National Highways & Infrastructure Development Corporation Limited

Feasibility Study, Preparation of Detailed Project Report and providing pre-construction services for up gradation of National Highway No. 217 (Paikan-Tura Section) in the state of Assam and Meghalaya

DETAILED PROJECT REPORT
PACKAGE-II
EXECUTIVE SUMMARY

M/s Almondz Global Infra-Consultant Limited

In association with

Thoughts Consultants Jaipur Private Limited

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Executive Summary

1 . Introduction

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

M/s Almondz Global Infra-Consultant Limited in association with Thoughts Consultants Jaipur Private Limited was appointed on 8th March 2019. For Consultancy Services for Feasibility Study, Preparation of Detailed Project Report and providing pre-construction services for up gradation of National Highway No. 217 (Paikan-Tura Section) in the state of Assam and Meghalaya. The Project Highway location map is given in Figure 1-1.

The existing Project Highway alignment is passing through two State Assam and Meghalaya, Three Districts Goalpara, North Garo Hills and West Garo Hills and 56 Revenue Villages. The Project Highway alignment was discussed and Approved by NHIDCL on 27-11-2019 and directed to obtain concurrence of all stake holders of State Govt. For obtaining the concurrence the various Public Consultation meeting were carried out in all three districts for obtaining concurrence of all stakeholders

Goalpara District Assam: The Public Consultation meeting was held in the Office of Deputy Commissioner Goalpara Assam on 06-03-2020, where DC, ADC, SP, DFO, other District level officials, village heads and local people along with NHIDCL official were present in the meeting. The Alignment was approved in Assam the some minor modifications.

West Garo Hills District: The Public Consultation meeting was held in the Office of Deputy Commissioner West Garo Meghalaya on 06-03-2020 where DC, ADC, SP, DFO, other District level officials, village heads and local people along with NHIDCL Official were present in the meeting. The alignment was approved with recommendation to take the realignment in Rongram Town on East side instate of Elevated Road on existing alignment.

North Garo Hills District: The Public Consultation Meeting were held at Bajengdoba playground 09.03.2020, Gokol Playground on 11.03.2020 and in the Office of Deputy Commissioner North Garo Resulbelpara on 11-03-2020. The DC, ADC, SP, DFO, other District level officials, village heads and local people were present in the meeting. Deputy General Manager Tura was present on behalf of NHIDCL. The Propsed alignment was approved with the suggestion of Elevated viaduct at Bajengdoba Bypass.

The outcome of the Public Consultation meeting were presented in Review meeting held on 12-03-2020 at New Delhi HQ. The minor changes suggested in alignment were agreed by Authority and directed to carry out further activities. NHIDCL has also directed to plan to construct the Project Highway road in six packages according to keeping in the View of State / Districts Boundaries. After the discussion the following six package are formulated.

Table 1-1: Key features of project

Package	State & District	Design Ch.	Design Length (Km)
Package-1	Assam, Goalpara	From Km. 0/000 to Km 21/200	21.2 Km
Package-II	Meghalaya, North Garo Hills	From Km. 20/900 to Km 47/075	26.175 Km
Package-III	Meghalaya, West Garo Hills	From Km. 47/075 to Km 77/055	29.980 Km

The Present Report is dealing with Package-II, which is located in North Garo Hill District of Meghalaya.

Figure 1-1: Location of Project Highway Road

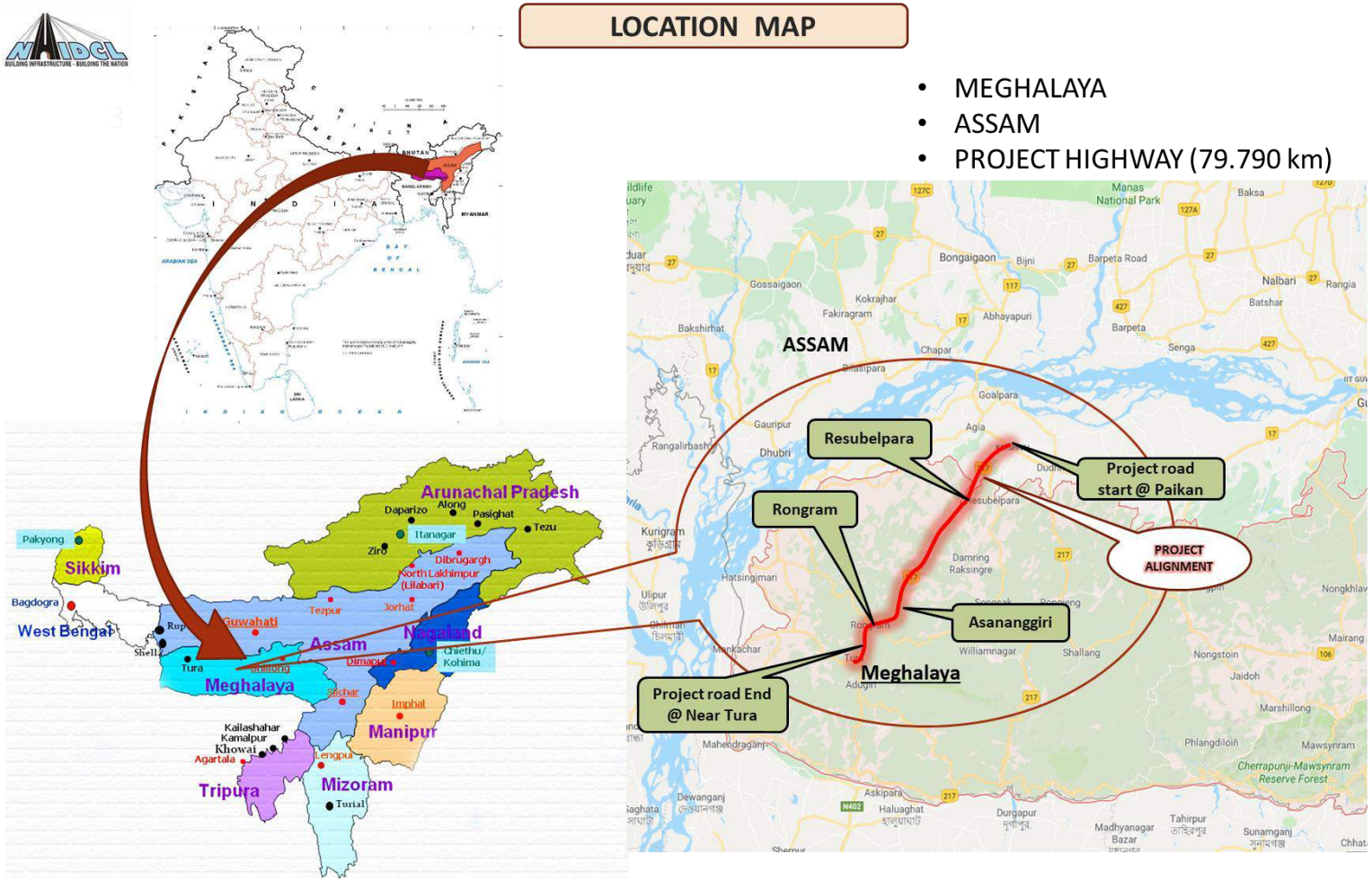


Figure 1-2: Existing Alignment of Project Highway all Packages

2 . Project overview

The Project Highway Package-II is located in North Garo Hills District of Meghalaya State. The existing Alignment is passing through Two CD blocks of and 15 Revenue villages. The existing alignment of Project Highway Starts from Assam-Meghalaya State Boarder at Km. 21/050 and end at Km. 48/625 Boarder the North & West Garo Hill District. The Project Highway has 2-lane flexible pavement in entire length.

2.1 Key features of project

Table 2-1: Key features of project

Particulars	Existing Details
Terrain	Runs in Mountainous terrain. Land use is predominantly Agricultural, and some built up areas too.
ROW	Varies between 15-22.2 m on site and 2x10.67 m as per Garo Hill Autonomous District Council Nonfiction
Carriageway Configuration	Two lanes of length 26.175 Km
Geometry	Horizontal and Vertical Alignment of Project Road has lot of deficiencies
Pavement Condition	Mostly fair, some part of stretch is damaged.
Bridges Numbers	Major Bridge = 0 Minor Bridge = 11
Culverts Numbers	Pipe Culvert = 105 and Slab Culvert = 31
Side Drains	Exist in built-up stretches 3286 m
Intersections/Junctions	Major =1 Minor Junction =22
Road Facility/Safety Feature	Safety installations are limited to speed breakers
Level Crossing/ROB/RUB	NIL
Breast/Retaining wall	4234 m

2.2 Key plan of existing project stretch

Figure 2-1: Key plan of existing project road

3 . Traffic demands on project road

3.1 Traffic volume surveys

For the purposes of traffic projections and lane design, one individual section of road were considered:

Table 3-1: Classified Volume Count Survey

Sr. No.	Category Of Road	State	Location of Survey
1	NH 217	Meghalaya	Konapara At Ch. 22+630

Traffic volume surveys for the project road were carried out at along the project road in the month of September 2019 to October 2019. The traffic data is projected to year 2021-2022 with growth factor of 5%. Multimodal Logistic Park is proposed at Jogighopha, so traffic will further increase as the diverted traffic will use the project road. 20% of induced traffic for the multimodal logistic park is assumed to be diverted on the project road. The results are as follows:

Table 3-2: Average Annual Daily Traffic

Type of Vehicles	Traffic in Year 2019-20 at Km 22+630 at Konapara	Traffic in Year 2021-2022 @ 5% Traffic Growth	Projected Traffic in Year 2021-2022 at Jogighopa Mulity Model Logistic Park	Induced Traffic in Year 2021-2022 on project Road due to Mulity Model Logistics Park @ 20%	Projected Traffic in Year 2021-2022 on project Road incl. induced traffic
Two-wheeler	937	1033	0	0	1033
Three-wheeler	321	354	0	0	354
Car	1825	2012	0	0	2012
Mini Bus	173	191	0	0	191
Bus	153	169	0	0	169
LCV (<3T)	407	449	461	93	542
LCV (> 3T)	21	23	96	20	43
LCV (> 7.5T)	41	45	0		45
2 Axle	69	76	107	22	98
3 Axle	36	40	0		40
Multi Axle	23	25	163	33	58

Type of Vehicles	Traffic in Year 2019-20 at Km 22+630 at Konapara	Traffic in Year 2021-2022 @ 5% Traffic Growth	Projected Traffic in Year 2021-2022 at Jogighopa Mulity Model Logistic Park	Induced Traffic in Year 2021-2022 on project Road due to Mulity Model Logistics Park @ 20%	Projected Traffic in Year 2021-2022 on project Road incl. induced traffic
Tractor without Trailer	0	0	0	0	0
Tractor with Trailer	0	0	0	0	0
HCM	3	3	0	0	3
Cycle	0	0	0	0	0
Cycle Rickshaw	0	0	0	0	0
Hand Cart	0	0	0	0	0
Animal Cart	0	0	0	0	0
Total Vehicle	4009	4420	827	168	4588
Total PCU	4530	4993	1890	384	5377
Total CVD	346	381	366	75	456

3.2 Axle load survey

Axle load surveys were conducted at NH-217, at one location for Package-II, km 22+360, Konapara using Load Pad to understand the actual load spectrum of commercial vehicles plying on the project road. The results of the load survey, were converted to Vehicle Damage Factor (VDF) using equivalency factors from IRC-37:2018 for the purpose of MSA calculations

Table 3-3: Axle load survey results

Sr. No.	Type of Vehicle	VDF @ 22+630
1	Bus	1.51
2	LCV	1.52
3	2 – Axle Truck	2.53
4	3 – Axle Truck	2.36
5	Multi Axle Truck	2.29
	Weightage VDF	2.05

3.3 Traffic volume forecast

Traffic volume forecast was developed using the Elasticity Model method and converted to Million Standard Axles (MSA) for the purposes of pavement design. Total Projected Traffic Volume for each of the locations of the project corridor are given in below Tables

Table 3-4: Projected traffic load on project road

Sr. No.	Years	Vehicles	PCU's
1	2022	4745	5517
2	2025	5520	6443.5
3	2030	7085	8308.5
4	2035	9078	10677.5
5	2040	11628	13719
6	2045	14882	17602

3.4 Turning movement surveys

Classified direction wise turning movement surveys were conducted at 5 intersections to determine the need for re-design and addition of structure at the intersection

Table 3-5: Turning movement survey results

Sr. No.	Location Details	Type	8 Hour TMC	Peak Hour TMC
			Total No. of Vehicle	Total No. of Vehicle
1	Start 21+960	3 Arm	1642	212

4 . Pavement and corridor surveys

4.1 Pavement condition and distress seen

The overall pavement condition Site has been inspected on visual basis. The pavement condition of road is good on the whole having good riding quality. In general, cracked area is around 15 –20%, patched area is about 5-10% and the average raveled area is 0% to 5%. Pot holes were only observed on the locations where water streams were crossing the road.

