2W	2592	1342

Sl. No.	Vehicle Type	ADT (In Nos.) AT Km. 85+000	ADT (In Nos.) AT Km. 12+250
12	3W	427	215
13	Tractor with Trailer	0	3
14	Tractor without Trailer	0	0
15	Cycle	0	0
16	Cycle Rickshaw	0	0
17	Hand Cart	0	0
18	Animal Drawn	0	0
Total Tollable		3773	2291
Total Non - Tollable		3019	1560
All Total		**6792**	**3851**

Table 2.3: Results of traffic surveys conducted

Traffic composition along the Project	
Car/Van/ Jeep	45.96%
Two-Wheeler	38.17%
Auto (3-Wheeler)	6.28%
Bus	1.39%
Mini Bus	0.55%
2 - Axle Truck	0.76%
3 - Axle Truck	0.35%
MAV	0.11%
HCM/ EME	0.00%
Mini LCV	5.48%
LCV-4	0.63%
LCV-6	0.24%
Tractor with Trailer	0.00%
Army Truck	0.00%

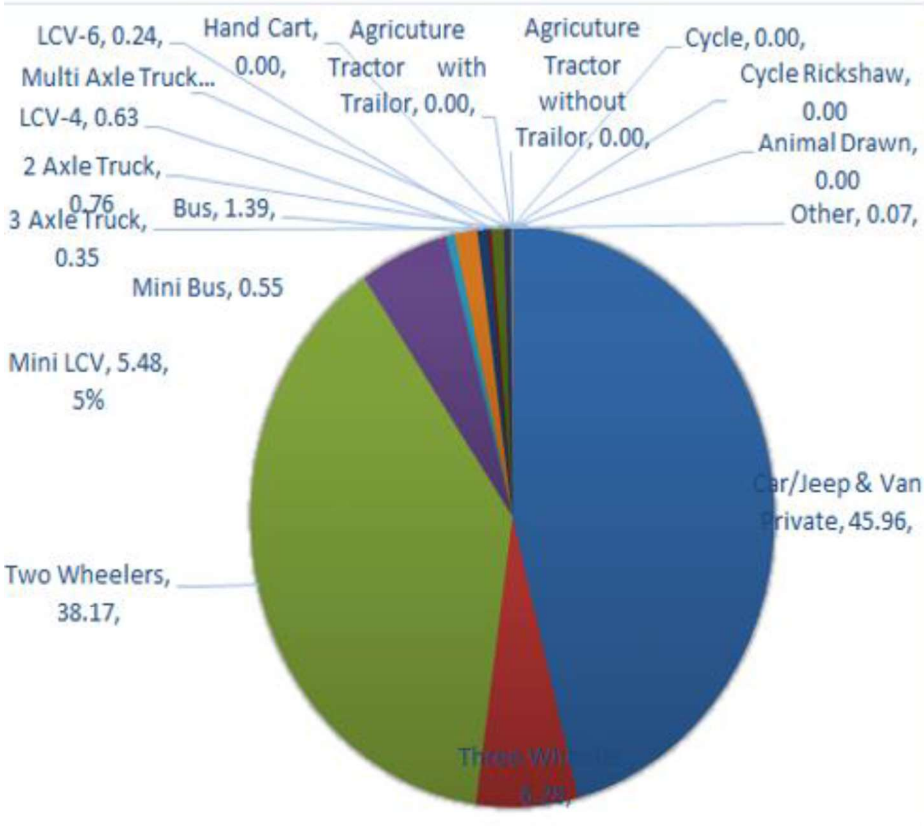


Fig 3: Results of traffic surveys conducted

2.3. Axle load survey

The O-D survey data has been analyzed to obtain lead and ranges for various vehicle types. Different categories of vehicles viz. Car/Jeep, Taxi, Bus, Mini Bus, LCVs, 2 axle, 3 axle and 4-6 axle trucks are distributed on the basis of trip lengths or lead ranges. The trip length frequency distribution in terms of proportion in each range is presented in Table2.4

Vehicle Type	Load Range in Tonnes							
	0.1-2.5	**2.6-5.0**	**5.1-10.0**	**10.1-20.0**	**20.1-30.0**	**30.1-40.0**	**>40.00**	**Average Load (Tonnes)**
LCV	100%	0%	0%	0%	0%	0%	0%	0.31
2 Axle	97%	0%	1%	2%	0%	0%	0%	0.71
3 Axle	76%	0%	3%	21%	0%	0%	0%	6.97
4-6Axle	79%	0%	0%	21%	0%	0%	0%	7.21
> 6 Axle	0%	0%	0%	0%	0%	0%	0%	0.00

Table 2.4.: Axle load survey results

2.4. Traffic volume forecast

Traffic volume forecast was developed and converted to Million Standard Axles (MSA) for the purposes of pavement design. The cumulative load in MSA for each section is given as under for various horizon years:

Based on the vehicle damage factors and the projected traffic volumes, the traffic loading in terms of cumulative number of equivalent 8.16 t standard axle loads have been computed for the 20 years' design period and shown in the following table.

