

Consultancy services for feasibility study, preparation of DPR & providing pre-construction services for up-gradation of selected road stretches/corridors to Two lane with paved shoulder NH configuration under BHARATMALA Project and National Highways connectivity to Backward areas/Religious/Tourist places of the country **in the state of Tripura.**

Package I : Agartala – Khowai Section :: Section II (design km 19.300 to km 31.300 (Length = 12.000 km)

CHAPTER 0.0:

EXECUTIVE SUMMARY

0.1 Background

National Highways and Infrastructure Development Corporation (NHIDCL) has proposed the feasibility study, preparation of DPR & providing pre-construction services for up- gradation of selected road stretches/corridors to two lane with paved shoulder NH configuration under BHARATMALA Project and National Highways connectivity to Backward areas/Religious/Tourist places of the country in the state of Tripura.

Under this scheme, the consultancy work is awarded to M/s. Technocrats Advisory Services Pvt. Ltd. in association with Vaishnavi Infratech Services Private Limited. for preparation of Detailed Project Report of **Agartala – Khowai section (NH -108 B).**

The existing length of project road is 13.600 km and design length after geometric improvement and proposed bypasses is 12.000 km.



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0.2 Consultancy Services

The consultancy services are to be provided in three stages as brought out below.

Stage 1: Inception Report (IR) & Quality Assurance Plan (QAP)

Stage 2: Feasibility Report

Stage 3: Detailed Project Report (DPR)

0.3 Objectives

The main objective of the consultancy service is to establish the technical, economical, and financial viability of the project and prepare detailed project reports for **Agartala – Khowai Section (NH-108B).**

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

0.4 Scope of Services

- The Consultant is required to suggest alternative alignments (minimum 3 nos.) for proposed bypasses, As far as possible, existing road having adequate ROW shall be include in the alignment. The widening/ improvement work to 2 lane with paved shoulder shall be within the existing right of way avoiding land acquisition, except for locations having inadequate width and where provisions of short alignment corrections, improvement of intersections are considered necessary and practicable and cost effective. However, new alignment should also be considered, wherever improvement to 2 lane of the existing road is not possible. The Consultant shall furnish land acquisition details as per revenue records/maps for further processing.
- The general scope of services is given in the sections that follow. However, the entire scope of services would, inter-alia, include the items mentioned in the Letter of Invitation and the ToR. The Consultant will also make suitable proposals for widening/ improvement of the existing road to 2 lanes etc. and strengthening of the carriageways, as required at the appropriate time to maintain the level of service over the design period.
- All ready to implement 'good for construction' drawings shall be prepared.



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- Environmental Impact Assessment, Environmental Management Plan and Rehabilitation and Resettlement Studies shall be carried out by the Consultant meeting the requirements of MoEF / other statutory bodies.
- Wherever required, consultant will liaise with concerned authorities and arrange all clarifications. Approval of all drawings including GAD and detail engineering drawings will be got done by the consultant from the Railways. However, if Railways require proof checking of the drawings prepared by the consultants, the same will be got done by NHIDCL. Consultant will also obtain 'No Objection Certificate from Ministry of Environment and Forest and also incorporate the estimates for shifting of utilities of all types involved from concerned local authorities in the DPR. Consultant is also required to prepare all Land Acquisition papers (i.e. all necessary schedules as per L.A. act) for acquisition of land either under NH Act or State Act.
- The Consultant shall prepare and submit the cost estimate and bid documents at Feasibility report stage
- Consultant shall obtain all types of necessary clearances required for implementation of the project on the ground from the concerned agencies. The client shall provide the necessary supporting letters and any official fees as per the demand note issued by such concerned agencies from whom the clearances are being sought to enable implementation.

0.5 Key Professional Staff

Table 0.1 – Key Professional staff

Sl. No.	Position	Name
1	Team Leader	Mr. Bhola Shanker Pandey
2	Geo-Technical and Pavement Expert	Mr. Brijesh Mishra
3	Environmental Specialist	Mrs. Meena Bhaduri
4	Traffic cum Safety Expert	Mr. Salil Pathak
5	Hill Road / Tunnel Expert	Mr. P.K Dubey
6	Revenue / Survey Expert	Mr. Mahaveer Singh
7	Bridge Design Engineer	Mr. D.P. Singh
8	Contract Specialist	Mr. Vir Bahadur Singh



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0.6 Chainage Reference

The Co-ordinates of proposed centre line @20m interval are presented at the end of this chapter **Table 0.25:-**

0.7 Project Alignment Description

The Project road (existing) starts from T-Junction at Lichhubagan (at Agartala City - Airport road), passes through Lembuchhera, Fatikcherra, Mohanpur, Hezamara, Padambil and ends at Nripen Chakraborty Chowmuhani (At Khowai town).

The existing length of project road is 13.600 km and design length (with new proposals) is 12.000 km.

The Project road runs parallel to International border (India – Bangladesh) of some of its length.

Existing lane of Project road varies from two lane to single lane with fair to poor riding quality.

The Project Road alignment shown in figure below-



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Figure 0.1– Proposed alignment of Project Road

0.8 Right of Way (ROW)

There is no marking at ground of existing right of way along the Project road, also the details of existing RoW is not available with PWD, however as per visual inspection and local people enquire, it is found that maximum available ROW is varies upto 20 m.

The proposed RoW has been considered 18-45m (Refer table 0.2) for entire road stretch. The proposed RoW wrt to design chainages is presented below:

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Table 0.2:- Details of Proposed RoW

Sl. No.	Design Chainage (Km)		Length (m)	Adopted PROW		Total PROW	Remarks
	From	To		LHS	RHS		
1	19300	19350	50	9	9	18	
2	19350	20900	1550	15	15	30	
3	20900	21350	450	9	9	18	
4	21350	22200	850	15	15	30	
5	22200	23960	1760	15.5	29.5	45	Hezamara Bypass
6	23960	25100	1140	15	15	30	
7	25100	26000	900	9	9	18	
8	26000	26200	200	15	15	30	
9	26200	26600	400	20	20	40	Both Side Hill
10	26600	26800	200	23	17	40	
11	26800	26900	100	7	7	14	As Per Land Available
12	26900	27100	200	12	23	35	Hill
13	27100	27700	600	12	18	30	
14	27700	29100	1400	18	12	30	
15	29100	29300	200	12	18	30	
16	29300	29800	500	18	12	30	
17	29800	30000	200	12	18	30	
18	30000	30550	550	7	7	14	As Per Land Available
19	30550	31300	750	18	12	30	Hill

0.9 Abutting Land Use Pattern

Project road passing maximum in plain & rolling terrain, only in 6.0 km length it passes through hilly-mountainous terrain.

Built-up and partially built-up are existing along the both side of Project road.

The details of Forest length will be described after confirmation of forest land length from concerned department.

Land use pattern in graphical view is as follows-



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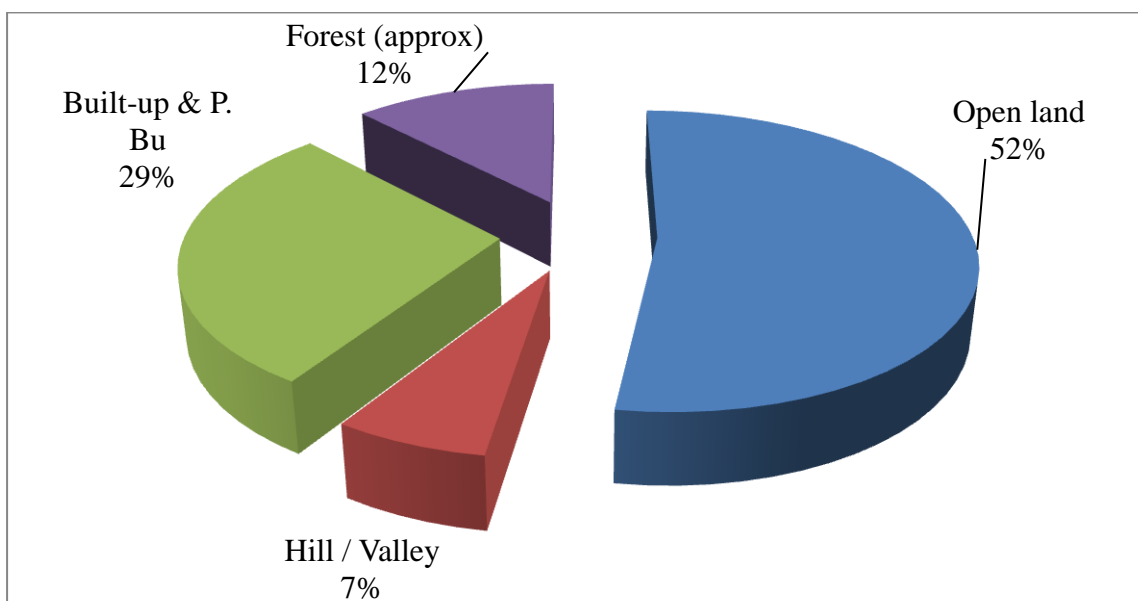


Fig 0.2- Land use Pattern

The terrain detail with reference to design chainages is presented below:-

Table 0.3 :- Details of Land

Sl. No	Design Chainage (Km)		Length (Km)	Terrain	Remarks
	From	To			
1	19.300	26.000	26.000	Plain & Rolling	
2	26.000	31.300	6.000	Hilly Terrain	

0.10 Terrain

Terrain is plain, rolling and mountainous.

• Design standards

Following design standards have been adopted as per Indian Roads Congress (IRC) guidelines, contained in IRC: 73, IRC: 86, IRC: 38, IRC 58-2011 and IRC: SP: 23 and is given in Table 0.4.



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Table 0.4- Design Parameters

Item	Plain / Rolling Terrain	Reference
Design Speed (kmph)	Ruling -100 Kmph (P) / 60kmph (M) Min.- 80 kmph (P) / 40kmph (M)	Table 2.1
Sight distance (minimum)	180 m (SSD) & 360m (ISD)	Table 2.6
Proposed Land width (ROW)	as per table 0.2 of “Executive summary”	
Lane configuration	2-lane with paved shoulders	
Formation width	1. 7.0 m of carriageway + 2.5 m Paved shoulder + 1.5m earthen shoulder (Fig. 2.2) of two lane manual (IRC SP-73: 2018)	
Edge strip	.25m Raised median	
	.5m Depressed Median	
Camber/cross fall	2.5 %	Table 2.7
Shoulders	2.5 % for paved shoulder and 3.0 % for earthen shoulder	Clause 2.8.2
Side Slope	1 (V): 2 (H) Fill (Fill height upto 3.0 m)	
	1 (V): 1.5 (H) Fill (Fill height 3 m to 6.0 m)	
	1 (V): 1 (H) Cut	
Maximum super-elevation	7.0 %	
Radii of horizontal curves in plain/hilly terrain (m)		Table 2.5
Drains		



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0.11 Surveys & Investigation

0.11.1 Traffic Surveys

Traffic surveys have been conducted at three locations.