Table 4-1: Condition survey of existing pavement

ID	Section	Condition Year	Roughness IRI	Total Cracking Area (%)	Raveled Area (%)	Potholes (no/km)	Edge Break(m²/ km)	Rut Depth (mm)
A-01	From Km 20/900 to 47/075 Km	2019	4.1	16	15	8	12	2

4.2 Pavement composition

The detailed layer composition of the existing pavement was recorded at every pit and the observations have been presented in Annexure 6-6. Generally the existing pavement structure comprise of three layers namely wearing coarse, base course and sub-base course. The wearing course consists of bituminous material that may be termed as Bituminous Top (BT). The base course comprises of mixture of boulder/aggregate. The sub base course mainly comprises of aggregate/sand and murrum. The total thickness of the pavement varies from 310 mm to 370 mm with an average of 340 mm. The summary of the crust thickness is shown in below in Table.

Table 4-2: Composition of existing pavement

Section	Bituminous course (mm)		Granular course (mm)	
From Km 20.900 to Km 47.075	40	350	80	600

4.3 Pavement strength

FWD was carried out to test the strength of the existing pavement, and the characteristic deflection values have been calculated for each homogeneous section of road to enable design of an overlay for the road. The summary of strength of existing pavement

Table 4-3: Strength of existing pavement

Section	Chainage		Distance	Remaining mm
	Start	End	Km	
Section-1	21/050	48/625	27.575	2 MSA

4.4 Sub-grade soil survey

Extensive review of available soil information and testing was done to understand the sub-grade characteristics. Summary of soil investigation surveys is as follows:

Table 4-4: Soil investigation survey results

Attribute	Results	Comments
Sub-grade CBR range (%)	7%- 8%	Low over large lengths of section
Degree of compaction (% of MDD)	95%-97%	Sufficient as per MORTH guidelines
Swelling ratio (%)	5.3 to 36%	Significant variation seen across stretch

Table 4-5: Soil types observed

Soil type	Plasticity index	Comments
Clayey sand (SC)/ CL	2.62 to 2.70	Poorly graded clay sand mixture

5 . Improvement proposals

5.1

5.2 Proposed alignment

As per the Discussion with NHIDCL and Outcome of the Public consultation with all stake holders, the widening of existing 2-lane road to 2- lane with paved shoulders has been planned along the existing road alignment only, except for curve improvement and minor realignment in some stretches. The existing road carriageway has been used most of the length.

As per site conditions due to elephant crossing at some locations and presence of built-up areas speed restrictions need to be adopted. The local and district administration were of the option that deficient curves should only be improved for minimum design speed 50 Kmph, So that Land acquisition can be minimized.

In built-up area the widening has been planned equally on both sides of the existing road alignment so that Minimum land is acquired for road project. The width of median be kept same in non-built-up area same as proposed in built-up area.

5.3 Bypasses proposed

Only one bypass of Bajengdoba Market Area has been proposed.

5.4 Road Geometry

The project road has been re-designed to accommodate the ruling design speed of 50 km/hr in Hill Terrain. The Manual of Standards and Specifications for "Two Laning of Highways with Paved Shoulder published by Indian Roads Congress IRC: SP: 73-2018" or consultation with NHIDCL. Enabling this higher speed will require re-design and re-alignment of the road in certain sections. Initial all the curves were improved for minimum Design Speed of 50 Kmph. During the Public Consolation meeting it was discussed that due to elephant crossing at some locations and presence of built-up areas, speed restrictions need to be adopted. After discussions, the locals and district administration were of the opinion that deficient curves should only be improved for Maximum design speed 40 Kmph only. Locals and district administration insisted to follow relaxed norms if possible so as to have minimum Land acquisition. The villagers insisted that in built-up area the widening must be done equally on both sides of the existing road alignment so that equal land is acquired on both sides of the Alignment and dwellers on both sides of the Alignment are equally affected. The villagers also requested the width of median be kept same in non-built-up area as proposed in built-up area and extra 1.5 m paved shoulders may be reduced, due to the presence of agriculture's fields. Due to these suggestions overall land requirement may be reduced. The Competent

Authority has approved the suggestion of Public Consolation meeting. Accordingly final alignment has been modified.

Table 5-1: Lane configuration planned for project road

Section	Chainage		Distance	Lane Configuration	TCS
	Start	End	Km		
Section-1	20/900	47/075	26.175	2-Lane	7 m + 2X1.5 m Paved Shoulders

5.5 Widening scheme

Basis traffic information available, level of service requirements and consultation with NHIDCL, local authorities etc., the following lane configuration is adopted for the project road:

Table 5-2: Typical Cross Section Details

Sr. No.	Particular of TCS	TCS Codes
1	TYPICAL CROSS SECTION -1 Both Side Widening of the Existing Road to 2 Lane with Paved Shoulders on Both Sides	TCS-1
2	TYPICAL CROSS SECTION -2 LHS Widening of Existing Road for 2 Lane with Paved Shoulders on Both Sides	TCS-2
	TYPICAL CROSS SECTION -2A New Construction of One Lane with Paved Shoulders on LHS for 2 Lane with Paved Shoulders on Both Sides	TCS-2A
3	TYPICAL CROSS SECTION -3 RHS Widening of Existing Road for 2 Lane with Paved Shoulders on Both Sides	TCS-3
	TYPICAL CROSS SECTION -3A New Construction of One Lane with Paved Shoulders on RHS for 2 Lane with Paved Shoulders on Both Sides	TCS-3A
4	TYPICAL CROSS SECTION -4 New Construction of 2 Lane Road with Paved Shoulders on Both Side	TCS-4
5	TYPICAL CROSS SECTION -5 New Construction of 2 Lane Road with Paved Shoulders on Both Side with High Embankment	TCS-5
6	TYPICAL CROSS SECTION -6 Construction of 2 Lane Road with Paved Shoulders on Both Side with High Embankment in Water Logged Areas	TCS-6
	TYPICAL CROSS SECTION -6A Construction of 2 Lane Road with Paved Shoulders on Both Side with Concrete Block on One Side at Elephant Crossing Location	TCS-6A

Sr. No.	Particular of TCS	TCS Codes
	TYPICAL CROSS SECTION -6E Construction of 2 Lane Road with Paved Shoulders on Both Side with Concrete Block at Elephant Crossing Location	TCS-6E
7	TYPICAL CROSS SECTION -7 TYPE I Construction of 2 Lane Road with Hill Cutting on Both Side with 4.0 m Gabion Wall with Hill Slope Protection Work	TCS-7 (Type I)
	TYPICAL CROSS SECTION -7 TYPE II Construction of 2 Lane Road with High Hill Cutting on Both Side with 6.0 m Gabion Wall with Hill Slope Protection Work	TCS-7 (Type II)
	TYPICAL CROSS SECTION -7 TYPE IV Construction of 2 Lane Road with Hill Cutting on One Side with 4.0 m Gabion Wall with Hill Slope Protection Work	TCS-7 (Type IV)
8	TYPICAL CROSS SECTION -8 Construction of 4 Lane Road in Built Up Area	TCS-8
9	2-lane New Bridge	TCS-9

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

Table 5-3: Chainage TCS Adopted

Chainagewise TCS details				
Sr. No.	Chainage (Km)		Design Length (Km)	TCS Code
	From	To		
(1)	(2)	(3)	(4)	(5)
1	20900	21000	100	TCS 1
2	21000	21288	288	TCS 4
3	21288	21312	24	MNB
4	21312	21650	338	TCS 4
5	21650	22600	950	TCS 8
6	22600	22800	200	TCS 3A
7	22800	23100	300	TCS 5
8	23100	23800	700	TCS 6
9	23800	24000	200	TCS 4
10	24000	24600	600	TCS 1
11	24600	24925	325	TCS 3A
12	24925	26099	1174	TCS 1
13	26099	26129	30	MNB
14	26129	26175	46	TCS 1
15	26175	26225	50	TCS 3A
16	26225	27323	1098	TCS 1
17	27323	27338	15	MNB
18	27338	28175	837	TCS 1
19	28175	28225	50	TCS 2
20	28225	28500	275	TCS 1
21	28500	28575	75	TCS 2
22	28575	29125	550	TCS 1
23	29125	29225	100	TCS 3A
24	29225	29300	75	TCS 3A
25	29300	29588	288	TCS 1
26	29588	29596	8	MNB
27	29596	29750	154	TCS 2
28	29750	29975	225	TCS 1

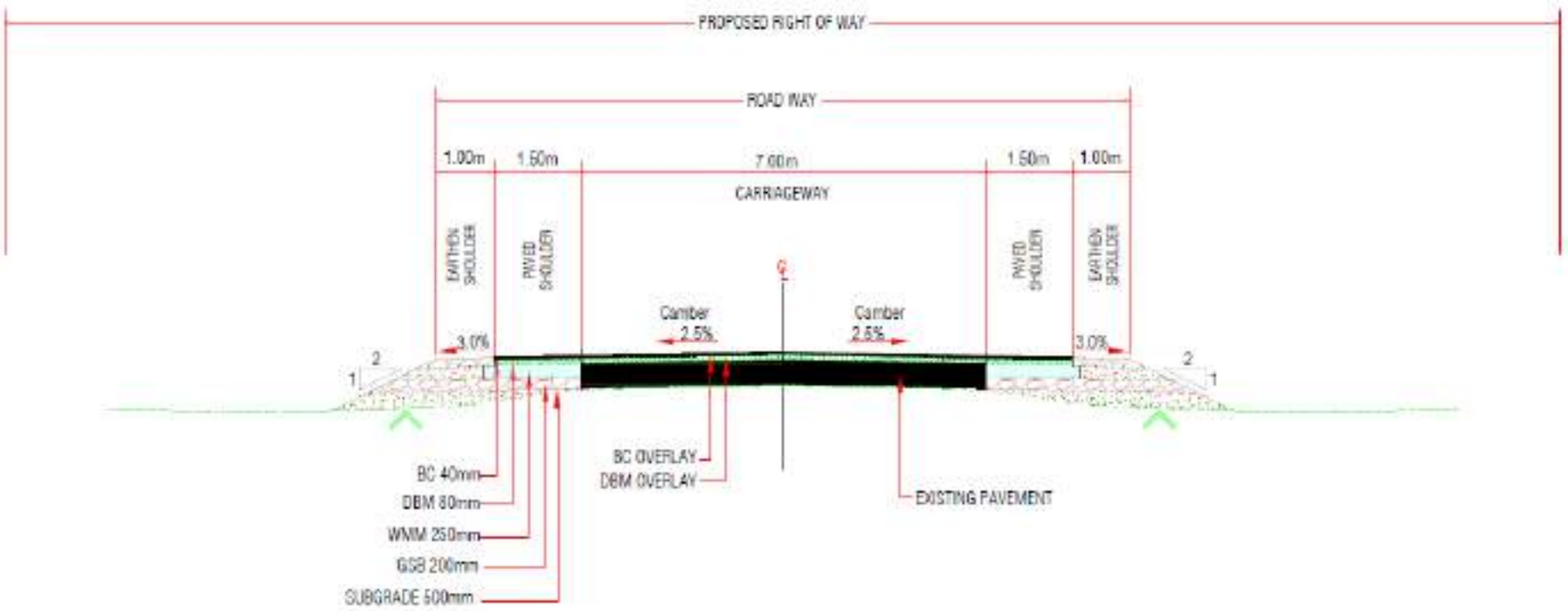
Chainagewise TCS details				
Sr. No.	Chainage (Km)		Design Length (Km)	TCS Code
	From	To		
(1)	(2)	(3)	(4)	(5)
29	29975	30250	275	TCS 3
30	30250	30300	50	TCS 3A
31	30300	30375	75	TCS 3A
32	30375	30450	75	TCS 3
33	30450	30850	400	TCS 2
34	30850	31175	325	TCS 4
35	31175	31400	225	TCS 2
36	31400	31700	300	TCS 1
37	31700	31878	178	TCS 3
38	31878	31890	12	MNB
39	31890	31921	31	TCS 3
40	31921	32000	79	TCS 2
41	32000	32040	40	TCS 6A
42	32040	32175	135	TCS 2
43	32175	32225	50	TCS 1
44	32225	32300	75	TCS 2
45	32300	32400	100	TCS 3
46	32400	32475	75	TCS 4
47	32475	32650	175	TCS 3A
48	32650	33100	450	TCS 8
49	33100	33736	636	TCS 1
50	33736	33755	19	MNB
51	33755	33800	45	TCS 1
52	33800	34100	300	TCS 8
53	34100	34725	625	TCS 1
54	34725	34800	75	TCS 3A
55	34800	34900	100	TCS 1
56	34900	35000	100	TCS 3