Design MSA at Km. 12+250

$$N = \frac{365 \times [(1+r)^n - 1]}{r} \times A \times D \times F$$

Where,

N cumulative number of standard axles to be catered for in the design in terms of MSA.
A Initial Traffic in The Year of completion of construction in terms of the number of commercial Vehicles per day (CVPD)
D Lane Distribution factor
F Vehicle damage factor (VDF)
n Design life in years.
r Annual growth rate of commercial vehicles in decimal (r=0.05).

The traffic in the Year of Completion is estimated using the formula:

$A = P(1+r)^x$

P = Number of Commercial Vehicles as per last count.

x = Number of years between the last count and the year of completion of construction.

Commercial vehicle per day to Used Project Road =

Bus = 94
LCV-4 = 43
LCV-6 = 16
2-Axle = 52
3-Axle = 24
4-6 Axle = 8

Construction Period = 2.0 years

A=P*(1+0.05)^n
A=237*(1+0.05)^2
A=262

Design life= 20 years
A=CVPD =262
D=Lane Distribution Factor = 0.50
VDF = 1.7

$$N = \frac{365 \times [(1+0.05)^{20} - 1]}{0.05} \times 262 \times 0.5 * 1.7$$

= 2.68 Msa

Design MSA at Km. 85+000

$$N = \frac{365 \times [(1+r)^n - 1]}{r} \times A \times D \times F$$

Where,

N cumulative number of standard axles to be catered for in the design in terms of MSA.
A Initial Traffic in The Year of completion of construction in terms of the number of commercial Vehicles per day (CVPD)
D Lane Distribution factor
F Vehicle damage factor (VDF)
n Design life in years.
r Annual growth rate of commercial vehicles in decimal (r=0.05).

The traffic in the Year of Completion is estimated using the formula:

$A = P(1+r)^x$

P = Number of Commercial Vehicles as per last count.

x = Number of years between the last count and the year of completion of construction.

Commercial vehicle per day to Used Project Road =

Bus = 31
LCV-4 = 97
LCV-6 = 47
2-Axle = 44
3-Axle = 38
4-6 Axle = 4

Construction Period = 2.0 years

A=P*(1+0.05)^n
A=261*(1+0.05)^2
A=288

Design life= 20 years
A= CVPD=288
D=Lane Distribution Factor = 0.50
VDF = 1.7

$$N = \frac{365 \times [(1+0.05)^{20} - 1]}{0.05} \times 288 \times 0.5 * 1.7$$

= 2.9 Msa

DESIGN TRAFFIC (MSA)

Table: Design Traffic (in MSA) for 10 years

Location	Design Traffic as per Investigation	
	Design Traffic (msa) – 10Year	Maximum Traffic (msa) (10 years)
Km.85+000	2.9 MSA	2.9 MSA
Km.12+250	2.68 MSA	

Table: Design Traffic (in MSA) for 20 years

Location	Design Traffic as per Investigation		
	Design Traffic (msa) – 20Year	Maximum Traffic (msa) (20 years)	Adopted * (20 Years)
Km.85+000	2.9 MSA	2.9 MSA	**30 MSA**
Km.12+250	2.68 MSA		

*As per Clause 5.4.1 of IRC: SP:73:2018 Flexible Pavement shall be designed for a minimum design period of 15 years subject to the condition that design traffic shall not be less than 20 MSA.

2.5. Pavement Composition

Pavement Design	Effective Subgrade CBR for Design (%)	Thickness (mm) as per IRC:37-2018 Designation of the Pavement Layer			Remarks
		Bituminous Concrete (BC) as wearing course (VG-40)	WMM Layer Grading IV of Table 400-1	CTSB Layer	
BC+WMM+ CTSB	8.0	50	150	200	-

3. Improvement Proposal

3.1. Proposed Alignment

The Design project road section starts from NH-127 B existing Km 57+500 of (Sanchonggre village) and ends at NH-217 Km 108+750 (Jenggitchakgre Village). The road passes through **West Garo Hills and South West Garo hills** district of the Indian state of Meghalaya.