Table 0.5: Traffic count survey locations

Sl. No.	Section	Chainage (Km)	Location	Remarks to Capture
1	Section I :: Km 0 to Km 24.300	Near Km 10.0 & Km 21.300	Before Agartala, Hezamara, Simna & Bijoy Nagar junction	Traffic coming from Agartala & moving towards simna, Khowai, Bijoy Nagar etc (both ways)
2	Section II :: Km 24.300 to Km 51.000	Near Km 45.600	Between in the homogenous section II	Traffic coming from Agartala, Simna, Bijoy Nagar & moving towards Khowai (both ways)

Growth Rate

The Adopted Traffic Growth rate is taken an average of 5% for all type of vehicles.

AADT, CVPD & Projected Traffic

Table 0.6- Commercial Vehicle Per day

SL. No.	Location	AADT	PCU	CVPD	Remarks
1	Km 10.00 (near Kamalghat)	2462	2292	311	
2	Km 21.300 (near Tarapur)	2566	2379	287	
3	Km 45.600 (near Padmabil)	2338	2082	196	



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Projected traffic on the project road is given below:

Table 0.7- Projected traffic

Year	Likely traffic on the Project road			Requirement of
	PCU at km 10.0 (Near Kamalghat)	PCU at km 21.300 (Near Tarapur)	PCU at km 45.600 (Near Padmabil)	
2017	2291	2379	2082	2 Lane
2020	2647	2762	2404	
2025	4035	4177	3648	
2030	5143	5327	4643	
2035	6565	6787	5917	
2040	8372	8660	7532	

As per the projected traffic & MoRT&H circular dated 26th May 2016, requirement for four lane is not qualifying upto year 2035 (For Plain terrain = 10000 PCU per day, for Rolling terrain = 8500 PCU per day & for Mountainous terrain = 6000 PCU per day), Hence, keeping view of importance of Project road, it is proposed to develop the Project Road as two lane with paved shoulder facility.

0.11.2 Axle load survey:

Though CVPD (as per above table) on all three locations are found very less (311, 287 & 196), so the Axle load survey could not carried out and the default values of VDF as per table 4.2 of IRC -37 : 2018 is considered 3.9 (for initial traffic volume 150-1500).

0.11.3 Testing of soil from existing embankment

The soil samples from various locations on the existing embankment have been collected by digging bore holes etc and subjected to laboratory testing for determination of various engineering properties. The CBR is found to be average of 8%.



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Table 0.8: - Existing Pavement Crust

Chainage (Km)	Position of Pit	Pavement Composition			Total (mm)
		Bitumen Layer (mm)	Brick Soling (mm)	Sub base Course (mm)	
21+000	RHS	40	265	-	305
21+500	RHS	50	245	-	295
22+000	LHS	30	255	-	285
22+500	RHS	30	245	-	275
23+000	LHS	45	210	-	255
23+500	RHS	50	210	-	260
24+000	LHS	35	235	-	270
24+500	RHS	35	210	-	245
25+000	LHS	45	155	-	200
25+500	RHS	45	175	-	220
26+000	LHS	35	180	-	215
26+500	RHS	35	155	-	190
27+000	LHS	35	160	-	195
27+500	RHS	35	165	-	200
28+000	LHS	40	195	-	235
28+500	RHS	45	250	-	295
29+000	LHS	35	200	-	235
29+500	RHS	45	225	-	270
30+000	LHS	35	255	-	290
30+500	RHS	30	260	-	290
31+000	LHS	50	230	-	280
31+500	RHS	50	245	-	295
32+000	LHS	40	220	-	260
32+500	RHS	40	195	-	235
33+000	LHS	40	265	-	305
33+500	RHS	50	255	-	305
34+000	LHS	35	245	-	280
34+500	RHS	40	200	-	240
35+000	LHS	45	240	-	285

Existing crust composition details







Detailed Project Report::

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CBR Test results of collected soil samples

	NORTH EAST SOIL TESTING (NEST)	Regd. Office : Ujan Abhoynagar, Opp. Post Office, Agartala , West Tripura, PIN - 799005 ,				
<u>TEST REPORT</u>						
Issue Date	: 25.03.17	Job No.	: B 5533			
Issued To	: TASPL	Date of Sample received	: 20.02.17			
Sample Deposited by	: Representative	Page	: 1 of 3....			
Sample Description	: Soil					
Location:- Agartala – Khowai Section						
Sl.No.	Chainage No. (Km)	MDD (g/cc)	OMC (%)	Unsoaked CBR (%)	Soaked CBR (%)	Swelling Index (%)
01	5.00	1.754	14.85	14.73	7.69	3.83
02	10.00	1.772	15.23	15.26	7.84	3.23
03	16.00	1.821	11.9	19.64	10.55	2.78
04	25.00	1.83	11.72	19.86	10.51	2.81
05	35.00	1.762	15.38	14.87	7.79	3.46
06	45.00	1.795	13.89	17.92	8.73	3.11
07	Borrow Area Near Km 12.00	1.801	13.33	18.35	9.65	2.98

Prepared by
Bhenuk
25/03/17
B. Tech (Civil)
Quality Manager,
North East Soil Testing,
Agartala-799005

(1) This test report pertains only to the sample tested. (2) This test report is valid at the time of and under the conditions specified here in. (3) Any correction invalidates this test report. This test report should not be published in part or in full by any body without written permission from 'NEST'. (4) Samples will be destroyed after 90 days from the date of reporting unless otherwise specified. (5) This report not to be reproduced wholly or in part & can not be used as an evidence in the court of Law & should not be used in any advertising media without our special permission in writing.



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0.11.4 Material survey

Aggregate quarry for structure works and road works is identified at Silchar (Assam) which is Approx 300 km away from Agartala.

Sand source has been located from local river with average lead of 20 km.

Borrow earth can be obtained from number of locations along the project road.

Cement for concrete works may purchase from local vendors of different grades of OPC & PPC.

Steel for concrete work may also use from local suppliers.

Bitumen supply is considered from Haldia IOCL with lead of approx. 1700 km.

0.12 Development Proposals

0.12.1 Pavement Design

Considering a growth rate of 5 % and VDF as 3.9 obtained from the IRC, design of pavement as per IRC 37 -2018 for a design life of minimum 20 years.

Accordingly design traffic has been worked out as 20MSA (as per 5.4.1 (i) of Two lane manual 2018) and considering sub-grade construction with soil of CBR not less than 8%, The Pavement compositions for Project road as per IRC 37-2018 (Plate 20) is as under:

- BC - 30 mm
- DBM - 50 mm
- WMM - 150 mm
- GSB - 200 mm



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0.12.2 Typical Cross Section and Widening Scheme

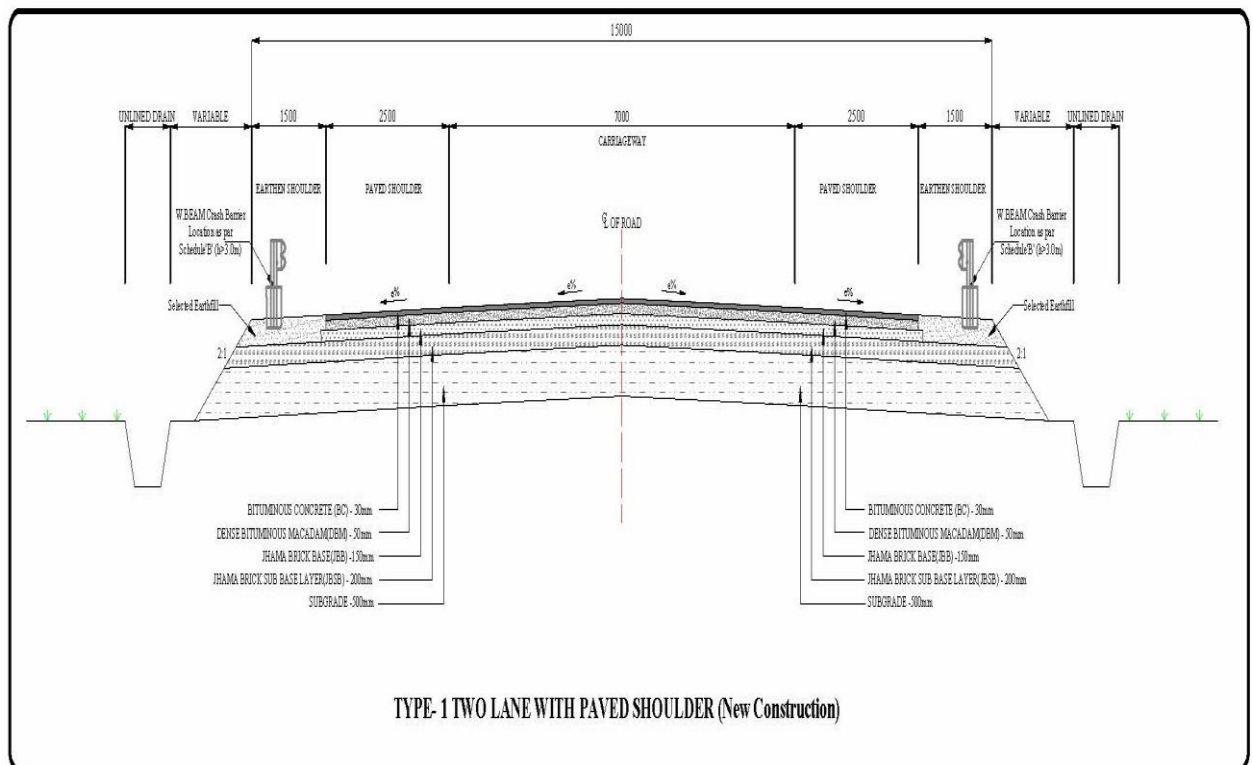
i) Roadway width -

- a. **For Plain areas -** Roadway width of 15.00 (7.0+2x2.5+2x1.5) is proposed for sections with 2 lane plus paved shoulders of 2.50m and unpaved shoulder of 1.50m on either side in plain areas and,
- b. **For Built-up areas -** Roadway width of 12.00 (7.0+2x2.5) is proposed for sections with 2 lane plus paved shoulders of 2.50m and RCC covered drain of 1m wide on either side of Road way,
- c. **For Hilly areas -** Roadway width of 10.00 (7.0+2x1.5) is proposed for sections with 2 lane plus paved shoulders of 1.50m (as per attached cross sections),