Chainagewise TCS details				
Sr. No.	Chainage (Km)		Design Length (Km)	TCS Code
	From	To		
(1)	(2)	(3)	(4)	(5)
57	35000	35775	775	TCS 1
58	35775	36210	435	TCS 4
59	36210	36285	75	TCS 6E
60	36285	36350	65	TCS 2
61	36350	36420	70	TCS 1
62	36420	36430	10	MNB
63	36430	36700	270	TCS 1
64	36700	36800	100	TCS 2
65	36800	37025	225	TCS 4
66	37025	37150	125	TCS 2A
67	37150	37225	75	TCS 1
68	37225	37325	100	TCS 4
69	37325	37387	62	TCS 2
70	37387	37403	16	MNB
71	37403	37500	97	TCS 3
72	37500	38175	675	TCS 1
73	38175	38370	195	TCS 2A
74	38370	38380	10	MNB
75	38380	38410	30	TCS 2A
76	38410	38450	40	TCS 6E
77	38450	38575	125	TCS 4
78	38575	38725	150	TCS 1
79	38725	38800	75	TCS 3
80	38800	38850	50	TCS 1
81	38850	38920	70	TCS 2A
82	38920	38930	10	MNB

Chainagewise TCS details				
Sr. No.	Chainage (Km)		Design Length (Km)	TCS Code
	From	To		
(1)	(2)	(3)	(4)	(5)
83	38930	39035	105	TCS 2A
84	39035	39085	50	TCS 6E
85	39085	39350	265	TCS 2
86	39350	39425	75	TCS 1
87	39425	39575	150	TCS 8
88	39575	39603	28	TCS 4
89	39603	39615	12	MNB
90	39615	39800	185	TCS 1
91	39800	39900	100	TCS 4
92	39900	40025	125	TCS 2
93	40025	40729	704	TCS 4
94	40729	40741	12	MNB
95	40741	40950	209	TCS 4
96	40950	41025	75	TCS 2
97	41025	41100	75	TCS 3
98	41100	45225	4125	TCS 7 type II
99	45225	45400	175	TCS 1
100	45400	45525	125	TCS 3
101	45525	45600	75	TCS 3A
102	45600	45725	125	TCS 3
103	45725	45825	100	TCS 4
104	45825	45900	75	TCS 2
105	45900	45975	75	TCS 4
106	45975	46275	300	TCS 1
107	46275	46375	100	TCS 3
108	46375	46425	50	TCS 2
109	46425	46600	175	TCS 7 type I

Chainagewise TCS details				
Sr. No.	Chainage (Km)		Design Length (Km)	TCS Code
	From	To		
(1)	(2)	(3)	(4)	(5)
110	46600	47075	475	TCS 7 type IV
Total Length			26.175	

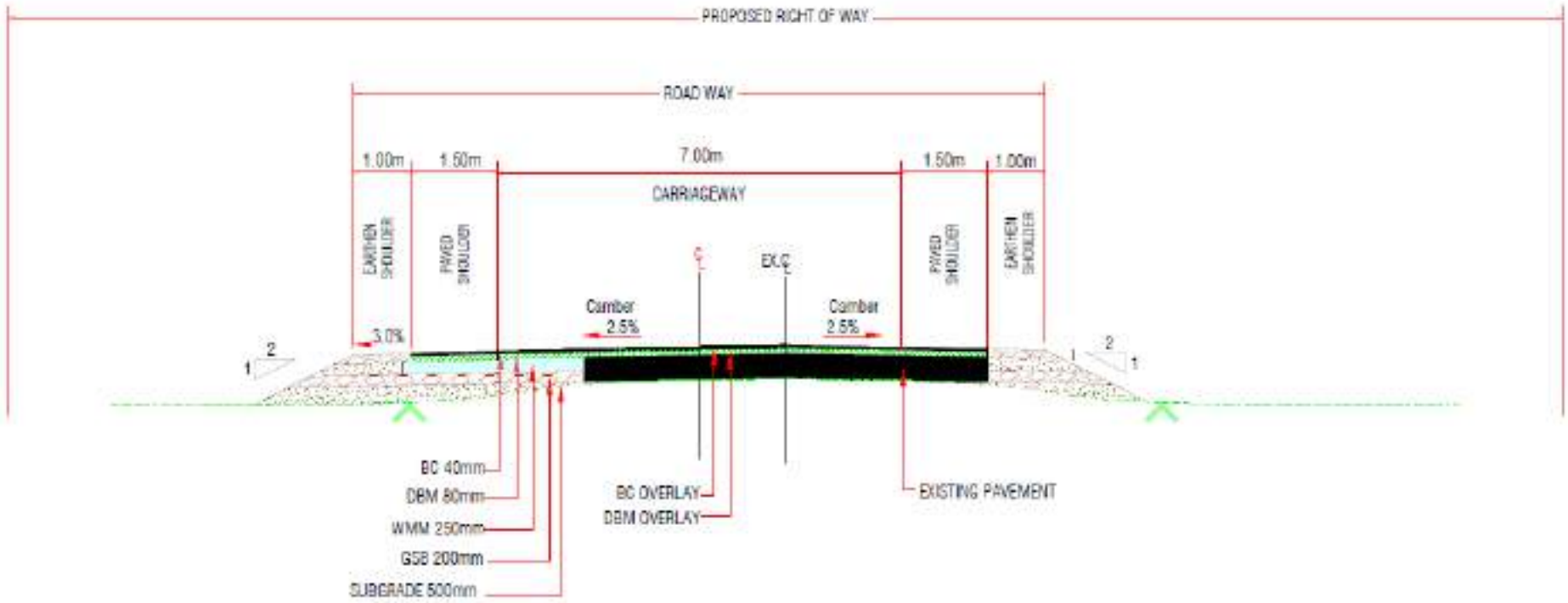
Typical Cross Sections Package-II



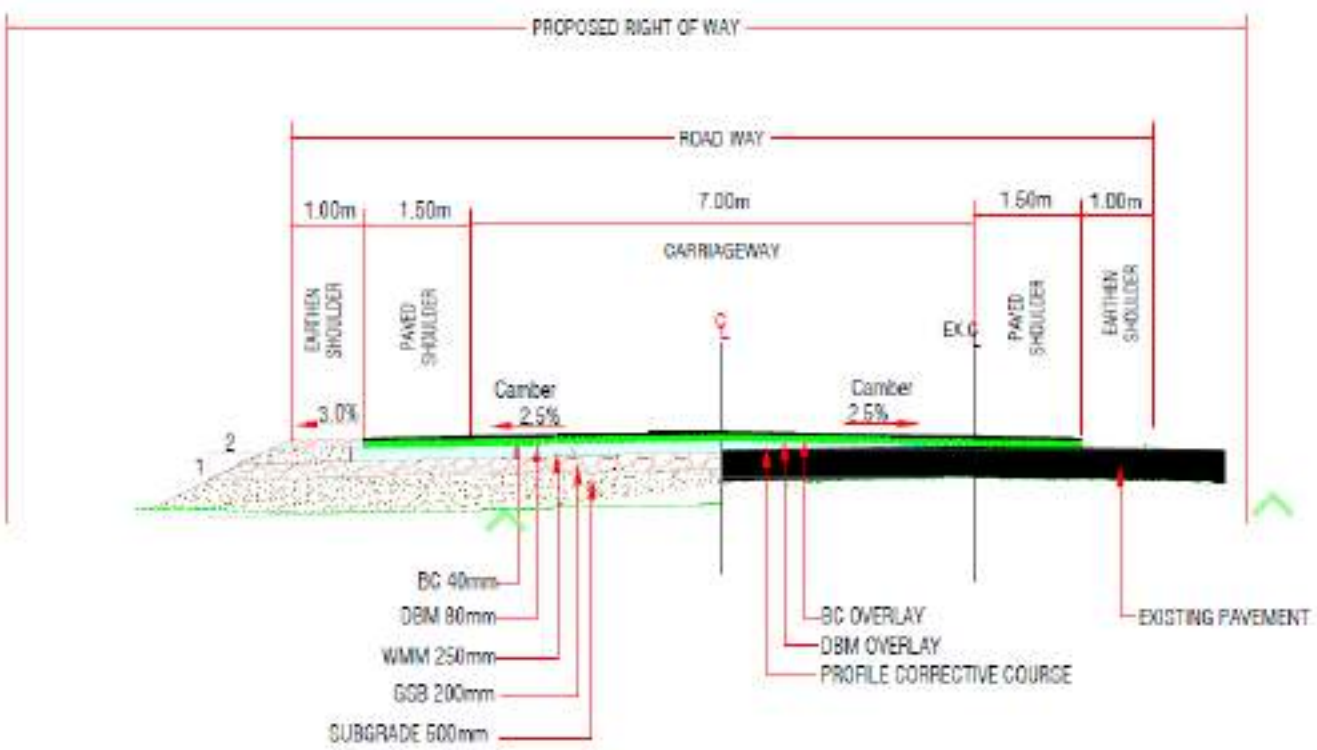
TYPICAL CROSS SECTION -1

(OPEN COUNTRY MOUNTAINOUS TERRAIN)

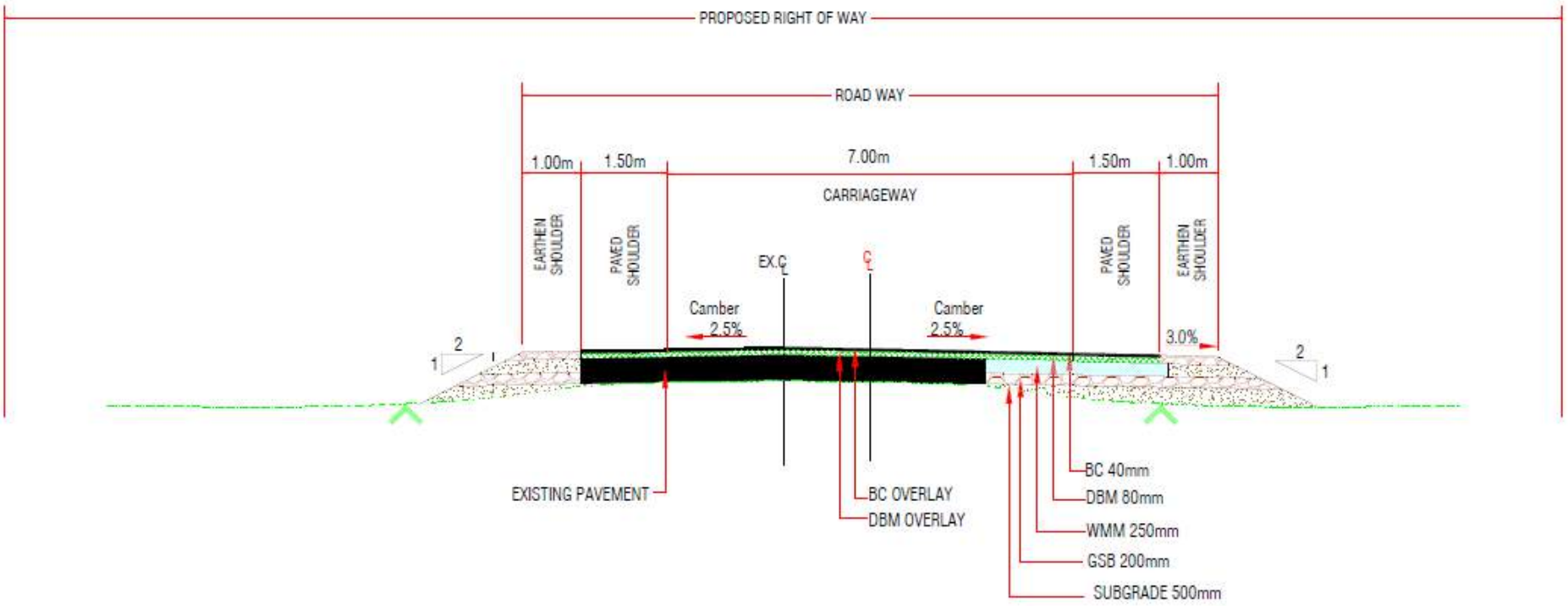
BOTH SIDE WIDENING OF THE EXSITING 2 LANE CARRIAGEWAY TO 2 LANE WITH PAVED SHOULDER



