Consultancy Services for conducting an Environmental and Social Impact Assessment (ESIA) of Urban Roads (Town roads) and non-urban roads and Major/Minor bridges and preparation of Environmental and Social Management instruments under MITP (World Bank) initiative

ESIA Report of Nongstoin-Maweit Road

CETEST Engineering Consultants

C. E. TESTING COMPANY PRIVATE LIMITED

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CHAPTERI: INTRODUCTION AND PROJECT BACKGROUND

Meghalaya is one of the north eastern States of India with undulating terrain and sharing international boundaries with Bangladesh at south andwest and state boundaries with Assam at north and east. Being landlocked and with difficult terrain there are major challenges of connectivity, be it road, power lines or telecom connectivity. The State is heavily dependent on sustenance agrarian economy and low industrial outputs. The Road Network is the major backbone, yet the density is only about 43.10 Km /100 sq Km (2015)[1].

The Government of Meghalaya has taken up initiative for the development of transport infrastructure using financial assistance (loan) from the World Bank (IBRD) under its Meghalaya Integrated Transport Project (MITP). The Public Works Department (PWD) of Meghalayais the executing agency with given responsibility for planning, designing and, implementing civil works that includes rehabilitation/ up-gradation of existing roads and construction of missing links/ bypasses/ bridges in across the State in phases. Under Phase I, rehabilitation of ten (10) existing strategic road stretches across east and west parts of the State covering mix of state highways, MDRs and bridges have been taken up. Under Phase II, Urban and other Non-Urban Roads have been selected including Jowai Town roads (34.843km), Nongstoin Town roads (20.752 km) and Williamnagar Town roads (13.451 km) as urban strectches and Nongstoin-Maweit Road (35km) and Umsning- Jagi Road (40km) as non-urban stretches. This Environmental and Social Impact Assessment (ESIA) report covers only Nongstoin-Maweit Road.

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The Project Road

Nongstoin-Maweit Road (an MDR) extends up to 35 km length in West Khasi Hills district of Meghalaya. The project road starts from the junction with Riangdo-Shillong Road near bridge over Nondein river at Nongstoin and ends at 34.801 km near the first bridge at Nonghyllam-Maweit road.The project road passes through hilly and rolling terrains.It connects towns/ villages viz. Nongpyndeng, Mawlait, Nongthraw, Wahlyndoh, Nongsbah, Mawdong, Miangshang, Nongpathar, Maweit and Nonglyer.