ii) Carriageway Width - Two Lane Carriage way (3.5m for each lane) is proposed,

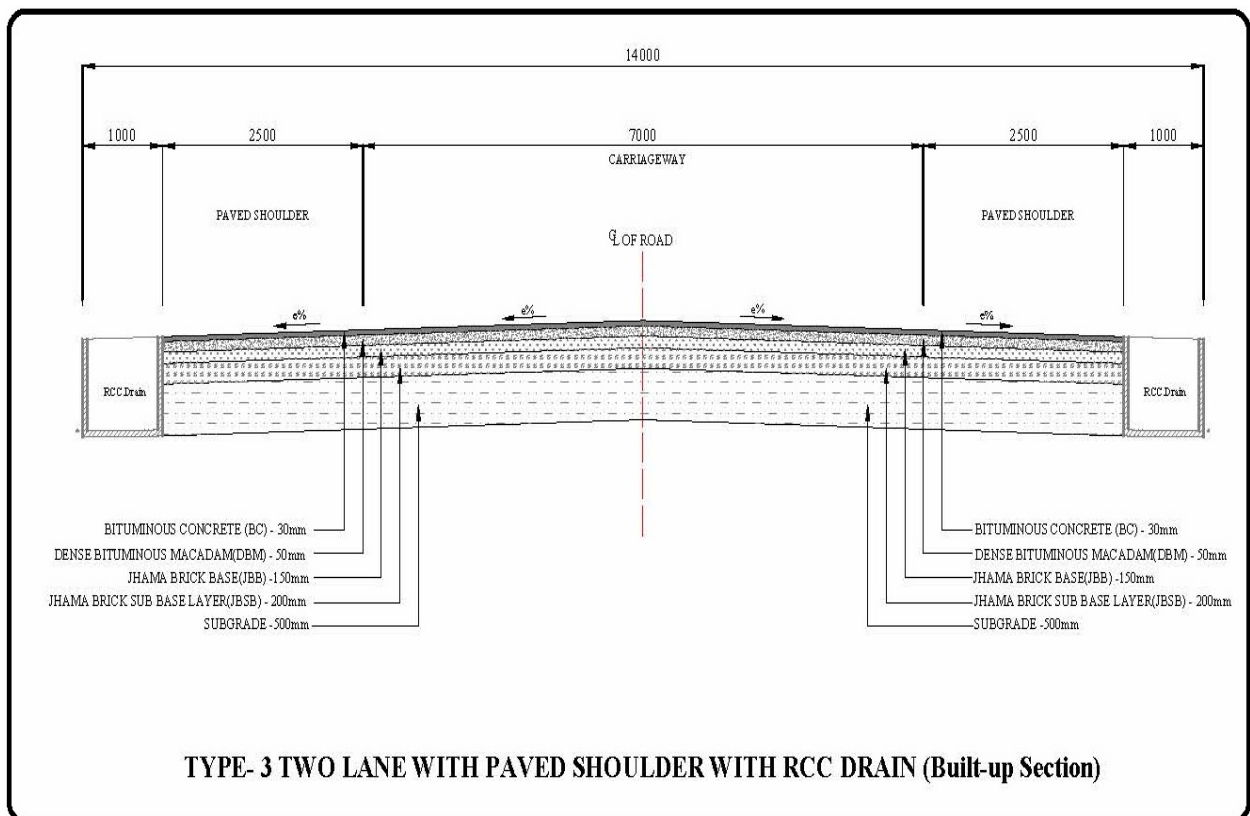
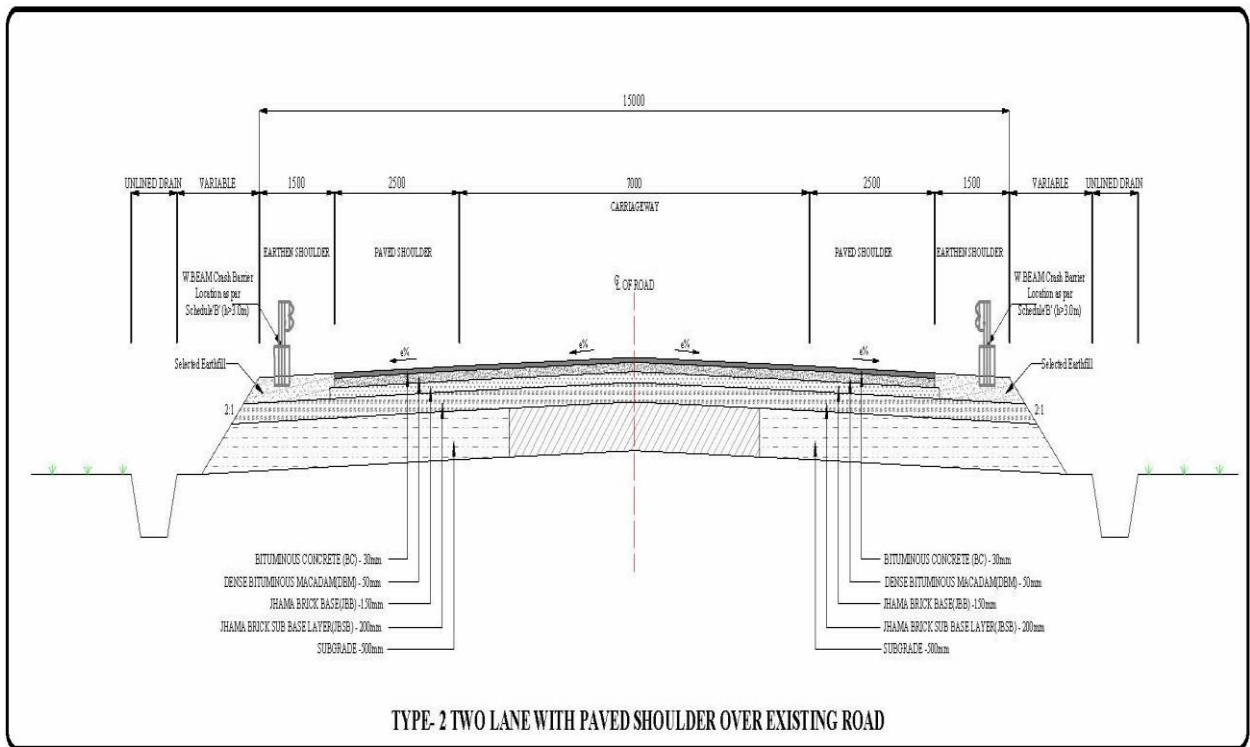
iii) Shoulders - Unpaved shoulders of 1.50 wide and paved shoulder of 2.50m are proposed on either side of the Carriage way

Proposed Typical cross sections (As per Flexible pavement) are shown here –



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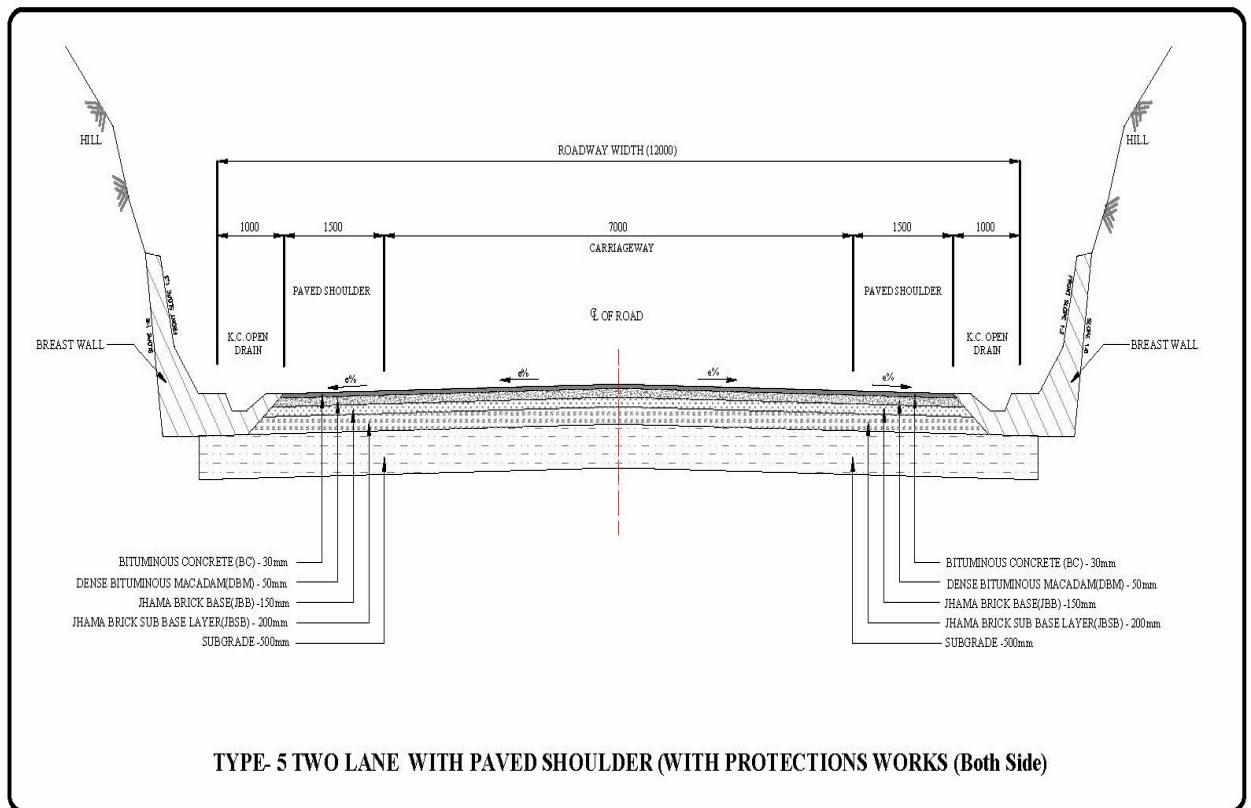
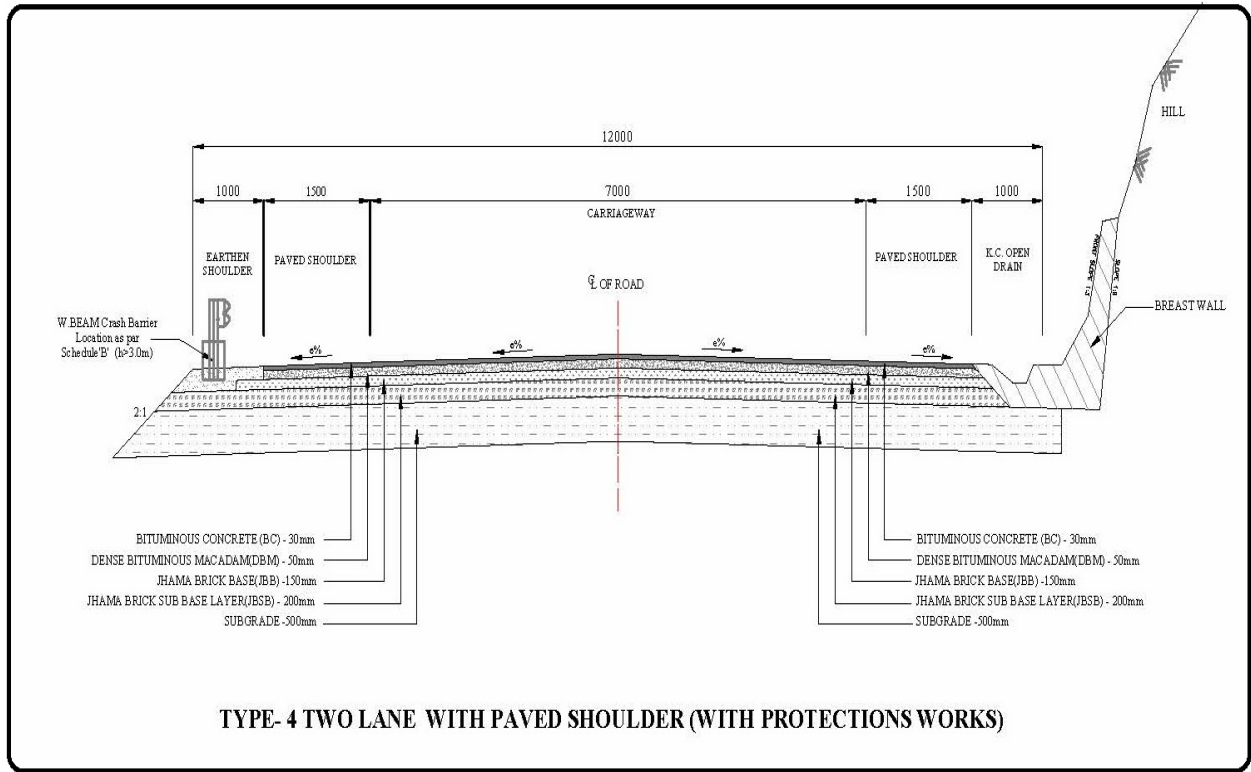