TYPICAL CROSS SECTION -2



TYPICAL CROSS SECTION -2A



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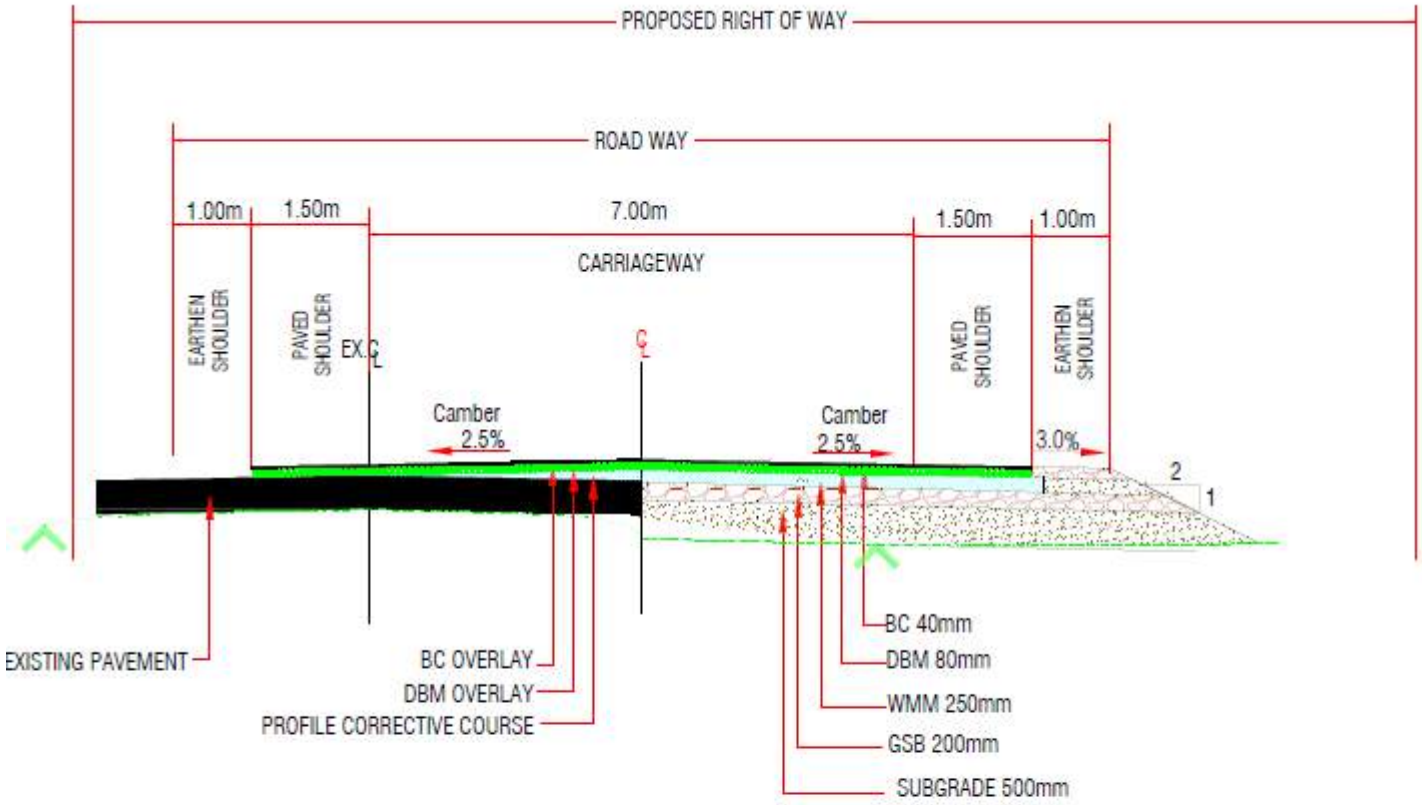
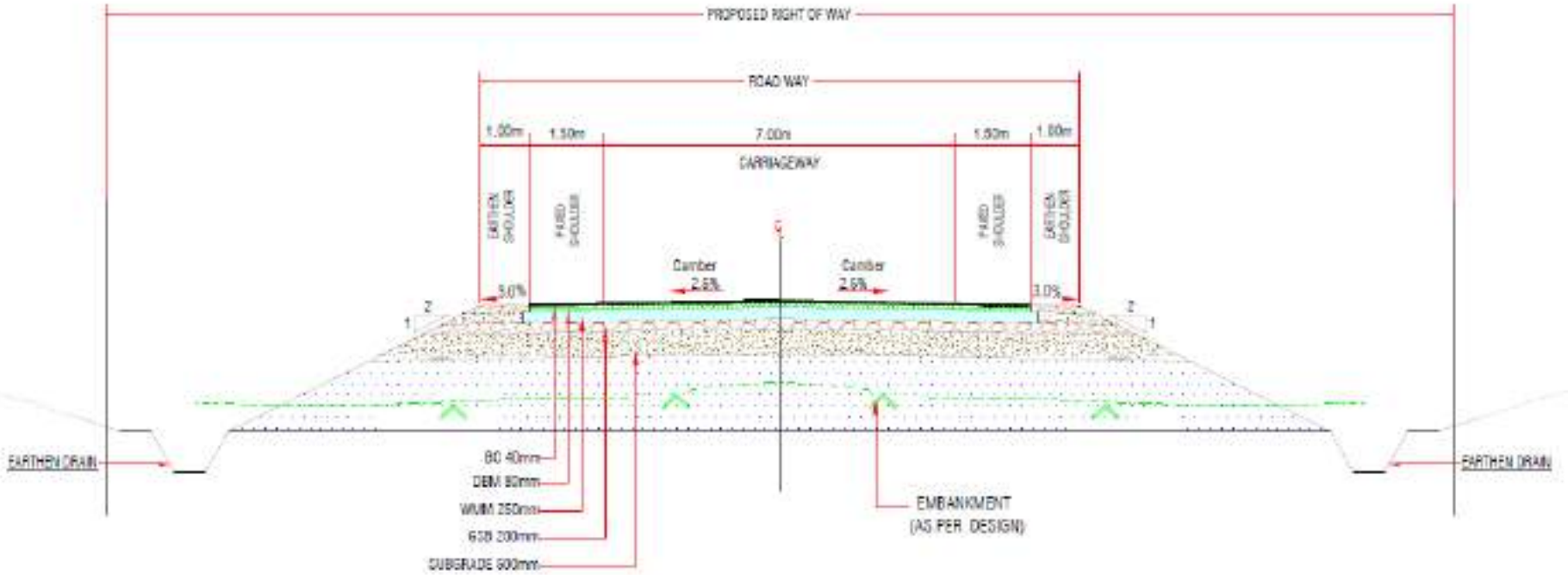


TYPICAL CROSS SECTION -3A



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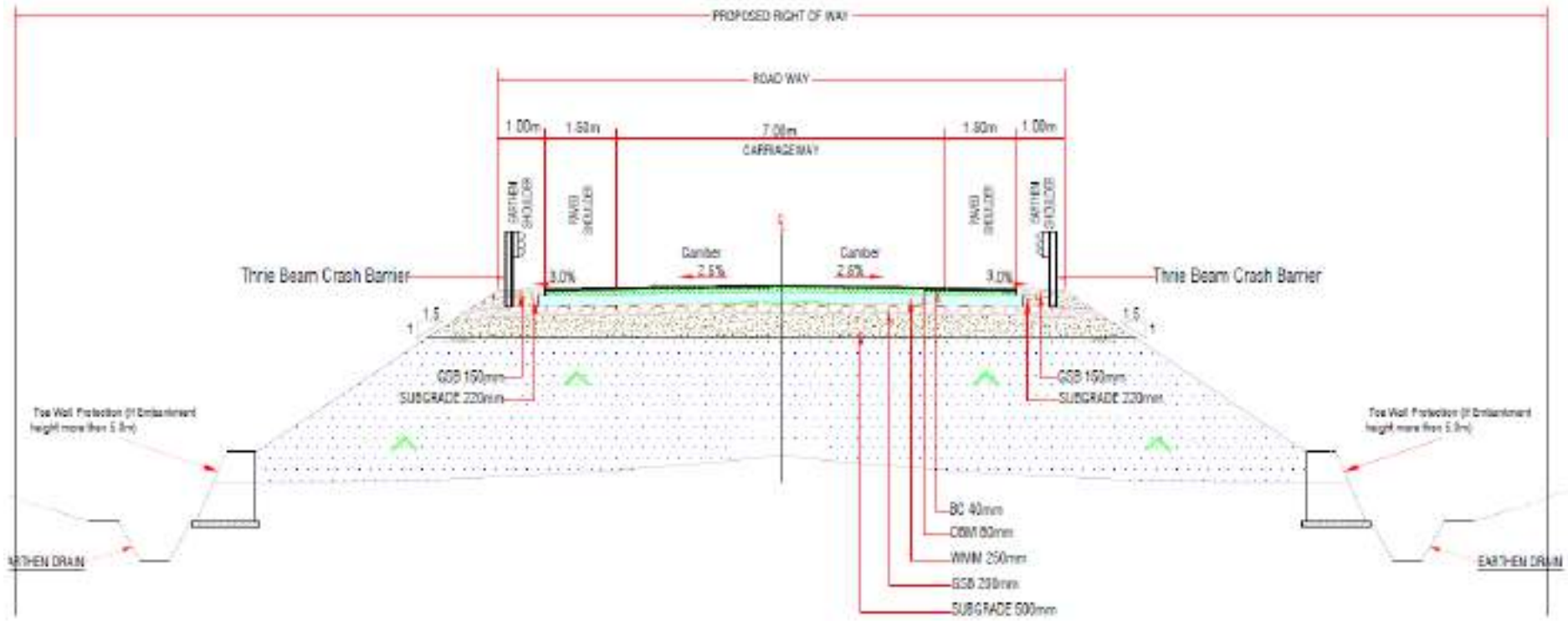