After Approval from the Competent Authority for alignment of the Tura Bypass which will bypass the existing stretch of Km 57+500 (NH-127 B) to Km 108+750 of NH-217 (Old NH-51), this section of NH-217 (Old NH-51) is heavily dense built up of Tura town.

The proposed Tura bypass will start from km 57+500 of the alignment of NH-127B and terminating at existing Km 108+750 of NH-217 (Old NH-51). Thus, the length of alignment works out to be 29.030 km.

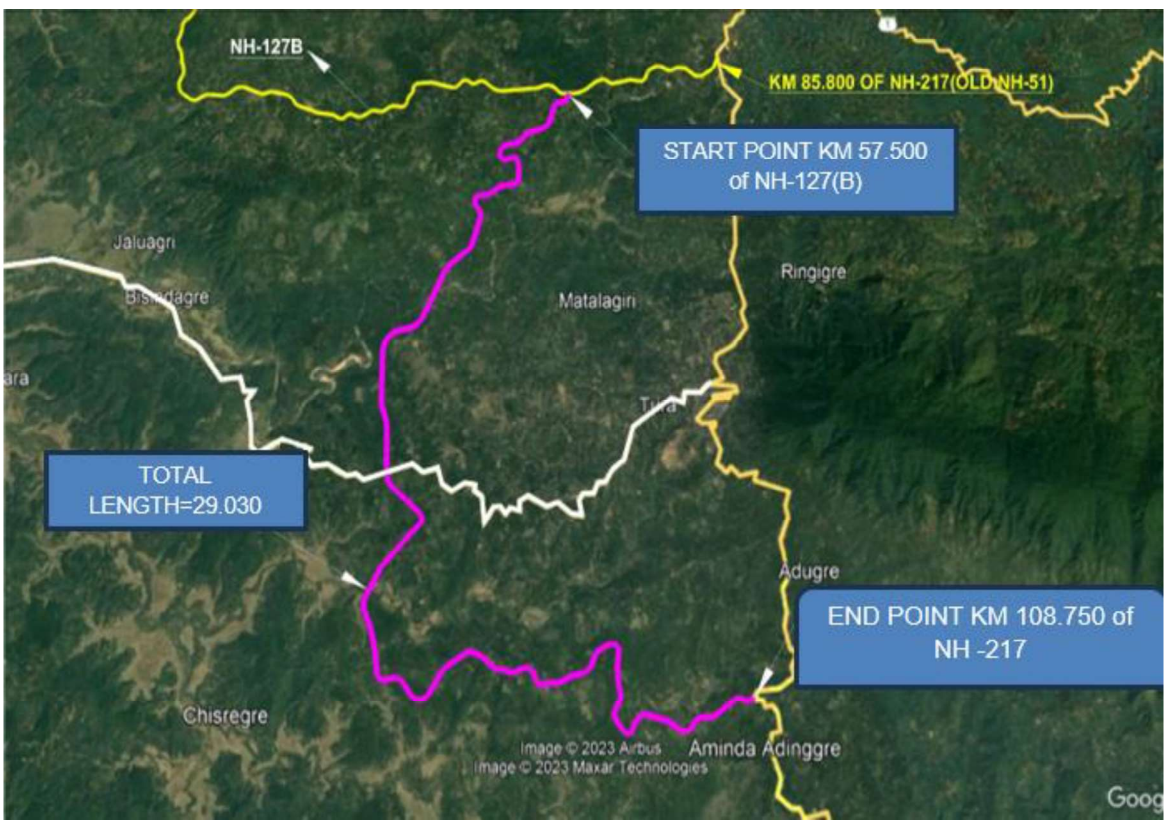


Figure 3: Location of project road

3.2. Road Parameters:

"The Manual of Standards and Specifications for "Two Laning of Highways with Paved Shoulder published by Indian Roads Congress IRC: SP: 73-2018" has been taken as the base document for design standards for the Project Highway