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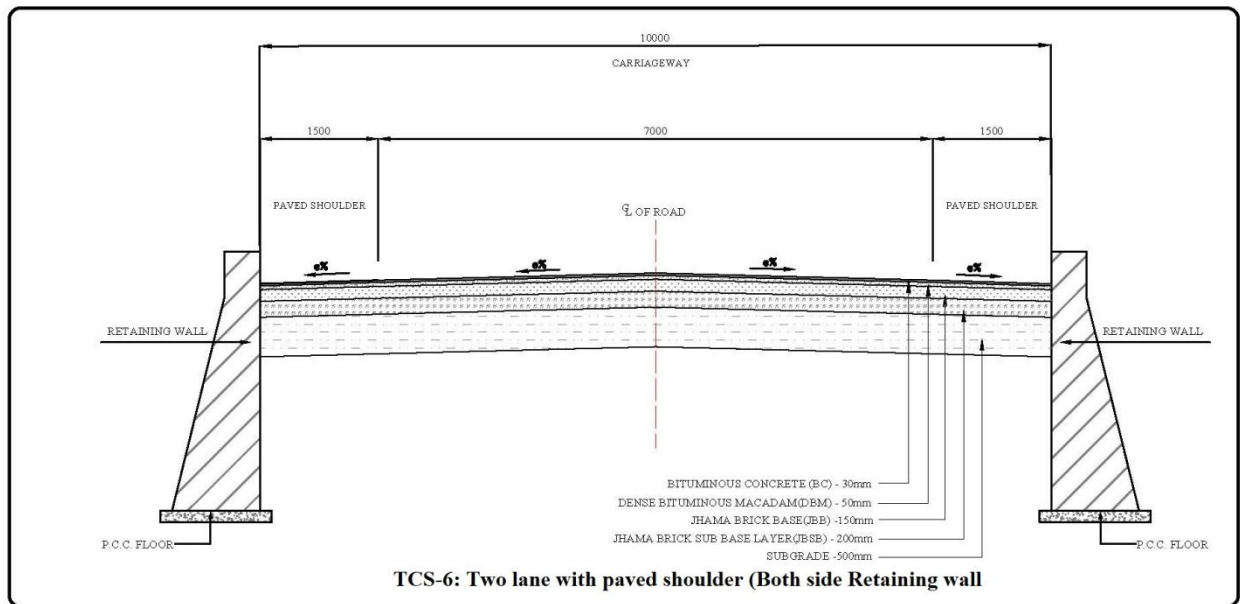


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0.12.3 Horizontal and Vertical Design of Project road

Horizontal Alignment

Table 0.9: Horizontal Report

Curve No.	HORIZONTAL CURVE				Terrain	Transition Length (m)	Speed
	Start Chainage (Km)	End Chainage (Km)	Radius	Direction			(Kmph)
1	19+406.540	19+619.540	1500	Right	Plain	35	100
2	19+901.675	19+911.312	600	Right	Plain	80	100
3	20+353.060	20+505.941	600	Left	Plain	80	100
4	20+821.789	20+897.450	400	Left	Plain	115	100
5	21+615.183	21+743.650	500	Right	Plain	45	80
6	22+088.027	22+344.918	1200	Right	Plain	40	100
7	23+554.489	23+659.939	2000	Right	Plain	0	100
8	24+247.024	24+337.201	600	Left	Plain	80	100
9	24+544.015	24+646.017	700	Right	Plain	70	100
10	24+855.922	25+154.658	500	Right	Plain	45	80
11	25+476.083	25+531.330	400	Right	Plain	55	80
12	25+674.101	25+711.604	400	Left	Plain	55	80
13	25+930.337	26+010.376	200	Left	Plain	35	50
14	26+157.244	26+173.465	200	Right	Hilly	35	50



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Curve No.	HORIZONTAL CURVE				Terrain	Transition Length (m)	Speed
	Start Chainage (Km)	End Chainage (Km)	Radius	Direction			(Kmph)
15	26+541.274	26+588.774	75	Left	Hilly	30	40
16	26+649.448	26+767.308	125	Right	Hilly	15	35
17	26+872.567	26+909.676	75	Left	Hilly	30	40
18	26+983.794	27+063.655	75	Right	Hilly	30	40
19	27+175.464	27+286.176	100	Left	Hilly	20	40
20	27+403.886	27+484.587	100	Right	Hilly	30	40
21	27+602.775	27+647.440	1000	Right	Hilly	55	100
22	27+793.706	27+934.431	100	Left	Hilly	20	40
23	27+999.092	28+042.398	50	Right	Hilly	20	30
24	28+091.666	28+121.294	50	Left	Hilly	40	40
25	28+339.055	28+458.176	125	Right	Hilly	35	50
26	28+541.234	28+634.792	200	Left	Hilly	20	50
27	28+716.618	28+750.238	100	Right	Hilly	20	40
28	28+852.265	28+865.987	100	Left	Hilly	20	40
29	28+936.512	28+937.522	50	Right	Hilly	40	40
30	29+048.673	29+070.803	75	Right	Hilly	30	40
31	29+175.537	29+191.275	200	Left	Hilly	30	50
32	29+326.681	29+339.680	50	Left	Hilly	40	40
33	29+490.188	29+556.805	125	Left	Hilly	35	50
34	29+754.256	29+809.928	50	Right	Hilly	40	40
35	29+908.073	29+948.726	50	Left	Hilly	40	40
36	30+022.109	30+040.767	30	Right	Hilly	15	20
37	30+088.415	30+111.971	20	Left	Hilly	10	20
38	30+144.907	30+156.249	20	Right	Hilly	10	20
39	30+181.529	30+189.923	20	Left	Hilly	10	20
40	30+223.013	30+264.747	60	Right	Hilly	20	25
41	30+331.376	30+344.981	50	Left	Hilly	20	30
42	30+386.112	30+393.361	125	Right	Hilly	15	35
43	30+439.435	30+479.975	120	Right	Hilly	20	30
44	30+557.237	30+560.225	100	Right	Hilly	20	40
45	30+585.583	30+612.621	30	Left	Hilly	15	20
46	30+661.931	30+684.933	30	Right	Hilly	20	20
47	30+765.973	30+811.705	75	Left	Hilly	20	35
48	30+836.171	30+859.731	50	Right	Hilly	30	35
49	30+915.600	30+927.207	100	Left	Hilly	30	30



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Curve No.	HORIZONTAL CURVE				Terrain	Transition Length (m)	Speed
	Start Chainage (Km)	End Chainage (Km)	Radius	Direction			(Kmph)
50	31+087.683	31+132.604	75	Right	Hilly	30	40
51	31+200.677	31+278.904	75	Left	Hilly	30	40

Out of 51 Curves, the 16 Nos. of curves are coming under deviation.

Vertical Alignment**Table 0.10: Vertical Report**

PVI No	PVI		Curve Length (m)	Gradient		Chainage(m)		Level (m)		Type of Curve	K Value
	Design Chainage (m)	Level (m)		IN	OUT	Start of Curve	End of Curve	Start of Curve	End of Curve		
1	19+320.531	27.275	300	0.448	0.893	19+170.531	19+470.531	26.603	28.615	Sag	674.11
2	20+267.525	35.733	300	0.893	-0.476	20+117.525	20+417.525	34.393	35.02	Hog	219.178
3	20+910.344	32.676	300	-0.476	1.385	20+760.344	21+060.344	33.389	34.754	Sag	161.217
4	21+249.805	37.378	200	1.385	0.492	21+149.805	21+349.805	35.993	37.87	Hog	223.878
5	21+796.864	40.07	300	0.492	0.966	21+646.864	21+946.864	39.332	41.518	Sag	633.561
6	22+305.944	44.986	250	0.966	0.565	22+180.944	22+430.944	43.779	45.692	Hog	623.765
7	23+118.580	49.576	400	0.565	-0.483	22+918.580	23+318.580	48.446	48.609	Hog	381.568
8	23+806.063	46.252	200	-0.483	0.245	23+706.063	23+906.063	46.735	46.497	Sag	274.51
9	24+254.049	47.35	300	0.245	-0.564	24+104.049	24+404.049	46.982	46.505	Hog	370.938
10	24+600.000	45.4	100	-0.564	0	24+550.000	24+650.000	45.682	45.4	Sag	177.411
11	24+800.000	45.4	100	0	0.551	24+750.000	24+850.000	45.4	45.675	Sag	181.563
12	25+959.281	51.785	120	0.551	6.132	25+899.281	26+019.281	51.455	55.464	Sag	21.501
13	26+146.256	63.25	60	6.132	0	26+116.256	26+176.256	61.41	63.25	Hog	9.785
14	26+243.567	63.25	40	0	6.666	26+223.567	26+263.567	63.25	64.583	Sag	6
15	26+640.311	89.698	150	6.666	2.044	26+565.311	26+715.311	84.698	91.231	Hog	32.45
16	27+026.310	97.587	125	2.044	-4.595	26+963.810	27+088.810	96.31	94.715	Hog	18.828
17	27+263.502	86.687	100	-4.595	5.114	27+213.502	27+313.502	88.985	89.244	Sag	10.299
18	27+579.252	102.836	80	5.114	-0.155	27+539.252	27+619.252	100.79	102.774	Hog	15.18
19	27+711.632	102.63	60	-0.155	5.59	27+681.632	27+741.632	102.677	104.307	Sag	10.443
20	27+838.205	109.705	60	5.59	1.696	27+808.205	27+868.205	108.029	110.214	Hog	15.408
21	28+118.624	114.461	100	1.696	-4.994	28+068.624	28+168.624	113.613	111.964	Hog	14.947
22	28+306.615	105.072	80	-4.994	4.511	28+266.615	28+346.615	107.07	106.876	Sag	8.416
23	28+624.697	119.421	200	4.511	3.177	28+524.697	28+724.697	114.91	122.598	Hog	149.914
24	29+154.882	136.265	100	3.177	-4.085	29+104.882	29+204.882	134.676	134.222	Hog	13.77