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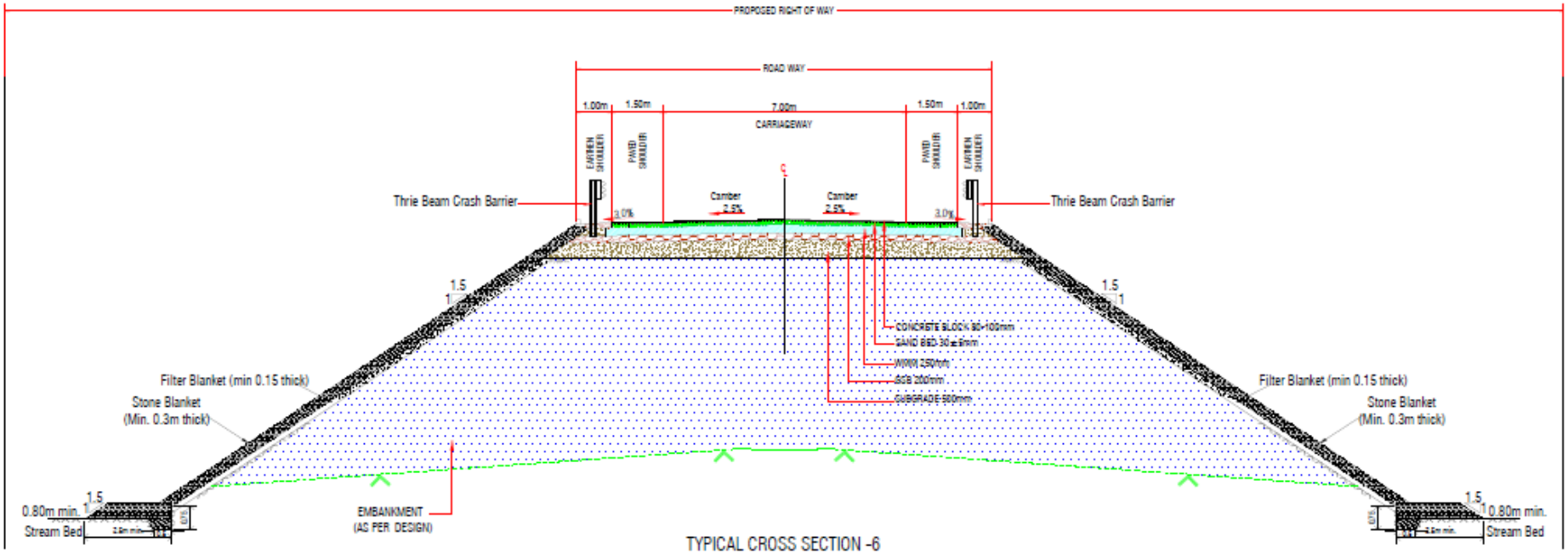
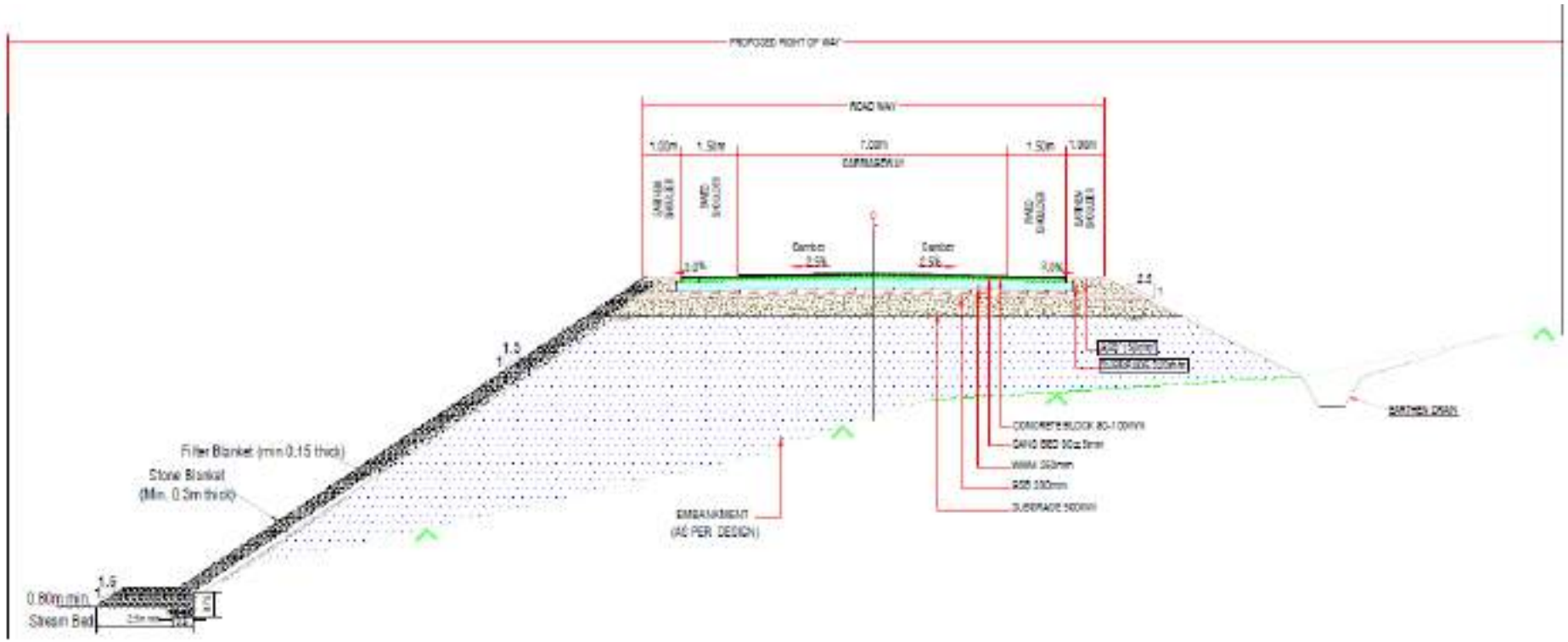
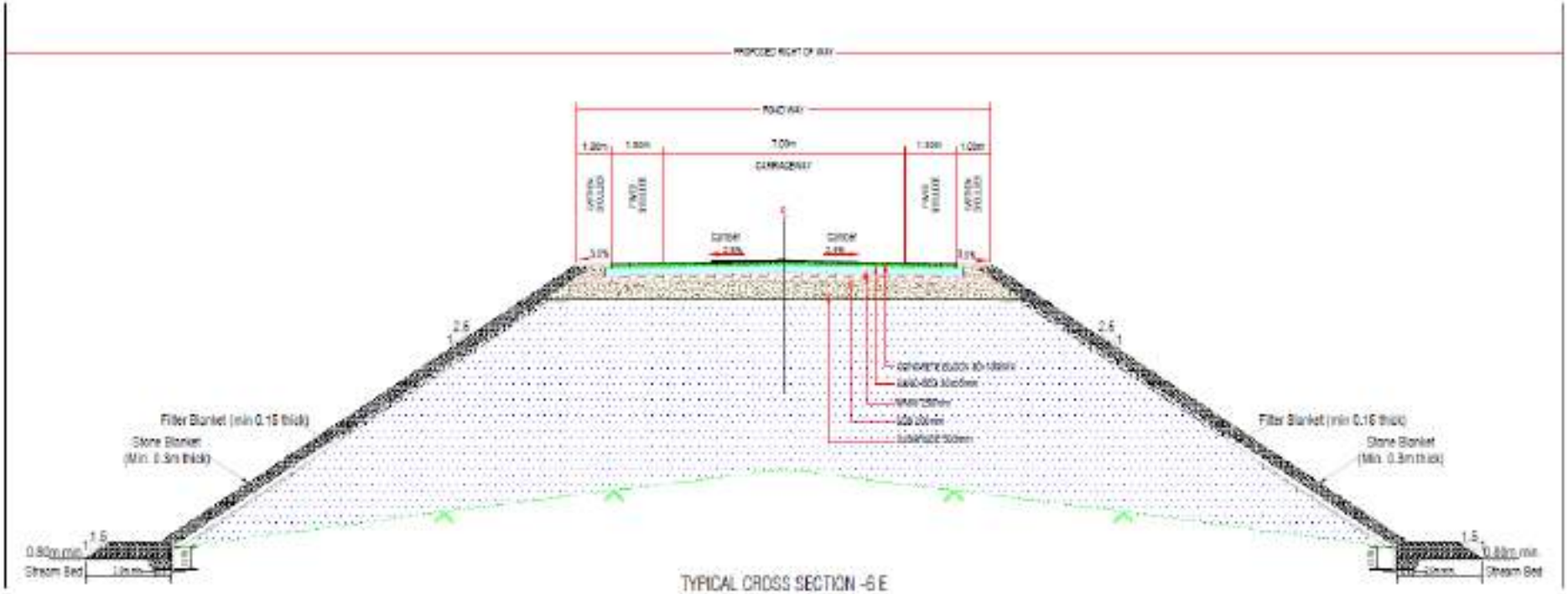