S. No	Parameters	Detail
1	Geometric design standards	IRC codes, guidelines and special publications. IRC:SP 73-2018 "Two-laning of Highways through Public Private Partnership" Manual of specifications and standards published by Planning Commission and orders issued by NHAI from time to time
2	Design Speed (km/hr)	60km/hr
3	Roadway Elements	Carriageway: 7.0 m
		Paved shoulders: 2 x 1.5 m
		Earthen shoulders:2 x 1.0 m
4	Service Road Width	5.50m
5	Slip Road Width	Not Required
6	Embankment Slope	In filling- 1V: 2 H
		In cutting- 1V:1H
7	Camber	Carriageway/Paved Shoulders: 2.5 %,
		Unpaved/Earthen Shoulders: 3.0. %
8	Super-elevation	Maximum 7%
9	Minimum Radius for Horizontal Curves	Desirable Minimum 150m and Absolute minimum 75m for Mountainous and Steep Terrain
10	Gradient	7.0% Limiting gradient for Steep terrain
11	Design Flood Frequency	Bridges: 100 years, with anticipated risk of rarer flood of next higher frequency i.e., 100-year return period flood on the structure
12	Free board	1.1 m to 1.5 m depending upon discharge

3.3. Pavement Design

3.3.1. Design Period, Loading & Pavement Type

Using the projected traffic, VDF Values, Lane and directional distribution factors, the design traffic Loading used for the Project is 30 **MSA.**

Through Preliminary design and lifecycle comparison, the flexible-type of pavement was chosen for construction with a design life of 20 years as per IRC 37:2018 has been considered for design.

3.3.2. Design Sub-Grade Strength

Considering the soil investigation conducted in the Project Road area and the availability of suitable soil in the region, the following sub-grade strength has been assumed 10% for various sections of the highway. Further Sub Soil Investigation is under Process at site and final results will be considered accordingly

3.3.3. Pavement Composition for New/ Recons. Carriageway

The Proposed Pavement Composition for the new and reconstruction sections carriageway basis IRC 37:2018, for 8% CBR and 10 MSA Traffic is:

<table>
<tr><th rowspan="3">Pavement Design</th><th rowspan="3">Effective Subgrade CBR for Design (%)</th><th colspan="3">Thickness (mm) as per IRC:37-2018</th><th rowspan="2">Remarks</th></tr>
<tr><th colspan="3">Designation of the Pavement Layer</th></tr>
<tr><th>Bituminous Concrete (BC) as wearing course (VG-40)</th><th>WMM</th><th>CTSB Layer</th><th></th></tr>
<tr><td>BC+WMM+ CTSB</td><td>8.0</td><td>50</td><td>150</td><td>200</td><td>-</td></tr>
</table>

Table 9: Pavement Composition

3.4. Design of Structures

Along the Project stretch, a summary of the total number and Proposed additions is given in the table below

<table>
<tr><th>Sr No</th><th>Structure</th><th>Existing</th><th>Dismantle</th><th>Widen</th><th>Recons.</th><th>New Const.</th><th>Total</th></tr>
<tr><td>1</td><td>Major Bridge</td><td>-</td><td>-</td><td>-</td><td>-</td><td>2</td><td>2</td></tr>
<tr><td>2</td><td>Minor Bridge</td><td>-</td><td>-</td><td>-</td><td>-</td><td>6</td><td>6</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Flyover/Double Decker Elevated Road</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="6">-</td></tr>
<tr><td>4</td><td>Vehicle Overpass</td><td>-</td><td>-</td><td>-</td><td>-</td><td>1</td><td>1</td></tr>
<tr><td>5</td><td>Vehicle Underpass</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>6</td><td>Passenger Underpass</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>7</td><td>Culvert</td><td>-</td><td>-</td><td>-</td><td>-</td><td>55</td><td>55</td></tr>
</table>

Table 10: Proposed Improvement to Structures along Project Road.

3.5. Toll Plaza

Based on the traffic and turning movement surveys, as well as the layout of the project road, a toll plaza has been proposed at chainage **18+150** along the project alignment.

3.6. Wayside Amenities Proposed

Based on the Project Location, no wayside amenities proposed along the stretch.

4. Environmental Impact Assessment

4.1. Impact and Clearances needed

The proposed Tura bypass is 29.030 km long. As per MoEFCC notification dated 22 August 2013, "Projects to expand national highways upto 100 kilometers length and which involve additional right of way or land acquisition up to 40 meters on existing alignments and 60 meters on realignments or by passes, will no longer come under the purview of the Environmental Impact Assessment Notification, 2006." The length of proposed Tura bypass is 29.030 km and it is less than 100 kilometers in length. Hence as per MoEFCC notification dated 22 August 2013 (discussed above), the project highway does not attract Statutory Environmental Clearance.

4.2. Cost of Environmental Mitigation

The cost for tree cutting was developed based on the estimation of resources required to implement the mitigation measures proposed. Environmental mitigation cost for the Proposed Project is calculated as per actual.