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PVI No	PVI		Curve Length (m)	Gradient		Chainage(m)		Level (m)		Type of Curve	K Value
	Design Chainage (m)	Level (m)		IN	OUT	Start of Curve	End of Curve	Start of Curve	End of Curve		
25	29+354.939	128.093	80	-4.085	3.741	29+314.939	29+394.939	129.727	129.589	Sag	10.222
26	29+656.393	139.371	100	3.741	-5.009	29+606.393	29+706.393	137.5	136.866	Hog	11.428
27	29+833.017	130.523	80	-5.009	3.967	29+793.017	29+873.017	132.527	132.11	Sag	8.912
28	30+128.955	142.264	80	3.967	-5.702	30+088.955	30+168.955	140.677	139.983	Hog	8.273
29	30+272.617	134.072	80	-5.702	5.957	30+232.617	30+312.617	136.353	136.455	Sag	6.861
30	30+416.884	142.667	80	5.957	-5.424	30+376.884	30+456.884	140.284	140.497	Hog	7.029
31	30+550.961	135.394	80	-5.424	1.358	30+510.961	30+590.961	137.564	135.937	Sag	11.795
32	30+781.602	138.526	80	1.358	-6.72	30+741.602	30+821.602	137.983	135.838	Hog	9.904
33	31+217.820	109.213	150	-6.72	-6.466	31+142.820	31+292.820	114.253	104.364	Sag	590.017

No verticals Curves are coming under deviation



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0.13 Road Junctions/Intersections

- There are 22 junctions exist on the project road including on realignment/bypasses.
- Out of 22, 14 Junction are proposed to improve/ Developed at grade only.
- Out of 22, 8 Junction are retained due realignment/bypasses.

Table 0.11: Details of Improvement proposal at the intersections

Sl. No.	Existing Chainage (Km)	Design Chainage (Km)	Type of Junction	Arm	Side	Village Name	Remarks
1	21+450	19+350	Y	3	RHS	Village Road	Improvement
2	22+000	-	T	3	RHS	Mohini Pur	Retained Due to bypass/Realignment
3	22+275	20+120	T	3	LHS	Mohini Pur	Improvement
4	22+290	-	T	3	RHS	Ranga Chhera	Retained Due to bypass/Realignment
5	22+350	-	T	3	LHS	-	Retained Due to bypass/Realignment
6	22+400	20+250	T	3	LHS	-	Improvement
7	22+475	20+350	Y	3	RHS	-	Improvement
8	22+550	20+390	T	3	RHS	Ranga Chhera	Improvement
9	23+000	20+850	Y	3	RHS	Bor gata	Improvement



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Sl. No.	Existing Chainage (Km)	Design Chainage (Km)	Type of Junction	Arm	Side	Village Name	Remarks
10	24+400	22+240	+	4	BHS	Khowai Chowmuhani	Improvement
11	22+425	22+270	Y	3	RHS	-	Improvement
12	24+975	-	T	3	RHS	Hezamara	Retained Due to bypass/Realignment
13	25+080	-	T	3	RHS	Barktala Road	Retained Due to bypass/Realignment
14	25+475	-	Y	3	RHS	Thamakari	Retained Due to bypass/Realignment
15	25+925	-	T	3	LHS	Town Road	Retained Due to bypass/Realignment
16	26+530	-	T	3	RHS	Dangar Bari	Retained Due to bypass/Realignment
17	26+700	23+970	Y	4	RHS	-	Improvement
18	27+700	24+940	T	3	LHS	Baikunthapur	Improvement



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Sl. No.	Existing Chainage (Km)	Design Chainage (Km)	Type of Junction	Arm	Side	Village Name	Remarks
19	28+775	26+010	Y	3	LHS	-	Improvement
20	30+800	27+570	T	3	RHS	Chargoriya	Improvement
21	34+100	30+600	Y	3	LHS	Mohan Bari	Improvement
22	34+310	30+810	T	3	RHS	Tuishakmaa basti	Improvement

0.14 Railway Track & Proposals

No any railway track is falling on the Project road section.

0.15 Cross Drainage Works

0.15.1 Bridges

Total **4 existing bridges** falling on Project Alignment

- 2 existing bridges are retained due to realignment / bypasses.
- 2 bridges are proposed to widen to 18m
- 2 bridges are proposed as new construction.



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Table 0.12: Proposal of Bridges

Sl. No.	Existing Chainage (km)	Design Chainage (km)	Existing Details				Proposals			Remarks
			Type of structure	No. of span	Span Arrangement (m)	Carriage way width (m)	Proposal	Type of structure	Span Arrangement (m)	
1	22+800	20+680	RCC GIRDER	1	25.33	11.0	New Construction of 2 lane bridge	RCC Slab	1 x 25	Existing Bridge Retained
2	27+500	24+720	GIRDER	1	32.6	11.0	Widen to 16m bridge			
3	28+150	25+390	RCC / GIRDER	1	19.0	11.1	Widen to 16m bridge			
4	28+970	26+190	RCC/SLAB	2	19.3	11.1	New Construction of 2 lane bridge	RCC Slab	1 x 25	Existing Bridge Retained

0.15.2 Culverts

Total 16 culverts are falling in this section of Project alignment.

- 6 culverts are proposed for reconstruction.
- 10 culverts are retained due to realignment or bypasses.
- 32 additional culverts are proposed as balancing culverts on new alignment.

Table 0.13 – Proposal of Existing Culverts

Sl. No.	Existing Chainage (Km)	Design Chainage (Km)	Proposal		
			Proposal	Size (m)	Type
1	21+450	-	Retained due to realignment/bypass		
2	21+600	-	Retained due to realignment/bypass		
3	21+750	-	Retained due to realignment/bypass		
4	21+970	-	Retained due to realignment/bypass		
5	22+550	20+400	Reconstruction	1 x 2 x 2	Box
6	23+200	21+050	Reconstruction	1 x 3 x 3	Box



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Sl. No.	Existing Chainage (Km)	Design Chainage (Km)	Proposal		
			Proposal	Size (m)	Type
7	23+800	-	Retained due to realignment/bypass		
8	24+780	-	Retained due to realignment/bypass		
9	25+350	-	Retained due to realignment/bypass		
10	26+800	24+060	Reconstruction	1 x 3 x 3	Box
11	27+220	24+450	Reconstruction	1 x 2 x 2	Box
12	27+950	-	Retained due to realignment/bypass		
13	28+250	25+480	Reconstruction	1 x 2 x 2	Box
14	28+430	25+660	Reconstruction	1 x 2 x 2	Box
15	28+800	-	Retained due to realignment/bypass		
16	34+230	-	Retained due to realignment/bypass		

Additional Culverts

Table 0.14: Proposal of Additional Culverts

Sl. No	Design Chainage (Km)	Type	Size (m)	Remark
1	19+520	Box Culvert	1 x 3 x 3	
2	19+900	Box Culvert	1 x 3 x 4	
3	20+120	Box Culvert	1 x 2 x 2	
4	21+340	Box Culvert	1 x 2 x 2	
5	21+640	Box Culvert	1 x 3 x 4	
6	21+940	Box Culvert	1 x 2 x 2	
7	22+240	Box Culvert	1 x 2 x 2	



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Sl. No	Design Chainage (Km)	Type	Size (m)	Remark
8	22+600	Box Culvert	1 x 3 x 4	
9	22+920	Box Culvert	1 x 2 x 2	
10	23+260	Box Culvert	1 x 3 x 4	
11	23+560	Box Culvert	1 x 2 x 5	
12	23+820	Box Culvert	1 x 2 x 2	
13	25+100	Box Culvert	1 x 2 x 3	
14	26+000	Box Culvert	1 x 3 x 2	
15	26+680	Box Culvert	1 x 2 x 2	
16	26+870	Box Culvert	1 x 2 x 2	
17	27+160	Box Culvert	1 x 3 x 2	
18	27+380	Box Culvert	1 x 2 x 2	
19	27+660	Box Culvert	1 x 2 x 2	
20	27+960	Box Culvert	1 x 2 x 2	
21	28+260	Box Culvert	1 x 2 x 2	
22	28+460	Box Culvert	1 x 2 x 2	
23	28+660	Box Culvert	1 x 2 x 2	
24	28+980	Box Culvert	1 x 2 x 2	
25	29+300	Box Culvert	1 x 2 x 2	
26	29+600	Box Culvert	1 x 2 x 2	
27	29+840	Box Culvert	1 x 2 x 2	
28	30+220	Box Culvert	1 x 2 x 2	
29	30+500	Box Culvert	1 x 2 x 2	
30	30+760	Box Culvert	1 x 2 x 2	
31	30+980	Box Culvert	1 x 2 x 2	
32	31+220	Box Culvert	1 x 3 x 4	



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0.16 Bus Lay Bys

2 Bus bays (including both side) are proposed along the Project road. The Locations are:

Table 0.15- Proposed Bus Bays

Sl. No.	LHS	RHS	Remarks
1	22.400	22.050	

0.16.1 Truck Lay Bye

One Truck lay bye is proposed along the Project road at design km 19.750 (LHS).