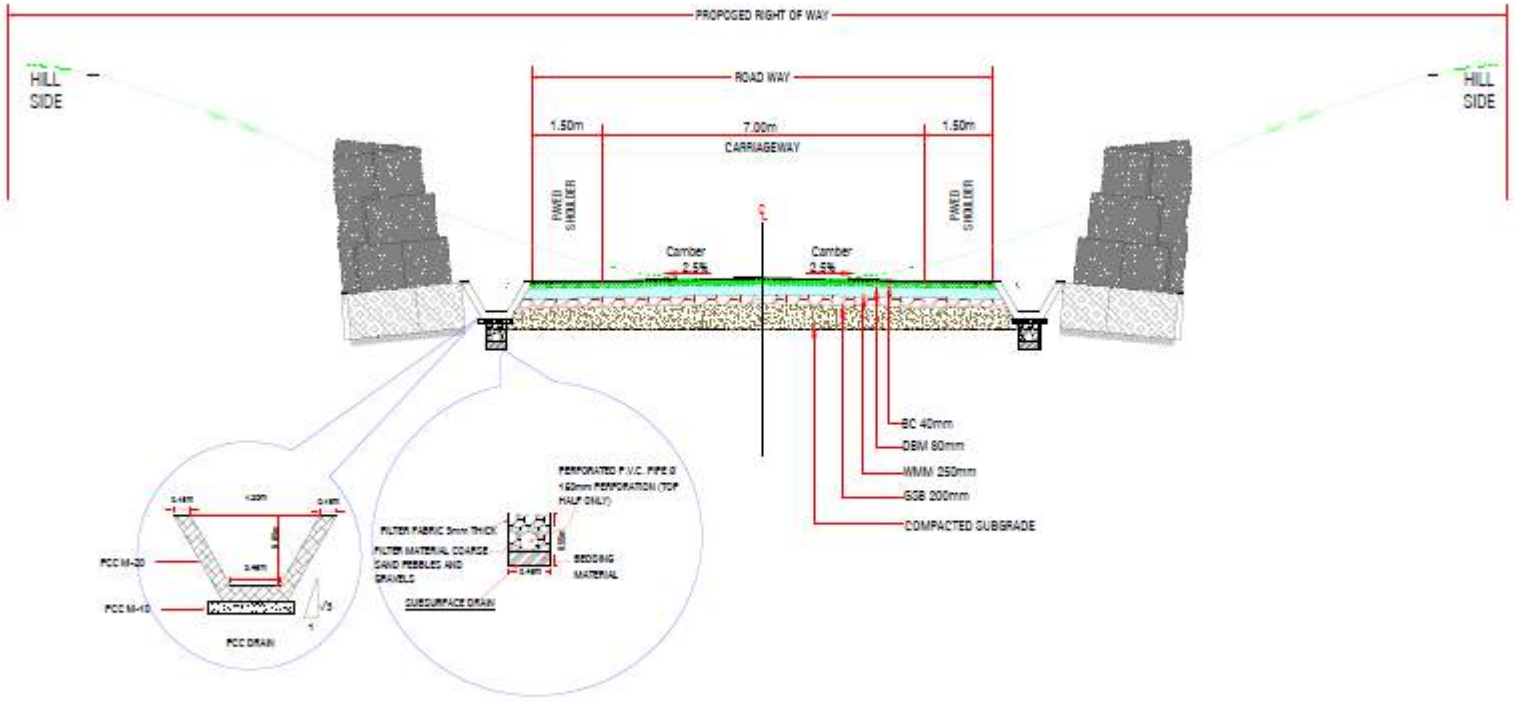
TYPICAL CROSS SECTION -6



TYPICAL CROSS SECTION -6 A



TYPICAL CROSS SECTION -5 E



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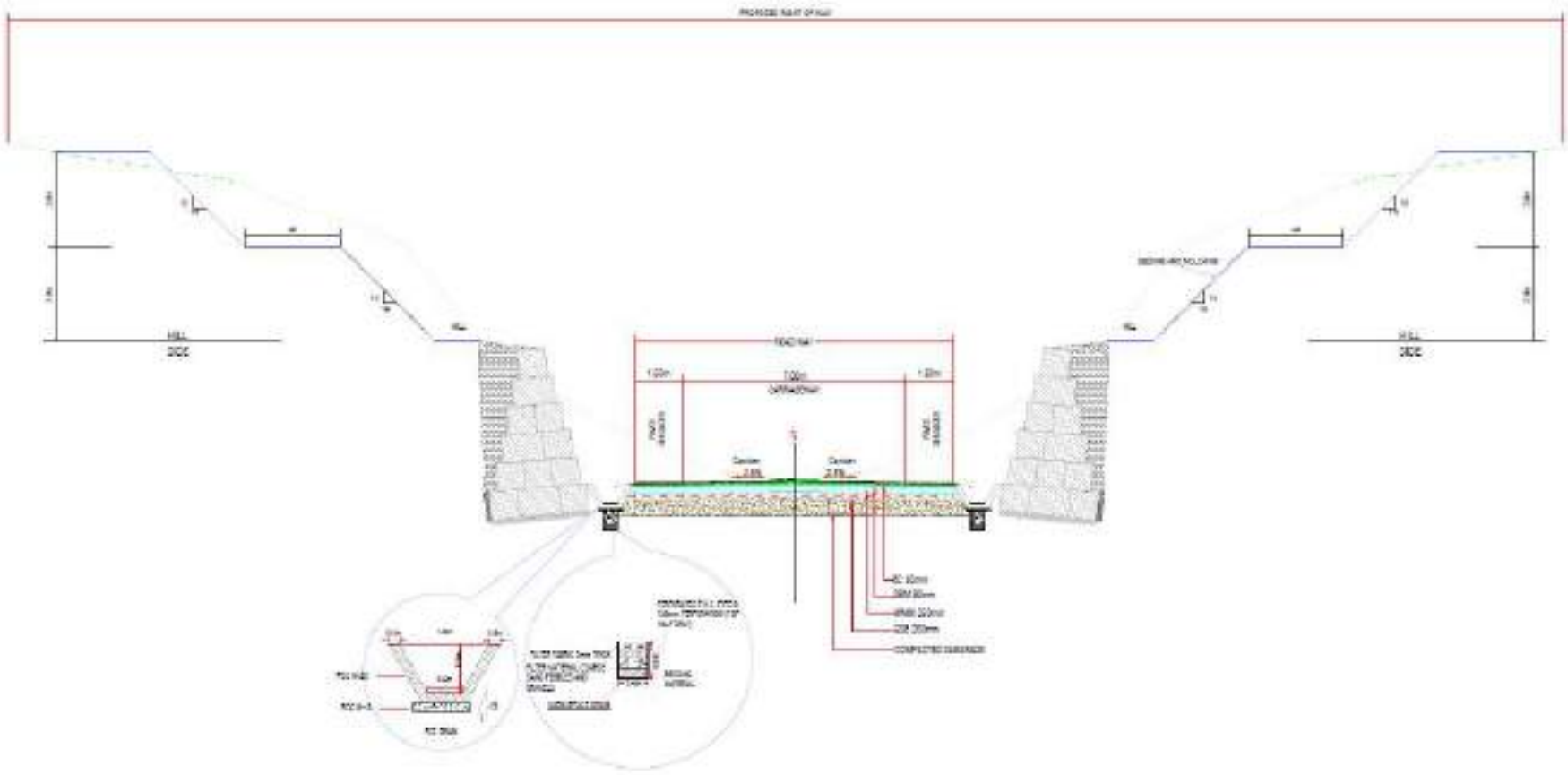
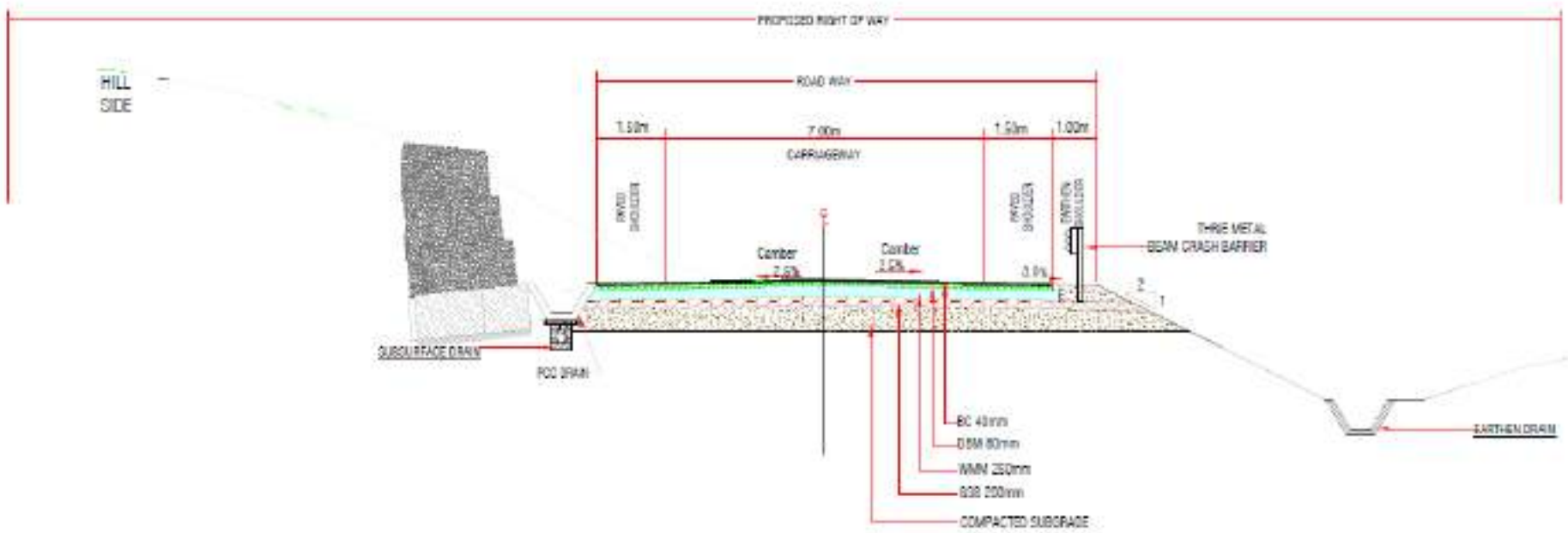
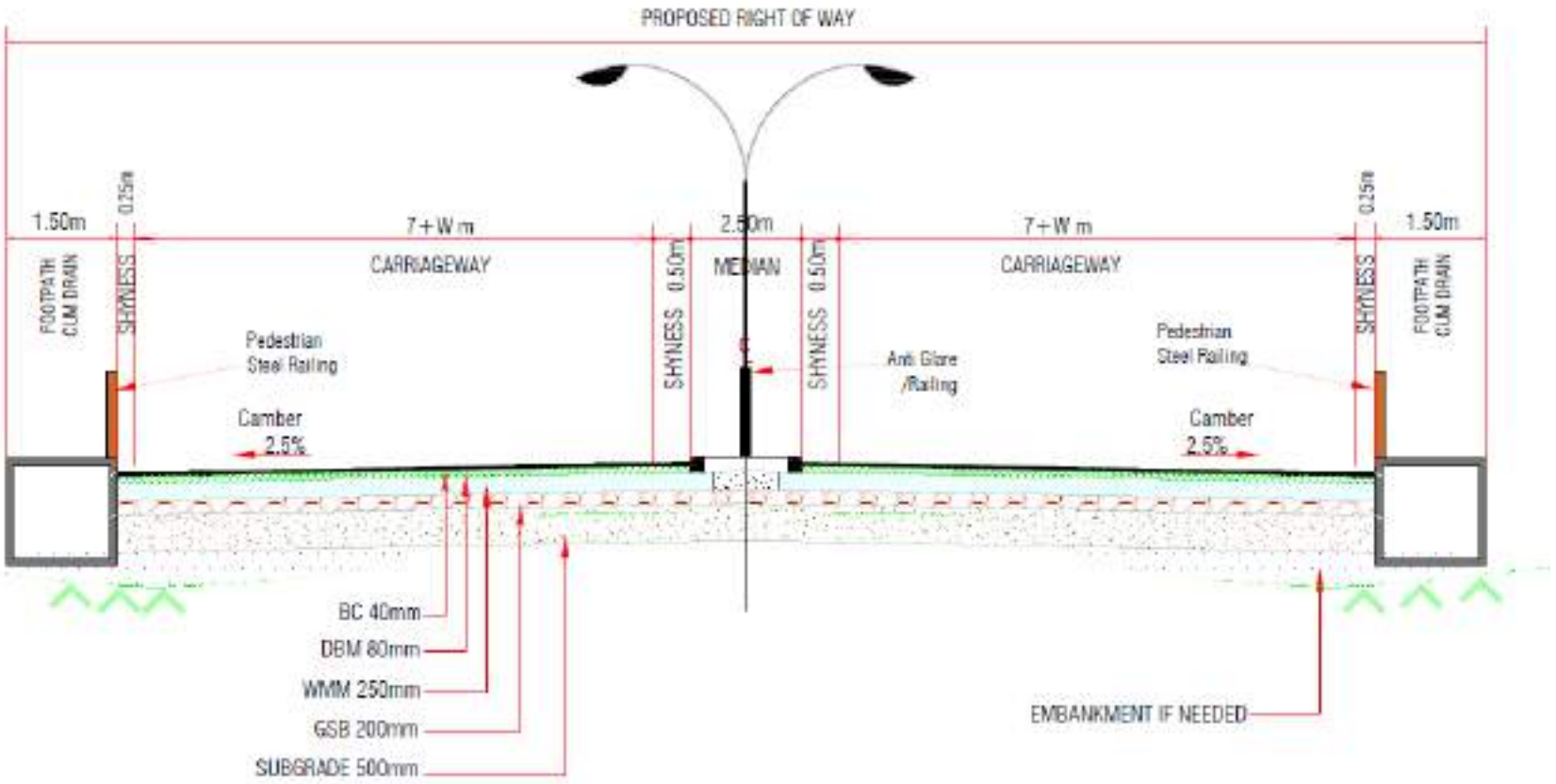


TYPICAL CROSS SECTION -7(TYPE-II)



TYPICAL CROSS SECTION -7(TYPE-IV)



TYPICAL CROSS SECTION -8

5.6 Pavement design

5.6.1 Design period, loading and pavement type

Using the projected traffic, VDF values, lane and directional distribution factors, the design traffic loading used for the project is 20 MSA.

Through preliminary design and lifecycle comparisons, the type of pavement was chosen for construction with a design life of 20 years has been considered for design.

5.6.2 Design sub-grade strength

Considering the soil investigations conducted in the project road area, and the availability of suitable soil in the region, the following sub-grade strength has been assumed to vary from 7.0% to 8.0% for various sections of the highway.

5.6.3 Pavement Composition for New Carriageway

The pavement design has been carried out to arrive most economic Pavement for main carriageway and service Road. Three pavement Composition options were considered.

1) Option-1: Conventional Pavement Design Composition
2) Option-2: Cement Treated Sub Base and Base Pavement Design Composition
3) Option-3: Cement Treated Sub Base Pavement Design Composition

The proposed pavement composition for the new sections carriageway basis "The Manual of Standards and Specifications for "Two Laning of Highways with Paved Shoulder published by Indian Roads Congress IRC:SP:73-2018", subgrade strength and design traffic is:

Table 5-4: Proposed pavement composition for Option-1: Conventional Pavement Design

Pavement Layer		Thickness for Main carriage way in mm for 20 MSA	Thickness for Service road carriage way in mm for 10 MSA
Bituminous	BC	40	30
	DBM	80	60
Granular	WMM	250	250
	GSB	200	200
Total Thickness		570	540

Table 5-5: Pavement Composition for Option-2: Cement Treated Sub Base and Base Pavement Design

Pavement Layer		Thickness for Main carriage way in mm for 20 MSA	Thickness for Service road carriage way in mm for 10 MSA
Bituminous	BC	50	40
Granular	Granular Crack Relief Layer AIL	100	100
	CTB	115	100
	CTSB	200	200
Total Thickness		465	440

Table 5-6: Pavement Composition for Option-3: Cement Treated Sub Base Pavement Design

Pavement Layer		Thickness for Main carriage way in mm for 20 MSA	Thickness for Service road carriage way in mm for 10 MSA
Bituminous	BC	30	40
	DBM	50	
Granular	WMM	150	150
	CTSB	200	200
Total Thickness		430	390

For Elephant crossing locations the interlocking block pavement has been provided as per IRC: SP: 63-2018. The minimum block Thickness 80-100 mm.

5.6.4 Strengthening of existing pavement

The strengthening requirements for the existing pavement have been estimated from the deflection measurements and estimated traffic loadings. The designed overlay proposed is as below:

Table 5-7: Overlay thickness required

Section	Chainage	Distance	Characteristic deflection	Overlay thickness (mm)
NA				

5.7 Design of Structures

Along the project stretch, there are several bridges, culverts, under/overpasses and flyovers. All new bridges have been proposed with a footpath on left side of the traffic direction. Overall width of all new culverts has been proposed to equal to roadway width of the approaches. The outer most face of railing/parapet has been in line with the outer most edge of shoulder. A summary of the total number and proposed additions is given in the table below

Table 5-8: Improvement proposals for Bridges and Culverts

Sr. No.	Particular	Existing Structure	Proposed				Left out	Total Proposed Structures
			Widening	Retain	Reconstruction	New Additional		
1	Major Bridge	Nil	--	--	--	--	--	--
2	Minor Bridge	11	7	--	4	1		12
3	Pipe Culverts	105	42	8	27	6	22	83
4	Slab Culverts	31	10	6	7	--	8	23
5	Box Culverts	Nil	--	--	--	31	--	31

5.8 Intersections and Grade Separators

Based on the traffic and turning movement surveys conducted, 31 junctions have been identified for redesign or grade separation, the details of which are given below

Table 5-9: Details of the Junctions

Sl. No.	Location of intersection(Design Chainage)	Type of intersection	Other features
(1)	(2)	(3)	(4)
Major Intersections			
1	22.800	Y	Bypass
2	23.425	X	MDR
3	23.975	Y	Bypass
Minor Intersections			
1	20.940	X	VR
2	21.680	T	VR
3	22.845	Y	VR
4	26.055	T	VR
5	27.175	T	VR
6	28.050	T	VR
7	28.600	T	VR
8	30.275	T	VR
9	31.275	T	VR
10	31.475	T	VR
11	31.830	Y	VR
12	31.860	Y	VR
13	32.595	T	VR
14	33.445	T	VR
15	33.620	T	VR

Sl. No.	Location of intersection(Design Chainage)	Type of intersection	Other features
(1)	(2)	(3)	(4)
16	33.725	Y	VR
17	33.875	T	VR
18	34.210	T	VR
19	34.425	Y	VR
20	34.650	T	VR
21	35.195	T	VR
22	38.295	Y	VR
23	39.485	T	VR
24	40.500	T	VR
25	40.700	Y	VR
26	41.950	Y	VR
27	43.025	T	VR
28	45.625	Y	VR

5.9 Drainage

An effective and efficient drainage system has been proposed for entire project highway including structures and facilities to avoid water logging. The storm water from road and adjacent areas shall be intercepted and carried through road side drains to the nearest natural outfalls. RCC footpath cum Drain and Open side trapezoidal PCC lined cross section drain has been provided as per TCS for the project Highway in order to intercept surface water from the carriageway, shoulders and slopes.