5. Social Impact Assessment and Land Acquisition

5.1. Social Impact Assessment

The legal framework and principles adopted for addressing resettlement issues in the Project have been guided by the existing legislation and policies of the GoI and the state Governments of Meghalaya. Prior to the preparation of the Resettlement Plan (RP), a detailed analysis of the existing National and State policies has been undertaken, and an entitlement matrix prepared for the project. This RP is to be prepared based on the review and analysis of all applicable legal and policy frameworks of the National and State Governments

5.2. Land Acquisition Requirement

Newly proposed alignment for bypass of Tura - 30m Right of way is proposed. Most of alignment passes through Protected Forest (community forest) & Agriculture land and electric poles, telephone poles, temporary structures, tree and other utilities need to be shifted.

6. Utility Shifting & Clearances.

Utilities belonging to Public Works Department (Electrical Department) have been identified that fall within the Project Road ROW and will need to be shifted to enable road construction. Shifting Proposals have been submitted to Public Works Department and initial estimates have not been received from the concerned agencies. The process of site inspection, review and revision of the proposals for utilities shifting is in process.

6.1. Utilities Shifting Estimates

Table: Key utilities shifting requirements

S. No.	Description of Tower	No. of tower needed to be shifted	Agency	Shifting required	Estimated cost (INR cr)	Supervision Charges %	Current Status
1	HT Crossing		Public Works Department (Electrical Department)	Yes	5.27 Cr.	20%	Under Process
2	HT Post (Single Pole)						
3	HT Post (Double						
4	LT Post						
5	LT Crossing						
6	Transformer						

6.2. Total Cost of Utilities Shifting

The total cost of utilities shifting for all the utilities identified in the road ROW is estimated to 5.27 Cr. be with supervision charges of 0.16 Cr. being paid as supervision charges to the concerned agencies.

7. Project Cost Estimates

The cost estimates for the project have been carried out based on detailed design, bill of quantities, and the schedule of rates for Meghalaya/PWD of year 2019.

Project Name -	Construction to 2-Lane with Paved Shoulder of Tura Bypass starting from existing Km 57+500 of NH-127B (design chainage Km 0+000) and ending at existing Km 108+750 of NH-217 (Design chainage Km 29+030) (Length =29.030) on EPC Mode in the state of Meghalaya.				
BILL SUMMARY					
Based on Meghalaya PWD NH SOR 2018-19			***Length (Km)***		***29.030***
Sr. No.	**Description**	**Amount (in Rs.) Excl. GST**	**Amount (in Cr.) Excl. GST**	**Cost per Km. (Cr.)**	**% Cost w.r.t. Civil Cost**
i	**Bill NO:1 *SITE CLEARANCE AND DISMANTLING***	38,34,803.96	0.38	0.01	0.08%
ii	**Bill NO:2 *EARTHWORK***				
	Excavation	67,59,23,231.54	67.59	2.33	14.12%
	Embankment/ Filling	10,31,14,503.59	10.31	0.36	2.15%
	Subgrade	6,25,66,903.98	6.26	0.22	1.31%
	Granular shoulder	87,19,615.61	0.87	0.03	0.18%
iii	**Bill NO:3 *CTSB AND BASE COURSES***				
a	*CTSB*	22,09,84,891.75	22.10	0.76	4.62%
b	*WMM*	15,48,57,846.20	15.49	0.53	3.24%
iv	**Bill NO:4 *BITUMINOUS WORKS (Flexible pavement)***				
a	*Prime Coat*	47,90,045.27	0.48	0.02	0.10%
b	*Tack Coat*	1,27,64,342.37	1.28	0.04	0.27%
c	*Dense Bituminous Macadam*	16,35,14,485.76	16.35	0.56	3.42%
d	*Bituminous Concrete*	15,84,16,693.57	15.84	0.55	3.31%
v	**Bill NO:5 *BRIDGES & STRUCTURES***				
a	*Bill NO:5A Major Bridge*	41,48,21,712.76	41.48	1.43	8.67%
b	*Bill NO:5B Minor Bridge*	57,93,12,205.43	57.93	2.00	12.11%
c	*Bill NO:5C Vehicular Overpass*	1,44,95,906.51	1.45	0.05	0.30%
d	*Bill NO:5D RS Wall for Minor & Major Bridges*	2,12,91,165.58	2.13	0.07	0.44%
VI	***BILL NO:6 CULVERTS***				
a	*Bill NO:6 - i Box Culvert*	10,01,70,704.39	10.02	0.35	2.09%
b	*Bill NO:6 - ii Slab Culvert*	14,94,96,092.21	14.95	0.51	3.12%
vii	**Bill NO:7 *DRAINAGE***	12,46,40,218.03	12.46	0.43	2.60%
viii	**Bill NO:8 *TRAFFIC SIGNS, MARKINGS AND ROAD APPURTENCES***	10,53,06,899.39	10.53	0.36	2.20%
ix	**Bill NO:9 *BUS SHELTER/ JUNCTIONS***				
a	*Bus Shelter*	14,82,098.21	0.15	0.01	0.03%
b	*Junctions*	95,10,156.87	0.95	0.03	0.20%
X	**Bill NO:10 *PROTECTION WORK***				
1	***Retaining Wall (Incl. Retaining wall at Approach Location)***				
a	*RCC Retaining Wall (5840) Mtr*	57,29,39,410.68	57.29	1.97	11.97%
b	*RS Wall (5425) Mtr*	34,17,32,519.89	34.17	1.18	7.14%
2	***Breast Wall***				
c	*RRM Wall (20170) Mtr*	55,71,90,039.25	55.72	1.92	11.64%
3	***Slope Protection***				
d	*Anchor Bolts (8945.85 Nos.)*	12,98,40,066.90	12.98	0.45	2.71%
e	*Double Twisted Wire Mesh (9136.85 Sqm)*	27,41,055.00	0.27	0.01	0.06%
f	*Hydro Seeding (91241.84 Sqm)*	2,73,72,551.50	2.74	0.09	0.57%
g	*Perforated Pipes (9510 Rmt)*	9,79,956.00	0.10	0.00	0.02%