0.16.2 Religious Structures

4 religious structures exist on the project road and details are presented in table below:

Table 0.16: Religious Structures

Sl. No.	Existing Chainage (Km)	Design Chainage (Km)	Side	Type	Remarks
1	22+275	-	LHS	Temple	
2	27+400	24+650	LHS	Temple	
3	28+000	-	RHS	Temple	
4	34+050	30+590	LHS	Temple	

0.16.3 School Details

No School exists on the project road and details are presented in table below:

Table 0.17: School Details

Sl. No.	Existing Chainage (Km)	Design Chainage (Km)	Side	Remarks
Nil				

0.16.4 Pond Locations

5 pond exists on the project road and details are presented in table below:



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Table 0.18: Pond Locations

Sl. No.	Design Chainage (Km)	Side	Length (m)	Remarks
1	19+400	LHS	20	
2	19+600	BHS	10	
3	25+300	LHS	25	
4	25+500	RHS	10	
5	25+800	BHS	10	
	Total..		75	

0.16.5 Toll Plaza

No Toll plaza is proposed.

0.16.6 Submergence Details

As per enquire with local people, The Following areas found submerge during heavy rain, the locations are:

Table 0.19: Submergence Details

Sl. No.	Existing Chainage (Km)	Area Name	Water Level (m)
1	22+600 to 22+930	Tara nagar	1.0 -2.0
2	24+650		0.5-1.0

The embankment has been raised at these locations.

0.17 Proposed Bypasses/ Realignment

1. Hezamara Bypass

A bypass is proposed for Hezamara built-up to avoid congestion of traffic and improvement of geometry, details of bypass is shown below:



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Sl. No.	Item	Details
1	Side of Bypass	L.H.S
2	Length of Bypass (Design)	1.7 Km
3	Start Chainage (Design/Existing)	Km 22.250 / Km 24.400
4	End Chainage (Design/Existing)	Km 24.000 / Km 26.730
5	Length of Existing road (to be bypassed)	2.33 Km
6	Type of Land	Open

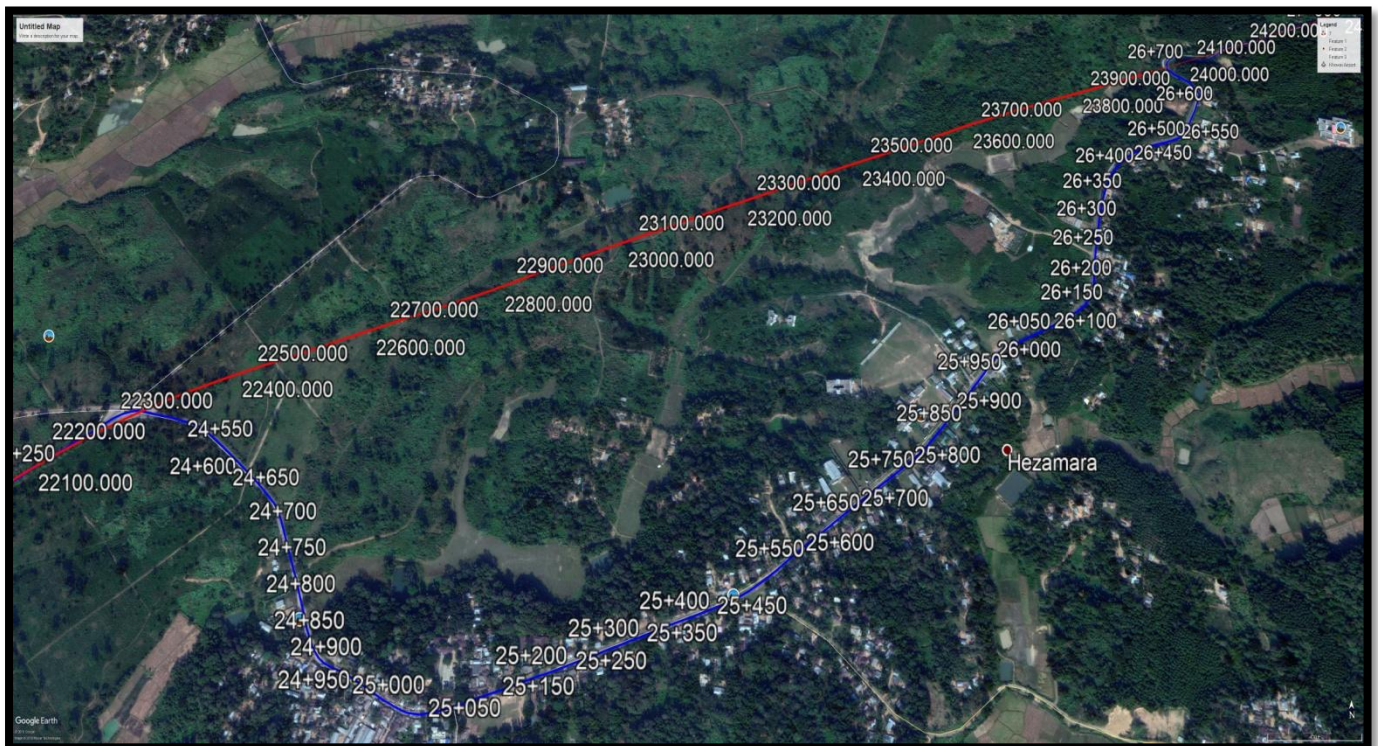


Figure 0.3: Hezamara Bypass

Existing Road	
Proposed Alignment	



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2. Other Realignments

Including above bypasses some realignments are also proposed for improvement of geometry as per IRC standards, the location wise details of realignments are:

Table 0.20 - Realignment Details

Sl. No	Existing Chainage (Km)			Design Chainage (Km)		
	From	To	Length	From	To	Length
1	21+425	23+050	1+625	19+350	20+900	1+550
2	35+860	36+300	0+600	32+140	32+550	0+410
	Total Length		2+225	Total Length		1+960

0.18 Protection Works

The protection work like retaining walls, breast walls, W Beam crash Barrier are provided at different locations as per site requirement, the details of protection works with their details are presented below –

a) Breast Walls

Sl. No.	Description	LHS	RHS	Total
1	Breast Wall 1m height	260	140	400
2	Breast Wall 2m height	740	640	1380
3	Breast Wall 3m height	200	200	400
4	Breast Wall 4m height	0	0	0
	Total ..	1200	980	2180

The chainage wise details of breast wall is presented in Vol. 8 Bill of Quantity

b) **Retaining wall – Retaining wall is proposed in 2460m length, The Chainage wise detail of retaining wall is presented in Vol. 8:: Bill of Quantity.**

c) **W- Beam Crash Barrier – W Beam crash barrier is proposed in 21067m length (Where height of embankment is more than 3.0m and at horizontal curves having radius less then 450m), The chainage wise details of W Beam crash barrier is presented in Vol. 8:: Bill of Quantity.**



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d) **RCC Drain – RCC linear drain is provided in 1862m length (BHS) in Built up section.**

e) **PCC Drain – PCC Drain is provided in 4755m length**

The details of above all protection works has been provided in Vol 8:: Bill of Quantity.

0.19 Road Side furniture

Road side furniture shall be provided in accordance with Section 11 of the Manual of Specification and Standards for Two Laning of Highways through PPP.

0.20 Landscaping and Tree Plantation

Landscaping and tree plantation shall be provided in accordance with Section 12 of the Manual of specification and Standards for Two Laning of Highways through PPP.

0.21 Highways Lighting

Street lighting shall be provided in accordance with para 13.3 of Section 13 of the Manual of Specification and Standards for Two Laning of Highways through PPP.

0.22 Safety

Keeping view of these all features, a proper safety precautions are recommended on roadway width, the safety items to be provided are –

- i) W Beam Crash Barrier/ Concrete Crash Barrier on either side of carriageway,
- ii) Pavement Marking on Centre and edges lines,
- iii) Provide adequate warning of hazards,
- iv) Providing Bio-turfing for Slope protection,

0.23 Utilities

The estimate of utilities relocation will be submitted after obtaining it from concerned departments.

0.24 Land Acquisition

The detail of Land acquisition will be finalized after approval of alignment, however, on tentative basis, the amount of **Rs 35 cr** is considered for Land acquisition.

The details of adjacent land of projection road is presented below, the details may change after got confirmation/joint site visit with/ forest department.



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Table 0.21: Details of Land

Sl. No.	Design Chainage (Km)		Length (Km)	Type of land	
	From	To		LHS	RHS
1	12+000	21+200	9+200	Private	
2	21+200	21+400	0+200	Govt.	
3	21+400	26+000	4+600	Private	
4	26+000	32+000	6+000	Forest/Govt.	

0.25 Resettlement And Rehabilitation (R & R) Policy

The Ministry of Rural Development (Department of Land resources) has prepared the National Policy on Resettlement and Rehabilitation for the people who will be affected by the project. The policy describes the principle and approach to minimize and mitigate the negative social and economic impacts caused by the project. The R & R policy broadly addresses all issues such as compensation, assistance, replacement value, vulnerable group, etc. The policy ensures that people affected by project must be able to restore their livelihood to the pre project level.

0.26 Cost Estimate

The details of the cost abstract are as under **Table 0.22 –**

Table 0.22 - Abstract of Cost

Bill No.	Description		Amount (in RS)	Amount (in Crores)	%age of Civil Cost
	Design Length in Km	12.000			
1	Site Clearance and Dismantling		1076953.00	0.11	0.13%
2	Earth Work		69847270.00	6.98	8.42%
3	Sub base and Base Course		166953338.00	16.70	20.12%
4	Bituminous Courses		205401603.00	20.54	24.75%
5	Bridges		143891000.00	14.39	17.34%
6	Culverts		103490141.00	10.35	12.47%
7	Drainage and Protection Works		125089946.00	12.51	15.07%
8	Traffic Signs, Marking and Appurtenances		1892654.00	0.19	0.23%



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Bill No.	Description	Amount (in RS)	Amount (in Crores)	%age of Civil Cost
9	Bus Bays	3030558.17	0.30	0.37%
10	Junctions	5438179.84	0.54	0.66%
11	Truck Lay Bye	2653577.07	0.27	0.32%
11	Miscellaneous Items	1024100.00	0.10	0.12%
A	Civil Cost (sum of 1 to 11)	829789320.08	82.98	
B	** GST on 'A' @ (Total 12%, 6% as VAT + 6% GST)	6.00%	49787359.20	4.98
C	Civil Cost including GST (A+B)	879576679.29	87.96	
	Cost per km	73298056.61	7.33	
D	Contingencies charges on 'C' @	2.80%	24628147.02	2.46
E	Sub Total (C + D)....	904204826.31	90.42	
F	Maintenance for 5 years (0.25%+0.25%+0.5%+0.5%+1%) on 'C'	2.50%	21989416.98	2.20
G	escalation (5% per year for two years) on 'C' @	10.00%	87957667.93	8.80
H	Construction Supervision Charges on 'C' @	3.00%	26387300.38	2.64
I	Agency (NHIDCL) Charges on 'E' @	3.00%	27126144.79	2.71
J	Total Project Cost (E to I)	1067665356	106.77	
K	Approx cost of Land Acquisition		35000000.00	35.00
L	Approx Cost of Utility Shifting		5000000.00	5.00
M	Total Project Cost (J to M)	1467665356	146.77	



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0.27 Economic Analysis -

The consultants carried out the economic appraisal using the appraisal methodology and economic costs and benefits described in the preceding paragraphs of this report.