Table 5-10: Location of proposed Line Drains

S. No.	Proposed Type	Remarks	Length (m)
(1)	(2)	(3)	(4)
1	RCC Rectangular drain Cum Foot PATH	TCS 8	2X1850
2	PCC Trapezoid Lined Drain on Hill Sides	TCS 7 (TYPE I) TCS 7 (TYPE II) TCS 7 (TYPE IV)	2X175 2X4125 1X475
3	Longitudinal Subsurface Drain	TCS 7 (TYPE I) TCS 7 (TYPE II) TCS 7 (TYPE IV)	2X175 2X4125 1X475

5.10 Toll plazas

Based on the traffic surveys, O-D surveys and layout of project road, No Toll Plaza shall be provided. Toll plazas are proposed along the project road:

Table 5-11: Location of current and proposed toll plazas

Existing chainage	Design chainage	Location	Existing no of lanes	Proposed no of lanes
NA				

5.11 Slope Protection Works

The side slopes have been provided using suitable slope protection measures; such as Turfing & Vegetation, Stone pitching and Toe wall, drainage chutes, energy dissipation basin at toe of chutes wherever required along the Project Highway conforming to IRC guidelines and standard specifications have been proposed.

a) Stone Pitching

Sr. No.	Chainage (Km)		Design Length (Km)	TCS Code	Remarks
	From	To			
(1)	(2)	(3)	(4)	(5)	(6)
1	23100	23800	700	TCS 6	Both sides of embankment slopes
2	32000	32040	40	TCS 6A	One side of embankment slopes
3	36210	36285	75	TCS 6E	Both sides of embankment slopes
4	38410	38450	40	TCS 6E	Both sides of embankment slopes
5	39035	39085	50	TCS 6E	Both sides of embankment slopes

b) Toe Wall (PCC 2M)

Sr. No.	Chainage (Km)		Design Length (Km	TCS Code	Remarks
	From	To			
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
1	22800	23100	300	TCS 5	Both side

c) Seeding and Mulching

Sr. No.	Chainage (Km)		Design Length (Km	TCS Code	Remarks
	From	To			
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
1	41100	45225	4125	TCS 7 Type II	Both Side

d) Hill Side Gabion Wall

Sr. No.	Design Ch. (Km)		Length (Km)	TCS	Remarks
	From	To			
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
1	41100	45225	4125	TCS 7 type II	Minimum 6 m Height Gabion Wall both side of Hill cutting
2	46425	46600	175	TCS 7 type I	Minimum 4 m Height Gabion Wall both side of Hill cutting
3	46600	47075	475	TCS 7 type IV	Minimum 4 m Height Gabion Wall one side of Hill cutting
Total Length OF 4 m wall in Km.			=2x0.175+1x0.475=0.825		
Total Length OF 6 m wall in Km.			=2x4.125=8.25		

5.12 Project Facilities

The following Project facilities have been included in the Project.

- Traffic Control Devices and Road Safety Works;
  - (a) Road Signs
  - (b) Road Marking
  - (c) Road Delineator
  - (d) Reflective Pavement Markers (Road Studs)
  - (e) Roadside & Median Side Safety Barriers
- Pedestrian facilities;
- Land Scoping & Tree Plantation
- Project Facilities
  - (a) Road Boundary Stone
  - (b) Kilometre & 200 m Stone
  - (c) Street Lighting
  - (d) Truck lay-byes;
  - (e) bus-bays and bus shelters;
  - (f) Highway Petro Units

(g) Emergency Medical Services Cranes;

(h) Crane Services

(i) Communication System

- Traffic Diversion during Construction
- Others

(a) Utilities Ducts

6 . Environmental impact assessment

An environmental impact study was undertaken during the process of creating the detailed project report to understand impact of the project road on the surrounding ecology and environment. The Project Highway Length is approximately 79.0 Km. Hence, the Environmental Clearance (EC) is not required for the Project Highway under Schedule 7(f) as per S.O. 2559 (E), MoEF Notification of 22nd August 2013 (as amendment of 14th September 2006) i.e., Expansion of National Highways greater than 100 km involving additional right of way or land acquisition greater than 40m on the existing alignments and 60m on re-alignment or bypasses. Hence No package out six does not attract Environment Clearance.

The proposed Project does not involve the acquisition of forest land in Package-II in the North Garo Hill District in State of Meghalaya. The DFO has issued NOC for package-II in this regard. However, no loss of rare/threatened/endangered species of flora is envisaged. All impacts are site-specific and can be addressed through proven mitigation measures. Hence, the project is warranting an initial environmental examination (IEE). The EIA & EMP report has been prepared as per MOEF & CC Guidelines

The Project Highway Package-II does not pass any Protected Area Network Hence, Wild Life clearance is not required. In this regard DFO has issued the necessary certificate. However the some elephant movement had been noticed. There two locations has been identified for Elephant crossing. The DFO & Chief Wild life waden (CWLW) has suggested some mitigation measures which has been incorporated in Draft DPR. The typical diagram is enclosed.

The Environmental Mitigation and Management Costs were developed based on the estimation of resources required to implement the mitigation measures proposed and also number of places where intervention is required. Environmental mitigation cost for the proposed project is Rs 1.0 Cr. including road side tree cutting.

7 . Social impact assessment and Land acquisition

7.1 Social impact assessment

The existing 2-lane Road has RoW 15-22.5 m, which is inadequate for the proposed widening. The land width for 2-lane has been proposed 45 m and 36 m in Rural Areas and Built-up.

Sl. No.	Design Chainage		ROW		Total Width of ROW (m)	Remarks
	From	To	LHS (m)	RHS (m)		
(1)	(4)	(5)	(6)	(7)	(8)	(9)
1	20900	21660	22.5	22.5	45	Minor Realignment
2	21660	22394	18	18	36	Berubari Built-Up Area
3	22394	32631	22.5	22.5	45	
4	32631	33355	18	18	36	Mendul Built-Up Area
5	33355	33743	22.5	22.5	45	
6	33743	34056	18	18	36	Gokul Built-Up Area
7	34056	35000	22.5	22.5	45	
8	35000	35889	22.500	22.500	45.000	
9	35889	36089	40.000	25.000	65.000	
10	36089	39294	22.500	22.500	45.000	
11	39294	40166	18.000	18.000	36.000	Rari Built Up Area
12	40166	40231	30.000	30.000	60.000	
13	40231	41284	25.000	25.000	50.000	
14	41284	41731	50.000	25.000	75.000	
15	41731	41933	50.000	50.000	100.000	
16	41933	42480	50.000	25.000	75.000	
17	42480	42892	50.000	40.000	90.000	
18	42892	43802	50.000	25.000	75.000	
19	43802	43957	50.000	40.000	90.000	
20	43957	44292	50.000	25.000	75.000	
21	44292	44698	50.000	40.000	90.000	
22	44698	46525	22.500	22.500	45.000	
23	46525	47054	30.000	20.000	50.000	
24	47054	47.075	22.500	22.500	45.000	

The Project Highway require total 130.64 Ha out of that 52.82 Ha land is available and remaining 77.82 Ha Private land need to be acquired.

Preliminary interactions have been held with locals to understand their issues and concerns and help communicate the project plan and its impact on them. The key concerns of title and non-title holders centered on Compensation of Land and Assists

7.2 Land acquisition requirements

The state and district wise details and status of land acquisition as on the date of publishing of this report is as follows:

Table 7-1: Cost for the Land Acquisition

Sr. No.	Particular	Assam
1	Chainage	From Km 20.900 to Km 47.075
2	Total Land Required for Project in Ha	130.64 Ha
3	Land Available in Ha	52.82
4	Land Need to be acquired in Ha	77.82 Ha (Private Land) +0.00 ha Government including forest
5	Total Compensation (in Cr.) Lum sum	Rs. 175.10 Cr.

A total of Rs. 175.10 crores is expected to be awarded for the acquisition of land required for this project. The land acquisition process is underway with a total of One CALAs appointed.

7.3 Key risks envisaged in land acquisition

No Major risk has been envisaged in the Proposed Project Highway.

8 . Utilities shifting and clearances

Utilities belonging to user agencies 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 the user agencies and initial estimates have been received from the concerned agencies. The process of site inspection, review and revision of the proposals for utilities shifting is in process.

To enable better management of utilities and installation going forward, all utilities are being shifted underground/into a utility corridor/out of the road RoW/ utilities trench is being planned as part of construction>

8.1 Utilities shifting estimates

Table 8-1: Key utilities shifting requirements

Sl No	Utility	Chainage affected	Agency	Shifting required	Estimated cost Cr.	Supervision	Current status
1	Electrical	Most of Project Highway	MePDCL	Yes	Rs. 7.05	Rs. 89.77 Lakhs	Final estimate has been submitted
2	Water Supply	At three locations	PHE	Yes	Rs. 0.76	Rs 11.24 Lakhs	Final estimate has been submitted
			Total in Cr.		Rs. 7.81	Rs 1.01	

8.2 Total cost of utilities shifting

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

9 . Project cost estimates

The cost estimates for the project has been carried out based on detailed design, bill of quantities, and the schedule of rates for NH BSR-2018-19 Garo Hills Meghalaya. The summary of Cost estimate for various options are as follows

Table 9-1: Summary of project cost for Option 1 Conventional Pavement

BILL SUMMARY				
		Based on Meghalaya PWD NH BSR 2018-19		
S.N.	PARTICULAR	Amount (INR)	Amount (INR) without GST	Amount in Cr
1	BILL NO: 1 SITE CLEARANCE AND DISMANTELING	3261283	2911860	0.29
2	BILL NO: 2 - EARTHWORK	702818089	627516151	62.75
3	BILL NO: 3 - SUB-BASE AND BASE COURSES			
	a) GSB	224239934	200214227	20.02
	b) WMM	218262122	194876895	19.49
	c) CTSB	0	0	0.00
	d) CTB	0	0	0.00
4	BILL NO: 4 (A) - BITUMINOUS WORKS - FLEXIBLE PAVEMENT			
	a) DBM	303159962	270678537	27.07
	b) BC	165554798	147816784	14.78
	c)Tack Coat	9991582	8921056	0.89
	d) Prime Coat	14108457	12596836	1.26
	BILL NO: 4 (B) - RIGID PAVEMENT	0	0	0.00
5	BILL NO: 5 CULVERTS			
A	Box Culvert (New/Reconstruction)	93512078	83492927	8.35
B	Box Culvert (Widening)	13719721	12249751	1.22
C	Pipe Culvert (New/Reconstruction)	25971433	23188779	2.32
D	Pipe Culvert (Widening)	23314554	20816566	2.08
E	Protection Work	54416608	48586257	4.86
F	Culvert Repairing	2458484	2195075	0.22
6	BILL NO:6 BRIDGES			
A	MINOR BRIDGES			
i)	SLAB MNB (New/Reconstruction)	74339729	66374758	6.64
ii)	SLAB MNB (Widening)	71778735	64088156	6.41
iii)	RCC GIRDER MNB	93206642	83220216	8.32
iv)	Protection Work	28285162	25254609	2.53

v)	Minor Bridge Repairing	7810065	6973272	0.70
7	BILL NO: 7 DRAINAGE & PROTECTION WORK	556511560	496885321	49.69
8	BILL NO: 8 - TRAFFIC SIGNS, ROAD MARKINGS AND APPURTENANCES	85203583	76074628	7.61
9	BILL NO: 9 - Passenger Shelter	4600000	4107143	0.41
10	BILL NO: 10 - Utility Duct	421763	376574	0.04
11	BILL NO: 11 - Street Lighting	2186111	1951885	0.20
12	Truck Lay bye	19205448.0	17147721	1.71
13	Junction	16228136.0	14489407	1.45
14	Tree Cutting @1000/ tree for 6000 trees		6000000	0.60
15	Muck Dumping		312675	0.03
	Civil Cost As Per SOR 2018-19 Exclusive GST		**2519318067**	251.93
A	**Civil Cost In 2021-22 Considering Inflation Rate 21.56% (Cost Index Feb 2022: 144.9, Cost Index June 2018:119.2)**		**3062483042**	**306.25**
	Utility Shifting			
B1	**Electrical**		**52241503**	5.22
B2	**Water**		**6451185**	0.65
B	**Cost of Utility Shifting**		**58692688**	**5.87**
C	**Estimated Civil Cost/ Cost Put to Tender (A+B)**		**3121175730**	**312.12**
	GST @ 12% of A		**367497965**	**36.75**
	GST as per Estimate given by Agency		**10023409**	**1.00**
	GST @ 18% of B2		**1161213**	**0.12**
	Contingencies @1% Of (C)		31211757	**3.12**
	Agency Charges @3% Of (C)		93635272	**9.36**
	O&M Cost For Last Five Years After Construction @2.5% Of (C)		78029393	**7.80**
	Supervision Charges @ 3% Of (C)		93635272	**9.36**
	Price Escalation @ 5% per year for 1 year on C		156058786	**15.61**
	Add other charges of Utility Shifting (Supervision @ 15%)		9448611	**0.94**
D	**Total Project Civil Cost**		3961877409	**396.19**
E	Land Acquisition Provisional Cost @ 2.25 Cr/Hect.		1750950000	**175.10**