[1]PWD, Government of Meghalaya, https://megpwd.gov.in/roads.html

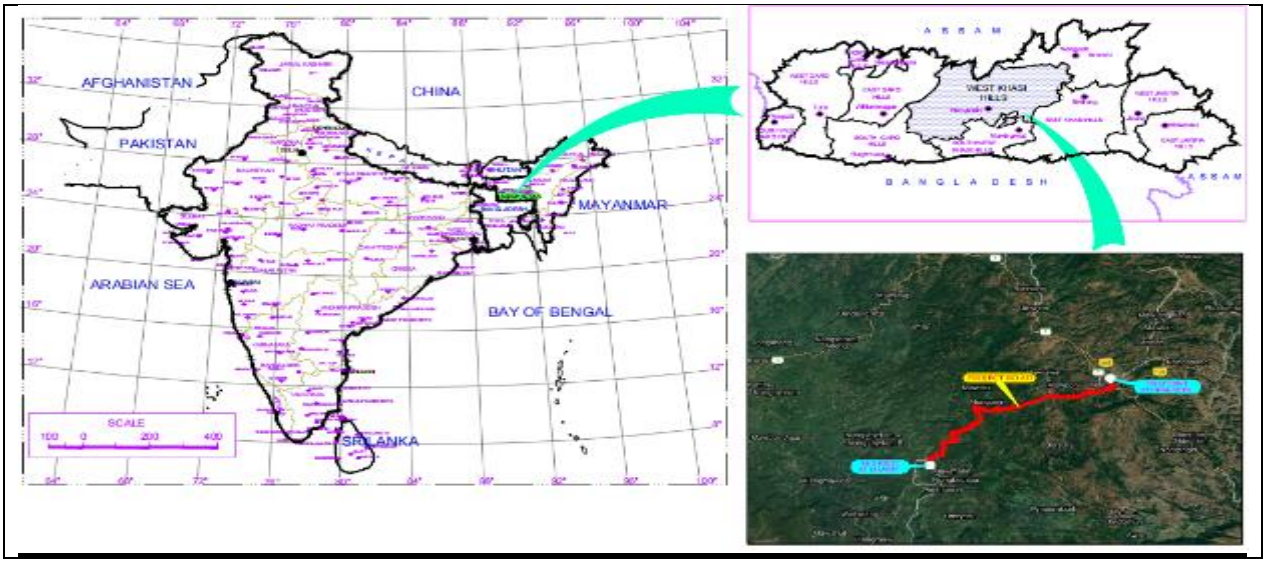

Figure 1: Location Map of the Nongstoin-Maweit Road

Scope of the ESIA Study

The scope of the ESIAstudy is: -

- Capturing the baseline condition of environmental and social parameters of the project area;
- Conducting Initial Impact Screening, Public Consultation and defining the scope of detailed assessment and safeguards instruments required based on outcome of initial screening exercise;
- Identification of the potential impacts during pre-construction, construction and operation phases;
- Defining mitigation measures for avoiding, minimizing and mitigating adverse impacts;
- PreparingEnvironmental and Social Management and Monitoring Plan.

Project's Area of Influence

The effects of the Project activities on a particular resource or receptor will have spatial (distance) and temporal (time) dimensions. Some activities would impact a larger radius than other identified impact sources. Thus, impacts were assessed both within area of impact of 50 meter either side of the alignment and project's area of influence up to 10 km. This area of influence encompasses project associated facilities, construction camps, labour camps, access roads, borrow pits and disposal areas. ~~The spatial and temporal dimensions have therefore been taken into account to define a Project's Area of Influence as given below:~~

~~Table 1: Area of Influence (AOI)~~

~~Sl.~~	~~Environmental and Social Issues~~	~~Area of Influence (AOI)~~	~~Justification~~
~~1~~	~~Air Quality~~	~~200 meters (m)~~	~~Dust emissions, fugitive dust, etc. is typically observed within 100m - 200m from the construction /operation area. Therefore, a minimum of 200m AoI on either side of road has been taken to capture all sources of these emissions, including vehicular movement across access roads.~~
~~2~~	~~Noise Pollution~~	~~500 m~~	~~Noise can often be detected up to 400-500m from any operation.~~

~~3~~	~~Water Environment~~	~~200 m~~	~~Waterbody located in the vicinity of the project area may get impacted due to activities at project footprint and allied sites.~~
~~4~~	~~Land Environment~~	~~Within proposed RoW~~	~~Impacts on soil and land are often restricted to the Project footprint area. An AoI with proposed RoW taken into account has indirect effects that usually occur due to vehicular/ heavy machinery movements and activities at allied sites~~
5	Socio-economicconditions	500m	Within 500 m is considered as an AoI for socioeconomic consultations to determine indirect impact due to the Project
~~6~~	~~Ecology~~	~~10 Km~~	~~An AoI of 10 km on either side of the roads are considered for the ecological study to understand the ecological settings in and around the project area~~

Corridor of Impact (CoI): The project RoW on either side of the proposed road centreline is considered as the corridor of impact. This area is more vulnerable to the project's direct impacts.

Approach for Environmental and Social Assessment

To identify the possible environmental and social issues arising out of the project road's planning, designing, and construction, the environmental and social conditions along the project's ROW were assessed. During these visits, consultations through group discussions with local communities, road users and panchayat/ village members were conductedas follows:

Task 1: Field Reconnaissance Survey and Review of Earlier Studies:
The field reconnaissance survey wascarried out to understand salient environmental and social features that are likely to be exposed to adverse impacts during construction and operation of project road. The salient feature includes the topography of the land, road geometry,environmental features like trees, any forest area, water bodies like ponds, rivers, etc. The social and physical features like settlement pattern, its density, typology of buildings, especially the presence of cultural, religious, and educational buildings, medical facilitiesland use, etc.