0.27.1 Base case

Derivation of passenger time costs always remained controversial issue, especially in respect of developing nations as saving in leisure time is mostly not appreciated that constitute majority except for commercially developed urban centres. Economic analysis for the base case has therefore, been carried out without considering the benefits on account passenger time savings.

0.27.2 Sensitivity Analysis

Two critical factors could affect the viability of the project and these are the Capital Cost and traffic level. The capital cost can increase or the expected traffic growth could not materialize or both factors could occur simultaneously sensitivity check using the following parameters has been carried out:

Sensitivity Option S1 Increase in base costs by 15%

Sensitivity Option S2 Decrease in base benefits by 15%

Sensitivity Option S3 Increase in base costs by 15% and decrease in base benefits by 15%

The EIRR and NPV (at 12%) for each link and section along with sensitivity analysis have been presented as follows:

Table 0.23 - Summary of Sensitive Analysis

Link ID	Length (km)	NPV (Million) @ 12%, Base Case	Economic Internal Rate of Return (%)			
			Base Case	Sensitivity S1	Sensitivity 2	Sensitivity S3
ESRR	12.000	2629	48.4%	38.3%	21.5%	18.4%

The project road is found to be economically viable with EIRR more than the resource cost of capital @ 12%.



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0.27.3 Financial Analysis -

Based on the project structure, study of all possible sources of revenue, financial feasibility analysis has been carried out as per the methodology outlined in earlier sections. The objective of the financial analysis is to ascertain the existence of sustainable project returns, which shall successfully meet the expectations of its financial investors. The analysis reveals various FIRR values corresponding to each year of operation. FIRR for the Returns on Investment and Returns on Equity for the years from 2020 and 2035 (concession period 15 years including 2 years construction period) for the following alternatives with varying subsidy options are: -

Alternative I : With Nil Grant.

Alternative I ; With 40%. Grant

With the above mention options financial analysis has been carried out for 15 years concession period when grant is 40% of the Capital Cost. The results are given below in **Table 0.24** for concession period 15 years are as under.

Table 0.24- Summary of Financial Analysis

Scenario	Pre tax FIRR %	Returns on Equity%	Post tax FIRR%	DSCR
Alternative- I	1.55%	-1.59%	1.19%	0.22
Alternative- II	4.92%	2.60%	4.48%	0.38

0.27.4 Conclusion

As it is clear from the results of the both the alternatives that the project is financially not viable even with 40% Grant. This is because of high cost of Construction and very low toll able traffic. **Therefore it is strongly recommended to construct the road on EPC basis and not on BOT basis.**



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Centre Line Co-Ordinates

Table 0.25- Centre Line Co-ordinates

Chainage (m)	Nothing	Easting
19300	337081	2653722
19320	337099.6	2653730
19340	337118.1	2653737
19360	337136.7	2653745
19380	337155.3	2653752
19400	337173.9	2653759
19420	337192.6	2653767
19440	337211.3	2653774
19600	337364.5	2653820
19620	337383.9	2653824
19640	337403.4	2653829
19660	337423	2653833
19680	337442.5	2653837
19700	337462	2653841
19720	337481.6	2653846
19740	337501.1	2653850
19760	337520.7	2653854
19780	337540.2	2653859
19800	337559.8	2653863
19820	337579.3	2653867
19840	337598.8	2653871
19860	337618.4	2653875
19880	337638.1	2653879
19900	337657.8	2653882
19920	337677.6	2653885
19940	337697.5	2653887
19960	337717.4	2653889
19980	337737.4	2653890
20000	337757.3	2653892
20020	337777.3	2653893
20040	337797.2	2653894

Chainage (m)	Northing	Easting
19460	337230.2	2653780
19480	337249.1	2653787
19500	337268.2	2653793
19520	337287.3	2653799
19540	337306.5	2653804
19560	337325.7	2653810
19580	337345.1	2653815
20580	338324.2	2653986
20600	338342.1	2653995
20620	338360.1	2654004
20640	338378.1	2654013
20660	338396.1	2654021
20680	338414.1	2654030
20700	338432	2654039
20720	338450	2654048
20740	338467.9	2654057
20760	338485.7	2654066
20780	338503.3	2654075
20800	338520.6	2654085
20820	338537.4	2654096
20840	338553.7	2654108
20860	338569.4	2654120
20880	338584.5	2654133
20900	338598.9	2654147
20920	338612.6	2654162
20940	338625.7	2654177
20960	338638.3	2654192
20980	338650.6	2654208
21000	338662.6	2654224
21020	338674.6	2654240
21040	338686.6	2654256



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Chainage (m)	Nothing	Easting
20060	337817.2	2653896
20080	337837.2	2653897
20100	337857.1	2653898
20120	337877.1	2653899
20140	337897	2653901
20160	337917	2653902
20180	337936.9	2653903
20200	337956.9	2653905
20220	337976.9	2653906
20240	337996.8	2653907
20260	338016.8	2653909
20280	338036.7	2653910
20300	338056.7	2653911
20320	338076.6	2653913
20340	338096.5	2653915
20360	338116.4	2653917
20380	338136.1	2653921
20400	338155.7	2653924
20420	338175.2	2653929
20440	338194.5	2653934
20460	338213.7	2653940
20480	338232.6	2653946
20500	338251.3	2653953
20520	338269.8	2653961
20540	338288.1	2653969
20560	338306.2	2653978
21560	338997.3	2654673
21580	339009.2	2654689
21600	339021.3	2654705
21620	339033.8	2654721
21640	339046.9	2654736
21660	339060.6	2654750
21680	339074.9	2654764
21700	339089.7	2654778

Chainage (m)	Northing	Easting
21060	338698.5	2654272
21080	338710.5	2654288
21100	338722.4	2654304
21120	338734.4	2654320
21140	338746.3	2654336
21160	338758.3	2654352
21180	338770.2	2654368
21200	338782.2	2654384
21220	338794.1	2654400
21240	338806.1	2654416
21260	338818.1	2654432
21280	338830	2654449
21300	338842	2654465
21320	338853.9	2654481
21340	338865.9	2654497
21360	338877.8	2654513
21380	338889.8	2654529
21400	338901.7	2654545
21420	338913.7	2654561
21440	338925.6	2654577
21460	338937.6	2654593
21480	338949.5	2654609
21500	338961.4	2654625
21520	338973.4	2654641
21540	338985.3	2654657
22540	339824.6	2655174
22560	339843.5	2655180
22580	339862.3	2655187
22600	339881.2	2655194
22620	339900.1	2655200
22640	339919	2655207
22660	339937.9	2655213
22680	339956.7	2655220
22700	339975.6	2655227



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Chainage (m)	Nothing	Easting
21720	339105	2654791
21740	339120.9	2654803
21760	339137.2	2654814
21780	339153.8	2654826
21800	339170.4	2654837
21820	339187.1	2654848
21840	339203.8	2654859
21860	339220.5	2654870
21880	339237.2	2654881
21900	339253.9	2654892
21920	339270.5	2654903
21940	339287.2	2654914
21960	339303.9	2654925
21980	339320.6	2654936
22000	339337.3	2654947
22020	339354	2654958
22040	339370.7	2654969
22060	339387.3	2654980
22080	339404.1	2654991
22100	339421	2655002
22120	339438	2655012
22140	339455.3	2655022
22160	339472.7	2655032
22180	339490.2	2655042
22200	339507.9	2655051
22220	339525.8	2655060
22240	339543.8	2655069
22260	339562	2655077
22280	339580.3	2655085
22300	339598.7	2655093
22320	339617.3	2655100
22340	339635.9	2655107
22360	339654.7	2655114
22380	339673.6	2655121

Chainage (m)	Northing	Easting
22720	339994.5	2655233
22740	340013.4	2655240
22760	340032.2	2655247
22780	340051.1	2655253
22800	340070	2655260
22820	340088.9	2655266
22840	340107.7	2655273
22860	340126.6	2655280
22880	340145.5	2655286
22900	340164.4	2655293
22920	340183.3	2655299
22940	340202.1	2655306
22960	340221	2655313
22980	340239.9	2655319
23000	340258.8	2655326
23020	340277.6	2655332
23040	340296.5	2655339
23060	340315.4	2655346
23080	340334.3	2655352
23100	340353.2	2655359
23120	340372	2655365
23140	340390.9	2655372
23160	340409.8	2655379
23180	340428.7	2655385
23200	340447.5	2655392
23220	340466.4	2655398
23240	340485.3	2655405
23260	340504.2	2655412
23280	340523	2655418
23300	340541.9	2655425
23320	340560.8	2655432
23340	340579.7	2655438
23360	340598.6	2655445
23380	340617.4	2655451



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Chainage (m)	Nothing	Easting
22400	339692.5	2655128
22420	339711.3	2655134
22440	339730.2	2655141
22460	339749.1	2655147
22480	339768	2655154
22500	339786.8	2655161
22520	339805.7	2655167
23520	340749.6	2655498
23540	340768.4	2655504
23560	340787.3	2655511
23580	340806.3	2655517
23600	340825.2	2655524
23620	340844.3	2655530
23640	340863.4	2655536
23660	340882.6	2655541
23680	340901.8	2655547
23700	340921	2655552
23720	340940.2	2655558
23740	340959.4	2655564
23760	340978.6	2655569
23780	340997.8	2655575
23800	341017	2655580
23820	341036.2	2655586
23840	341055.4	2655592
23860	341074.6	2655597
23880	341093.8	2655603
23900	341113	2655608
23920	341132.2	2655614
23940	341151.4	2655620
23960	341170.6	2655625
23980	341189.8	2655631
24000	341209	2655636
24020	341228.2	2655642
24040	341247.4	2655648

Chainage (m)	Northing	Easting
23400	340636.3	2655458
23420	340655.2	2655465
23440	340674.1	2655471
23460	340692.9	2655478
23480	340711.8	2655484
23500	340730.7	2655491
24500	341665.8	2655831
24520	341682.8	2655841
24540	341700	2655851
24560	341717.5	2655861
24580	341735.2	2655870
24600	341753.2	2655879
24620	341771.5	2655887
24640	341789.9	2655895
24660	341808.6	2655902
24680	341827.4	2655909
24700	341846.4	2655915
24720	341865.3	2655922
24740	341884.3	2655928
24760	341903.3	2655934
24780	341922.2	2655941
24800	341941.2	2655947
24820	341960.2	2655953
24840	341979.2	2655959
24860	341998.4	2655965
24880	342017.8	2655970
24900	342037.3	2655974
24920	342057.1	2655978
24940	342076.9	2655980
24960	342096.8	2655982
24980	342116.8	2655983
25000	342136.8	2655983
25020	342156.8	2655982
25040	342176.7	2655981