F	Forest Clearnace & Environment Cost		0	**0.00**
G	Approx Cost of Environment Mitigation		10000000	**1.00**
H	**Total Non Civil Cost (E+F+G)**		1760950000	**176.10**
I	**Total Project Cost (D+H)**		5722827409	**572.28**

Table 9-2: Summary of project cost for Option 2 Cement Treated Sub-Base Pavement

BILL SUMMARY				
		Based on Meghalaya PWD NH BSR 2018-19		
S.N.	**PARTICULAR**	**Amount (INR)**	**Amount (INR)**	**Amount in Cr**
1	BILL NO: 1 SITE CLEARANCE AND DISMANTELING	3261283	2911860	0.29
2	BILL NO: 2 - EARTHWORK	702396536	627139764	62.71
3	BILL NO: 3 - SUB-BASE AND BASE COURSES			
	a) GSB	80562901	71931162	7.19
	b) WMM	241803489	215895972	21.59
	c) CTSB	136408824	121793593	12.18
	d) CTB	0	0	0.00
4	BILL NO: 4 (A) - BITUMINOUS WORKS - FLEXIBLE PAVEMENT			
	a) DBM	261512842	233493609	23.35
	b) BC	151693780	135440875	13.54
	c)Tack Coat	9936351	8871742	0.89
	d) Prime Coat	15075448	13460222	1.35
	BILL NO: 4 (B) - RIGID PAVEMENT	0	0	0.00
5	BILL NO: 5 CULVERTS			
A	Box Culvert (New/Reconstruction)	93512078	83492927	8.35
B	Box Culvert (Widening)	13719721	12249751	1.22
C	Pipe Culvert (New/Reconstruction)	25971433	23188779	2.32
D	Pipe Culvert (Widening)	23314554	20816566	2.08
E	Protection Work	54416608	48586257	4.86
F	Culvert Repairing	2458484	2195075	0.22
6	BILL NO:6 BRIDGES			
A	MINOR BRIDGES			
i)	SLAB MNB (New/Reconstruction)	74339729	66374758	6.64
ii)	SLAB MNB (Widening)	71778735	64088156	6.41

iii)	RCC GIRDER MNB	93206642	83220216	8.32
iv)	Protection Work	28285162	25254609	2.53
v)	Minor Bridge Repairing	7810065	6973272	0.70
7	BILL NO: 7 DRAINAGE & PROTECTION WORK	556511560	496885321	49.69
8	BILL NO: 8 - TRAFFIC SIGNS, ROAD MARKINGS AND APPURTENANCES	88918383	79391413	7.94
9	BILL NO: 9 - Passenger Shelter	4600000	4107143	0.41
10	BILL NO: 10 - Utility Duct	421763	376574	0.04
11	BILL NO: 11 - Street Lighting	2186111	1951885	0.20
12	Truck Lay bye	10855487.0	9692399	0.97
13	Junction	8719524.0	7785289	0.78
14	Tree Cutting @1000/ tree for 6000 trees		6000000	0.60
15	Muck Dumping		312675	0.03
	Civil Cost As Per SOR 2018-19 Exclusive GST		**2473881866**	247.39
A	**Civil Cost In 2021-22 Considering Inflation Rate 21.56% (Cost Index Feb 2022: 144.9, Cost Index June 2018:119.2)**		**3007250796**	**300.73**
	Utility Shifting			
B1	**Electrical**		**52241503**	5.22
B2	**Water**		**6451185**	0.65
B	**Cost of Utility Shifting**		**58692688**	**5.87**
C	**Estimated Civil Cost/ Cost Put to Tender (A+B)**		**3065943484**	**306.59**
	GST @ 12% of A		**360870096**	**36.09**
	GST as per Estimate given by Agency		**10023409**	**1.00**
	GST @ 18% of B2		**1161213**	**0.12**
	Contingencies @1% Of (C)		30659435	**3.07**
	Agency Charges @3% Of (C)		91978305	**9.20**
	O&M Cost For Last Five Years After Construction @2.5% Of (C)		76648587	**7.66**
	Supervision Charges @ 3% Of (C)		91978305	**9.20**
	Price Escalation @ 5% per year for 1 year on C		153297174	**15.33**
	Add other charges of Utility Shifting (Supervision @ 15%)		9448611	**0.94**
D	**Total Project Civil Cost**		3892008619	**389.20**

E	Land Acquisition Provisional Cost @ 2.25 Cr/Hect.		1750950000	**175.10**
F	Forest Clearnace & Environment Cost		0	**0.00**
G	Approx Cost of Environment Mitigation		10000000	**1.00**
H	**Total Non Civil Cost (E+F+G)**		1760950000	**176.10**
I	**Total Project Cost (D+H)**		5652958619	**565.30**

Table 9-3: Summary of project cost for Option 3 Cement Treated Base and Cement Treated Sub-Base Courses Pavement

BILL SUMMARY				
		Based on Meghalaya PWD NH BSR 2018-19		
S.N.	**PARTICULAR**	**Amount (INR)**	**Amount (INR)**	**Amount in Cr**
1	BILL NO: 1 SITE CLEARANCE AND DISMANTELING	3261283	2911860	0.29
2	BILL NO: 2 - EARTHWORK	645508407	576346792	57.63
3	BILL NO: 3 - SUB-BASE AND BASE COURSES			
	a) GSB	80562901	71931162	7.19
	b) WMM	209300036	186875032	18.69
	c) CTSB	137571742	122831912	12.28
	d) CTB	57398665	51248808	5.12
4	BILL NO: 4 (A) - BITUMINOUS WORKS - FLEXIBLE PAVEMENT			
	a) DBM	170675927	152389221	15.24
	b) BC	178125685	159040790	15.90
	c)Tack Coat	7824511	6986171	0.70
	d) Prime Coat	14161934	12644584	1.26
	BILL NO: 4 (B) - RIGID PAVEMENT	0	0	0.00
5	BILL NO: 5 CULVERTS			
A	Box Culvert (New/Reconstruction)	93512078	83492927	8.35
B	Box Culvert (Widening)	13719721	12249751	1.22
C	Pipe Culvert (New/Reconstruction)	25971433	23188779	2.32
D	Pipe Culvert (Widening)	23314554	20816566	2.08
E	Protection Work	54416608	48586257	4.86
F	Culvert Repairing	2458484	2195075	0.22
6	BILL NO:6 BRIDGES			

A	MINOR BRIDGES			
i)	SLAB MNB (New/Reconstruction)	74339729	66374758	6.64
ii)	SLAB MNB (Widening)	71778735	64088156	6.41
iii)	RCC GIRDER MNB	93206642	83220216	8.32
iv)	Protection Work	28285162	25254609	2.53
v)	Minor Bridge Repairing	7810065	6973272	0.70
7	BILL NO: 7 DRAINAGE & PROTECTION WORK	556511560	496885321	49.69
8	BILL NO: 8 - TRAFFIC SIGNS, ROAD MARKINGS AND APPURTENANCES	85203583	76074628	7.61
9	BILL NO: 9 - Passenger Shelter	4600000	4107143	0.41
10	BILL NO: 10 - Utility Duct	421763	376574	0.04
11	BILL NO: 11 - Street Lighting	2186111	1951885	0.20
12	Truck Lay bye	8392703.0	7493485	0.75
13	Junction	7026360.0	6273536	0.63
14	Tree Cutting @1000/ tree for 6000 trees		6000000	0.60
15	Muck Dumping		312675	0.03
	Civil Cost As Per SOR 2018-19 Exclusive GST		**2379121945**	237.91
A	**Civil Cost In 2021-22 Considering Inflation Rate 21.56% (Cost Index Feb 2022: 144.9, Cost Index June 2018:119.2)**		**2892060636**	**289.21**
	Utility Shifting			
B1	**Electrical**		**52241503**	5.22
B2	**Water**		**6451185**	0.65
B	**Cost of Utility Shifting**		**58692688**	**5.87**
C	**Estimated Civil Cost/ Cost Put to Tender (A+B)**		**2950753324**	**295.08**
	GST @ 12% of A		**347047276**	**34.70**
	GST as per Estimate given by Agency		**10023409**	**1.00**
	GST @ 18% of B2		**1161213**	**0.12**
	Contingencies @1% Of (C)		29507533	**2.95**
	Agency Charges @3% Of (C)		88522600	**8.85**
	O&M Cost For Last Five Years After Construction @2.5% Of (C)		73768833	**7.38**
	Supervision Charges @ 3% Of (C)		88522600	**8.85**
	Price Escalation @ 5% per year for 1 year on C		147537666	**14.75**

	Add other charges of Utility Shifting (Supervision @ 15%)		9448611	**0.94**
D	**Total Project Civil Cost**		3746293066	**374.63**
E	Land Acquisition Provisional Cost @ 2.25 Cr/Hect.		1750950000	**175.10**
F	Forest Clearnace & Environment Cost		0	**0.00**
G	Approx Cost of Environment Mitigation		10000000	**1.00**
H	**Total Non Civil Cost (E+F+G)**		1760950000	**176.10**
I	**Total Project Cost (D+H)**		5507243066	**550.72**

Note: Rates considered: P.W.D Schedule of rates 2018-19 along with upto date addenda and corrigenda.

Conventional Pavement composition has been recommended for construction based on the reasons as under:

i. The existing pavement proposed for retaining and widening with full width overlay of DBM and BC (along with profile correction course, as required at site) is 14.840 Km out of 26.175 Km. Therefore, to make the layers of widening stretches and new construction stretches homogenous with the existing crust, a conventional pavement composition has been recommended.

ii. Shorter stretches of new construction. And hence considering other type of pavement composition with different layer thickness and composition, that will make the layers uneven and non-homogenous w.r.t the existing pavement.

10 .Material investigation

Material investigations were carried out to explore the availability and identify sources of suitable material for the construction of the road. The summary of source of available material along with lead are as follow

Table 10-1: Lead of Material

Sl. No	Name of Material	Place	Distance from Source to Start/ End Point of Project Road	Distance up to Project C.G from Start/ End Point (km)	Total Lead (Km)
1.00	Sand (Fine)	Samanda. On Williom Nagar Road	46.75	13.24	59.99
2.00	Moorum/ Rubbish	Samanda. On Williom Nagar Road	46.75	13.24	59.99
3.00	Stone Metal	Samanda. On Williom Nagar Road	46.75	13.24	59.99
4.00	Stone Boulder	Samanda. On Williom Nagar Road	46.75	13.24	59.99
5.00	Stone Chips, Aggregate	Samanda. On Williom Nagar Road	46.75	13.24	59.99
6.00	Coarse Sand	Didram Riber Bajengdoba Area	0.00	13.24	13.24
7.00	Lime	Bongaigaon Assam	106.40	13.24	119.64
8.00	Cement	Bongaigaon Assam	106.40	13.24	119.64
9.00	Steel	Bongaigaon Assam	106.40	13.24	119.64
10.00	Tar, Bitumen	Haldia West Bengal	980.00	58.09	1038.09
11.00	Bitumen Emulsion	Haldia West Bengal	980.00	58.09	1038.09
12.00	Structural Steel	Bongaigaon Assam	106.40	13.24	119.64

11 .Economic & Financial analysis and Implementation

11.1 Economic & Financial

The EIRR of the project has been carried out using which more than 12 % of threshold limit. Similarly as per the financial analysis the Project Highway is financially not viable on PPP VGF model or it may not attract any investor for Hybrid annuity model Execution plan.

11.2 Packaging

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

11.3 Bidding mode and timelines

The authority has proposed to initiate bidding of the project under EPC upon reviewing the improvements planned and in consultation with NHIDCL, the design and construction period for this project has been arrived at 24 months from the date of appointment of the contractor. This also includes a traffic management and lane closure plan for the period of construction.

12 .Conclusions and recommendation

The development of project road shall improve transport efficiency of Assam and Meghalaya and also serve strategic defense purposes.

This will be realized by

(i) improving the region & highway network,

(ii) facilitating safe and appropriate road usage,

(iii) increasing efficiency of transport services

Project's immediate outcome will improve accessibility to social services and markets, increase fuel efficiency, reduce travel time and accidents, vehicle emissions and better employment opportunities outside agriculture, both through improved access to economic centers and increase industrial activities in the project area.

Apart from this, the developments of this road link enhance the land values many folds along the proposed Project Road.

The Project road meets the present and future requirements of the area in terms of services and utilities. Hence, looking at above potentials it is recommended that this Improvement of road should be done.