Task 2: Review and Assessment of Applicable Environmental and Social Regulations:
Thevarious rules/regulations and guidelines applicable to the project roads vis-à-vis central (GoI) and state (GoM) statutory requirements and World Bank policies were reviewed and referred to for assessing current environmental and social impacts that are likely to emanate.

Task 3: Assessment of Baseline Environmental and Social Conditions:
This task comprises a collection of baseline data for the project road locations primarily based on physical, biological and socio-economic conditions. The secondary source of information was utilised for giving a generic snapshot of socio environment features. In addition, existing environmental and social quality/features along the project roads were assessed based on a walk-through surveys, public consultations, FGD's and discussions with line department officials.

Task 4: Public Consultations/ Focus Group Discussions:
To cover a wide range of stakeholders in the study area, corner meetings were conducted at selected places with women groups, men and road users to understand the people's perception about the project as well as their issues and concerns. Overall project features, social safeguards, issues related to women's safety and security, environmental safeguards, and enhancement measures that would be implemented in the project was also discussed with the public.

Task 5: Preparation of ESIA Report including Impact Identification, Mitigation Planning and preparation of ESMP.
Identified likely impacts that would arise due to the construction of project roads, through changes in the physical, biological or socio-economic baseline environment. The impacts were also analysed with respect to pre-construction, construction and operation phases and were categorised in terms of magnitude and significance.The assessment considered both positive and negative impacts at different stages of implementation, i.e. pre-construction, construction and operation stages of the project roads.

A comprehensive Environmental and Social Management Plan (ESMP) was prepared which included mitigation measures for all the negative impacts of sub-projects and enhancement measures for the positive impacts.

Task 6: Preparation of Environmental and Social Management Budget:
Based on environmental and social mitigation and monitoring plansa suitable budget has been estimated for enhancing the positive impact, implementing the mitigation plan, train the relevant staff and contractual employees on importance of Safeguards Measures, World Bank's Safeguards Requirement and Implementation of ESMP and last but not least implementation monitoring.

Task 7: Environmental Safeguard Clauses in the Bid Document:
Suitable safeguard clauses have been prepared based on the ESIA, the prepared clauses shall form part of the bid document either in the General conditions or Specific conditions of the contract agreement/ bid document. The prepared ESMP shall also be part of the bid document.

CHAPTERII: PROJECT DESCRIPTION

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Need for the Project

The project stretch has bitumen surface throughout. The entire bituminous surface has stripped away as a result of water accumulation for long periods. Existing road is not motorable and thus 'poor' in condition. The safety provision of road is also inadequate. Therefore, it is imperative to upgrade this road section to standard configuration with adequate safety measures in order to enhance traffic operational efficiency and to ensure safety to road users. Additionally the project road upgradation will lead to tourist footfall at Khudoi Falls and the Kohmang Falls is met.

Project Location

The project road starts from the junction with Riangdo-Shillong Road near bridge over Nondein river at Nongstoin. The project road ends at 34.801 km near the first bridge at Nonghyllam-Maweit road. The project road start point is at latitude of 25°31'40.25"N and longitude of 91°15'24.74"E. The end point is at latitude of 25°25'50.97"N and longitude of 91°04'24.82"E. The Project Highway corridor is situated in Eastern Part of India in the state of Meghalaya. The project is located in the Universe Transverse Meter (UTM) zone 46. The height of the dissected Meghalaya Plateau is 150 meters - 1961 meters above sea level. The existing road level varies from 1325 meter at start point to 720 meter at end point of the project road.

Figure 2:Project Start Point at junction with Riangdo-Shillong road

Figure 3: Project End Point at Nonghyllam-Maweit Road

Salient Features of the Project Road

Table 1: Project Feature

Sl.	Project Component	Details
1	Location of Project	Nongstoin-Maweit (35km). Project road is situated in Eastern Part of India in the state of Meghalaya.
2	Administrative locations	West Khasi Hills
3	State	Meghalaya