xi	**Bill NO:11 *Toll Plaza***	6,26,79,296.37	6.27	0.22	1.31%
1	**CIVIL COST excl. GST**	**4,78,54,89,418.61**	**478.55**	**16.48**	

a	***UTILITY SHIFTING***		
(i)	***ELECTRICAL***		
	Sub-Division Barenggapara (Lines at Dinasagre)	21,16,027.00	0.21
	Sub-Division Barenggapara (Lines at Balamagre & Marengre)	28,17,622.00	0.28
	Sub-Division Barenggapara (Lines at Adugre Songittal & Adugre Songgitcham)	49,59,442.00	0.50
	Sub-Division Asanang	11,65,180.00	0.12
	Sub-Division Tura West	32,31,800.00	0.32
(ii)	***WATER PIPELINE***		
	Garo-Hills & South west Garo Hills	3,83,95,300.00	3.84
2	***Cost of Utility Shifting***	**5,26,85,371.00**	**5.27**
3	**Estimated Civil Cost**	**4,83,81,74,789.61**	**483.82**

GENERAL ABSTRACT			
Project Name -	**Construction to 2-Lane with Paved Shoulder of Tura Bypass starting from existing Km 57+500 of NH-127B (design chainage Km 0+000) and ending at existing Km 108+750 of NH-217 (Design chainage Km 29+030) (Length =29.030) on EPC Mode in the state of Meghalaya.**		
Sr. No.	**Description**	**Amount (in Rs.) Excl. GST**	**Amount (in Cr.) Excl. GST**
1	**Civil Construction Cost**	**4,83,81,74,789.61**	**483.82**
a	Interest During Construction Period (3 Years)	27,25,00,000.00	27.25
b	Preoperative Expenses (1% of Civil Cost)	4,83,82,000.00	4.84
c	Financing, Legal Expenses 1.5% of Debt	4,49,00,000.00	4.49
2	**HAM Bid Cost**	**5,20,39,56,789.61**	**520.40**
3	GST CHARGES (18%) of (1+b+c)	88,76,62,222.00	88.77
4	Land Acquisition & RR Estimate for 103.902 Hectares) + 1% Administrative Charges	2,01,69,97,572.24	201.70
5	Tree Cutting Cost *(Considering 4000 rs. Lump Sump rate per Tree for all 8117)*	3,24,68,000.00	3.25
6	Contingency @ 1% of 1	4,83,81,747.90	4.84
7	Agency Charges @ (3% of 1) + GST @ 18%	17,12,71,387.92	17.13
8	Supervision Charge @ 3% of 1	14,51,45,243.69	14.52
9	Price Adjustment @ 10% of 1	48,38,17,478.96	48.38
10	O&M Charges	52,29,19,678.51	52.29
11	***TOTAL PROJECT COST (Including Centages)***	***9,51,26,20,120.83***	***951.26***
12	***Total HAM Cost per km***	***17,92,61,343.08***	***17.93***
13	***Total Project Cost per km***	***32,76,82,401.68***	***32.77***

8. Material Investigation

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

8.1. Borrow Pits for Soil

Material investigation of locations near Puducherry indicates that soil suitable for embankment (of CBR>8%) and for sub-grade (CBR>8%) is available at an average lead within 40 km for the project stretch.