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Chainage (m)	Nothing	Easting
24060	341266.6	2655653
24080	341285.8	2655659
24100	341305	2655664
24120	341324.2	2655670
24140	341343.4	2655676
24160	341362.6	2655681
24180	341381.8	2655687
24200	341400.9	2655693
24220	341420	2655699
24240	341438.9	2655705
24260	341457.7	2655712
24280	341476.2	2655720
24300	341494.4	2655728
24320	341512.4	2655737
24340	341530.1	2655746
24360	341547.4	2655756
24380	341564.5	2655766
24400	341581.5	2655777
24420	341598.3	2655788
24440	341615.2	2655798
24460	341632.1	2655809
24480	341648.9	2655820
25480	342592.2	2655840
25500	342610	2655831
25520	342627.4	2655821
25540	342644.2	2655811
25560	342660.6	2655799
25580	342676.7	2655787
25600	342692.8	2655775
25620	342708.8	2655763
25640	342724.9	2655752
25660	342741.2	2655740
25680	342757.9	2655729
25700	342775.1	2655719

Chainage (m)	Northing	Easting
25060	342196.6	2655979
25080	342216.4	2655976
25100	342236	2655972
25120	342255.5	2655967
25140	342274.7	2655962
25160	342293.8	2655956
25180	342312.6	2655949
25200	342331.3	2655942
25220	342350	2655935
25240	342368.6	2655928
25260	342387.3	2655921
25280	342406	2655913
25300	342424.7	2655906
25320	342443.4	2655899
25340	342462	2655892
25360	342480.7	2655885
25380	342499.4	2655878
25400	342518.1	2655870
25420	342536.8	2655863
25440	342555.4	2655856
25460	342573.9	2655849
26460	343511.5	2655614
26480	343531.4	2655612
26500	343551.3	2655610
26520	343571.2	2655609
26540	343591.2	2655609
26560	343610.5	2655614
26580	343627.7	2655624
26600	343641.4	2655638
26620	343652.3	2655655
26640	343662.9	2655672
26660	343674.5	2655688
26680	343688.6	2655702
26700	343704.7	2655714



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Chainage (m)	Nothing	Easting
25720	342792.8	2655710
25740	342810.9	2655701
25760	342829.2	2655693
25780	342847.5	2655685
25800	342865.9	2655677
25820	342884.2	2655669
25840	342902.6	2655661
25860	342920.9	2655653
25880	342939.2	2655645
25900	342957.6	2655637
25920	342976.1	2655629
25940	342995	2655623
25960	343014.5	2655619
25980	343034.3	2655616
26000	343054.3	2655616
26020	343074.3	2655617
26040	343094.1	2655620
26060	343113.8	2655623
26080	343133.5	2655627
26100	343153.2	2655630
26120	343173	2655633
26140	343192.7	2655636
26160	343212.6	2655639
26180	343232.6	2655639
26200	343252.5	2655638
26220	343272.5	2655636
26240	343292.4	2655634
26260	343312.3	2655632
26280	343332.2	2655630
26300	343352.1	2655629
26320	343372	2655627
26340	343392	2655625
26360	343411.9	2655623
26380	343431.8	2655621

Chainage (m)	Northing	Easting
26720	343722.5	2655723
26740	343741.5	2655729
26760	343761.3	2655732
26780	343781.2	2655732
26800	343801.2	2655731
26820	343821.2	2655731
26840	343841.2	2655730
26860	343861.2	2655729
26880	343880.9	2655732
26900	343899.1	2655740
26920	343914.4	2655753
26940	343927.1	2655768
26960	343939.4	2655784
26980	343952.7	2655799
27000	343969	2655810
27020	343987.9	2655817
27040	344007.9	2655817
27060	344027.2	2655812
27080	344044.5	2655803
27100	344060.5	2655791
27120	344076.3	2655778
27140	344092.2	2655766
27160	344108	2655754
27180	344124.5	2655743
27200	344142.8	2655735
27220	344162.3	2655730
27240	344182.3	2655730
27260	344201.9	2655734
27280	344220.4	2655742
27300	344237.2	2655752
27320	344253.1	2655765
27340	344269	2655777
27360	344284.9	2655789
27380	344300.9	2655801



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Package I : Agartala – Khowai Section :: Section II (design km 19.300 to km 31.300 (Length = 12.000 km)

Chainage (m)	Nothing	Easting
26400	343451.7	2655619
26420	343471.6	2655618
26440	343491.6	2655616
27440	344354.8	2655825
27460	344374.8	2655826
27480	344394.5	2655823
27500	344413.3	2655816
27520	344431.3	2655807
27540	344449.2	2655798
27560	344467.2	2655790
27580	344485.1	2655781
27600	344502.9	2655772
27620	344520.5	2655762
27640	344537.9	2655752
27660	344555.2	2655742
27680	344572.2	2655732
27700	344589.2	2655721
27720	344606.2	2655711
27740	344623.2	2655700
27760	344640.2	2655690
27780	344657.2	2655679
27800	344674.9	2655670
27820	344694	2655664
27840	344713.8	2655662
27860	344733.7	2655664
27880	344752.7	2655670
27900	344770.2	2655680
27920	344785.4	2655693
27940	344797.7	2655709
27960	344807.9	2655726
27980	344818.5	2655743
28000	344832.3	2655757
28020	344850.4	2655765
28040	344870.2	2655766

Chainage (m)	Northing	Easting
27400	344317.4	2655812
27420	344335.4	2655821
28420	345183	2655922
28440	345202.9	2655920
28460	345222.2	2655915
28480	345240.7	2655908
28500	345258.7	2655899
28520	345276.7	2655890
28540	345294.7	2655882
28560	345313.4	2655875
28580	345332.7	2655869
28600	345352.5	2655866
28620	345372.4	2655865
28640	345392.4	2655866
28660	345412.3	2655868
28680	345432.2	2655870
28700	345452	2655872
28720	345472	2655873
28740	345491.8	2655871
28760	345510.8	2655865
28780	345529	2655857
28800	345547.3	2655848
28820	345565.5	2655840
28840	345583.7	2655832
28860	345602.6	2655825
28880	345622.3	2655822
28900	345642.2	2655820
28920	345662	2655818
28940	345680.5	2655810
28960	345695.6	2655797
28980	345708.3	2655782
29000	345720.6	2655766
29020	345732.9	2655750
29040	345744.6	2655734



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Package I : Agartala – Khowai Section :: Section II (design km 19.300 to km 31.300 (Length = 12.000 km)

Chainage (m)	Nothing	Easting
28060	344889.1	2655760
28080	344907.5	2655752
28100	344926.8	2655747
28120	344946.5	2655750
28140	344963.7	2655760
28160	344978.5	2655773
28180	344992.8	2655787
28200	345007	2655801
28220	345021.3	2655816
28240	345035.6	2655830
28260	345049.8	2655844
28280	345064.1	2655858
28300	345078.4	2655872
28320	345092.7	2655885
28340	345108.1	2655898
28360	345125.1	2655909
28380	345143.6	2655916
28400	345163	2655921
29400	345836.3	2655416
29420	345855	2655409
29440	345873.7	2655402
29460	345892.3	2655395
29480	345911.2	2655388
29500	345930.7	2655384
29520	345950.7	2655383
29540	345970.5	2655385
29560	345989.9	2655390
29580	346008.4	2655397
29600	346026.4	2655406
29620	346044.4	2655415
29640	346062.4	2655423
29660	346080.4	2655432
29680	346098.5	2655441
29700	346116.5	2655449

Chainage (m)	Northing	Easting
29060	345752.9	2655716
29080	345755.8	2655696
29100	345754.9	2655676
29120	345753.3	2655656
29140	345751.6	2655636
29160	345750.1	2655616
29180	345749.5	2655596
29200	345750.8	2655576
29220	345753.5	2655557
29240	345756.4	2655537
29260	345759.3	2655517
29280	345762.3	2655497
29300	345765.4	2655478
29320	345771.1	2655458
29340	345782.6	2655442
29360	345799.1	2655431
29380	345817.6	2655423
30380	346645.1	2655356
30400	346663.8	2655363
30420	346683.1	2655368
30440	346702.5	2655373
30460	346722.3	2655375
30480	346742.3	2655374
30500	346761.8	2655370
30520	346781.3	2655365
30540	346800.8	2655360
30560	346820	2655355
30580	346838.2	2655347
30600	346857.1	2655341
30620	346875.6	2655348
30640	346891.1	2655360
30660	346907.5	2655372
30680	346927.1	2655373
30700	346944.1	2655363



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Package I : Agartala – Khowai Section :: Section II (design km 19.300 to km 31.300 (Length = 12.000 km)

Chainage (m)	Nothing	Easting
29720	346134.5	2655458
29740	346153.1	2655465
29760	346172.8	2655468
29780	346192	2655463
29800	346207.6	2655450
29820	346217.3	2655433
29840	346221.5	2655413
29860	346223.8	2655394
29880	346226	2655374
29900	346230.7	2655354
29920	346241	2655337
29940	346257.1	2655326
29960	346276.5	2655321
29980	346296.4	2655322
30000	346316.2	2655325
30020	346336.1	2655327
30040	346354.4	2655320
30060	346366.8	2655305
30080	346378.6	2655288
30100	346396.4	2655281
30120	346412.6	2655292
30140	346424.2	2655308
30160	346441.5	2655317
30180	346461.5	2655315
30200	346478.3	2655325
30220	346492.6	2655339
30240	346509.9	2655349
30260	346529.4	2655352
30280	346549.2	2655350
30300	346568.7	2655346
30320	346588.3	2655341
30340	346608.2	2655341
30360	346627.1	2655347

Chainage (m)	Northing	Easting
30720	346958.9	2655350
30740	346973.6	2655336
30760	346988.5	2655323
30780	347005.6	2655313
30800	347024.9	2655307
30820	347044.8	2655308
30840	347064.5	2655312
30860	347084.3	2655310
30880	347102.4	2655301
30900	347119.2	2655291
30920	347136.1	2655280
30940	347154.4	2655272
30960	347173.5	2655266
30980	347192.7	2655260
31000	347211.9	2655255
31020	347231.1	2655249
31040	347250.3	2655244
31060	347269.5	2655238
31080	347288.4	2655232
31100	347305.5	2655221
31120	347319.2	2655207
31140	347328.2	2655189
31160	347333.3	2655170
31180	347337.7	2655150
31200	347343.8	2655131
31220	347354.5	2655114
31240	347369.4	2655101
31260	347387.5	2655093
31280	347407.2	2655090
31300	347427.1	2655092
31320	347446.7	2655095
31340	347466.3	2655099