8.2. Sand

Sand is available within 48km, JP Crusher, Dhapgurikuratanga, Assam.

8.3. Gravel

Gravel is available within West Garo Hills Meghalaya

8.4. Bitumen

Bulk bitumen of the grades VG10, VG30 and VG 40 is available at Haldia.

8.5. Cement

Cement is available in guwahati.

8.6. Other Local Material Available

Sr. No.	Material	Source
1	Steel	Guwahati
2	Pipes	Guwahati

8.7. Key Risks

Despite the best efforts of the consultant, there continue to be some materials and sections of the project road where material will have to brought from significant leads.

Table: Key risks envisaged in material procurement

Sr. No.	Material	Closest Source
1	Bitumen	Bulk bitumen of the grades VG10, VG30 and VG 40 is available at Haldia.

8.8. Locations of Material Sources

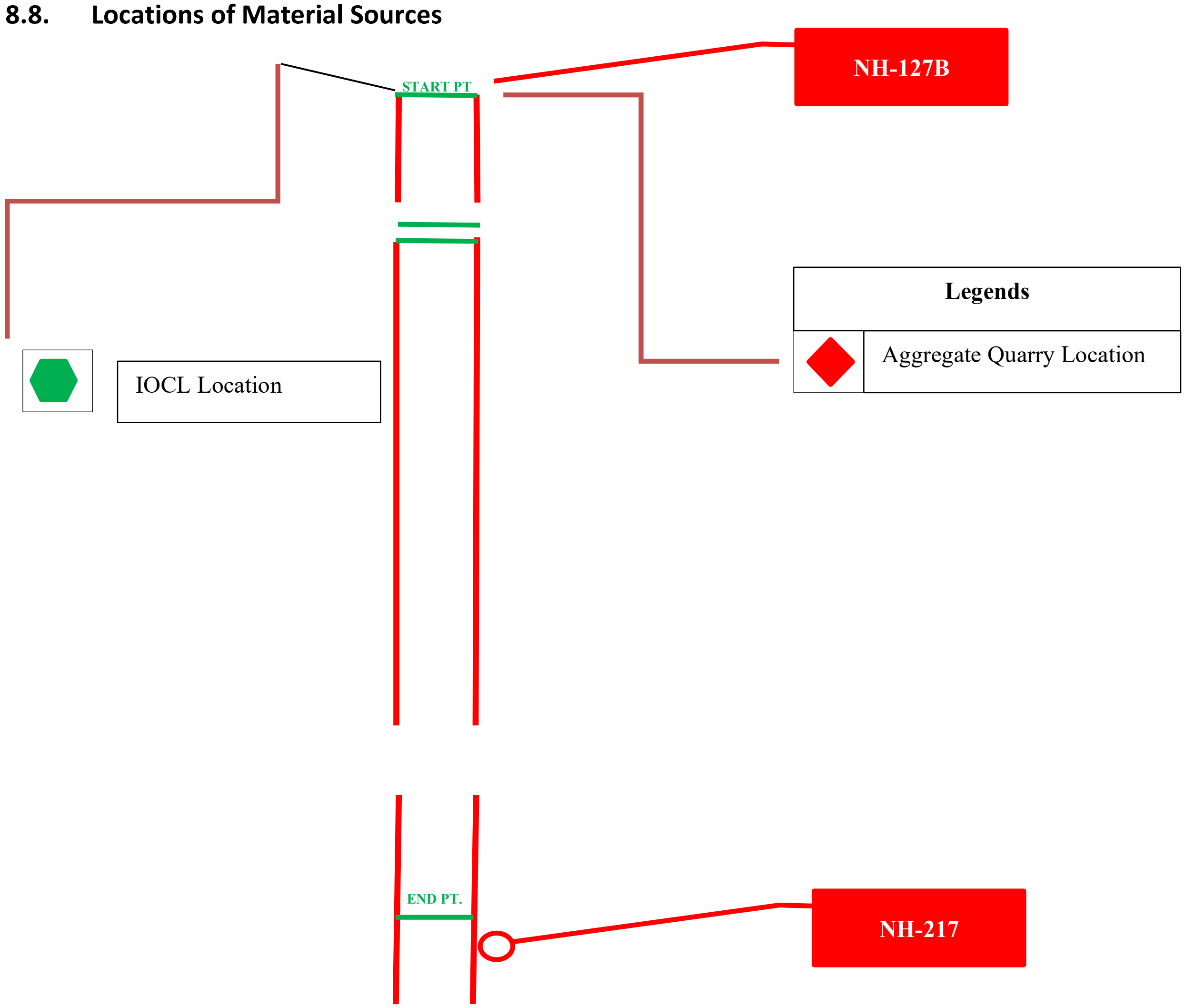


Figure: Key plan showing location of aggregates and potential borrow pits tested

9. Potential for value engineering and innovative technologies

Throughout the detailed design of the project, several opportunities for value engineering and introduction of new technology were explored that will help in reducing the cost of the project or increase quality and longevity of project road. Approval of these elements as part of the construction design and suitable instructions to all stakeholders of the project can help significantly lower the projected cost of construction.

A summary of these opportunities is provided here.

Table: Key value engineering opportunities identified

Sr. No.	Value engineering Opportunity	Potential Impact
1	Safety and Durability	
2	Reduction in Cost	

10. Economic and Financial Analysis

10.1. Economic analysis of the project

The main objective of financial analysis is to assess the likely returns to the investors under realistic conditions/assumptions. As Design length of this package is approx. 29.030 km.

On calculation of Project IRR, it can be observed that Toll Revenues are not sufficient to finance the Project Cost along with Operations and Maintenance Cost during Concession Period. Thus, the project is not viable to be implemented on BOT Toll basis. Accordingly, it can be considered either to be developed on HAM mode or Hybrid Annuity Mode.

10.2. Financial analysis

Economic Internal Rate of Return (EIRR) of the Project Highway for 30 Years including construction period is 0.55%.

Time Period	EIRR (%)
15 Years	-15.49
20 Years	-7.28
30 Years	0.55

Table: Economic Analysis Results

10.2.1. Results of financial analysis

Sensitivity Analysis has been carried out to examine the effect on economic viability of the Project due to the changes in the levels of the key input factors, including upgrading costs, traffic flows and unit input costs. The sensitivity of the EIRR has been studied under the following change in conditions.

- Case I: 15% increase in project costs, while traffic volume remains unaffected as per demand estimates.
- Case II: 10% decrease in traffic volume, project costs remaining unchanged Case II
- Case III: 15% increase in the project costs and 10% decrease in traffic materialization – worst case scenario.
- Case IV: Project costs remains unchanged and 10% increase in traffic materialization – worst case scenario.

Sensitivity Analysis results for different cases are given below:

Packages	15 Years EIRR (%)	20 Years EIRR (%)	30 Years EIRR (%)
Case I	-16.59	-8.19	-0.13
Case II	-16.30	-7.96	0.04
Case III	-17.39	-8.86	-0.62
Case IV	-14.71	-6.64	1.02

Table: Sensitivity Results

The main objective of financial analysis is to assess the likely returns to the investors under realistic conditions/assumptions. As Design length of this package is approx. 29.030km.

As per the project cost, 98.45 % grant is required for 15% IRR which is much higher than 20%. Hence it is recommended to implement this project on HAM mode of delivery

11. Execution plan

In consultation with PMU, it is proposed to complete the proposed project road in a period of 24 months. Planning for the project packaging, bidding process and construction was conducted as a part of this project.

11.1. Packaging

Given the length of the project, the entire project is planned to be bid out in 1 package.

11.2. Bidding mode and time lines

The authority has proposed to initiate bidding of the project under HAM mode with a grant/premium of 5%.

11.3. Construction time and planning

Upon reviewing the improvements planned and in consultation with PMU, the design and construction period for this project has been arrived at 24 months from the date of appointment of the contractor/concessionaire. To enable this construction schedule, a detailed construction plan and timeline has been included in the detailed project report. This also includes a traffic management and lane closure plan for the period of construction.

12. Conclusions and recommendation

The main objective of financial analysis is to assess the likely returns to the investors under realistic conditions/assumptions. As Design length of this package is approx. 29.030 km.

On calculation of Project IRR, it can be observed that Toll Revenues are not sufficient to finance the Project Cost along with Operations and Maintenance Cost during Concession Period. Thus, the project is not viable to be implemented on BOT Toll basis. Accordingly, it can be considered either to be developed on HAM mode or Hybrid Annuity Mode.