Sl.	Project Component	Details
4	Design Chainage	0+000 to 34+801
5	Length of the project section	34.801 km
6	Proposed Carriageway width	5.5m C/W throughout the project road
7		7.0m C/W is proposed in 900 m length of project road
8	Major Junctions (Nos.)	4
9	Minor Junctions (Nos.)	32
10	Major Bridge	Nil
11	Minor Bridge (up to 30m waterway)	14
12	Minor Bridge (more than 30m waterway)	1
13	Total Culverts (new)	164 (41 no. pipe culvert and 123 no. slab culvert)
14	Bus Shelters (Nos.)	20 locations (both side), 40 Nos.
15	Slope Protection	Hydro seeding at Gabion Wall, Breast Wall
16	Terrain	The project road passes mostly through hilly terrain and few stretches pass through rolling terrain
17	Major Settlement along the Project Stretch	Nongpyndeng, Mawlait, Nongthraw, Wahlyndoh, Nongsbah, Mawdong, Miangshang, Nongpathar, Maweit and Nonglyer
18	Land use	The adjoining land is generally hilly with vegetation. Agricultural land used for cultivation is also observed in a few locations.
19	Forest area	No forest area along the project area
20	Road Configuration	Existing project road is single lane
21	Pavement condition	Existing road is not motorable, thus 'poor' in condition.

Right of Way (RoW)

The existing right of way along the project road varies from 7 m to 20 m. Care has been taken to design the project road without land acquisition to reduce the corridor of impact.

Proposed Land Acquisition

As the Proposed Right of Way is well within the existing Right of Way, therefore the project does not involve any land acquisition.

Proposed Cross Section Details

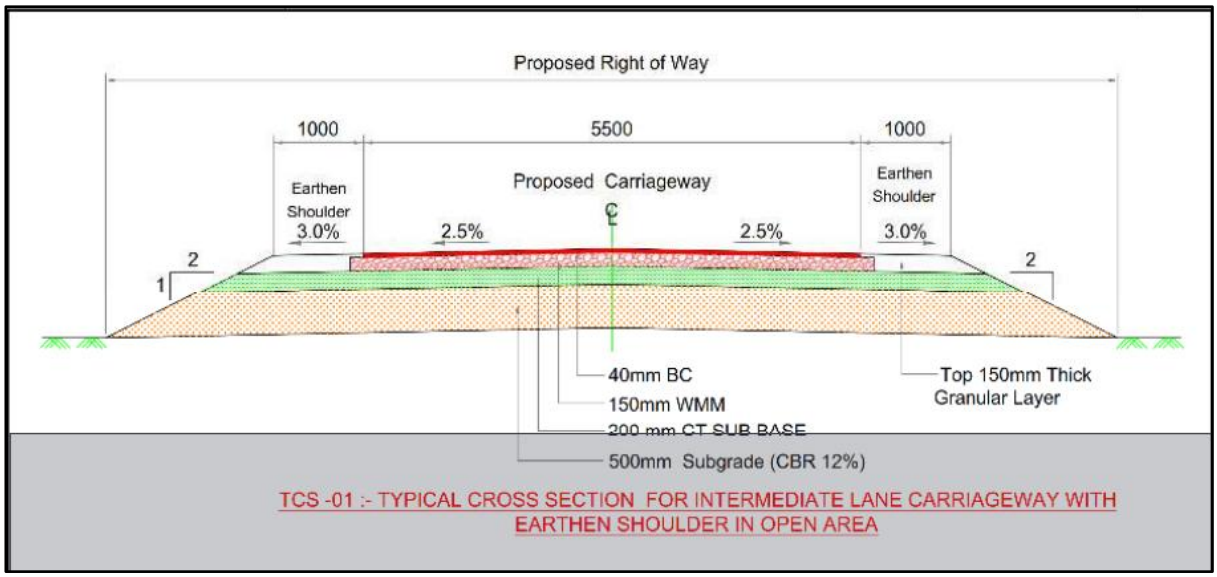
Carriageway Width: The carriageway configuration of two lanes with a paved and hard shoulder is proposed for the project road having a 7.0 m carriageway width.
Shoulder: Paved Shoulder and Earthen shoulders are proposed to be 1.0m and 1.0m respectively on both sides of the Carriageway.
Footpath: The minimum width of footpath in urban stretches is proposed to be 1.5m. The side drain in such stretches may be accommodated under the footpath.
Embankment Slopes: Side slopes shall not be steeper than 2H:1V.
Typical Cross Section: The Typical cross section summary for the complete project stretch is shown in the table below:

Table 2:Typical Cross Section Summary

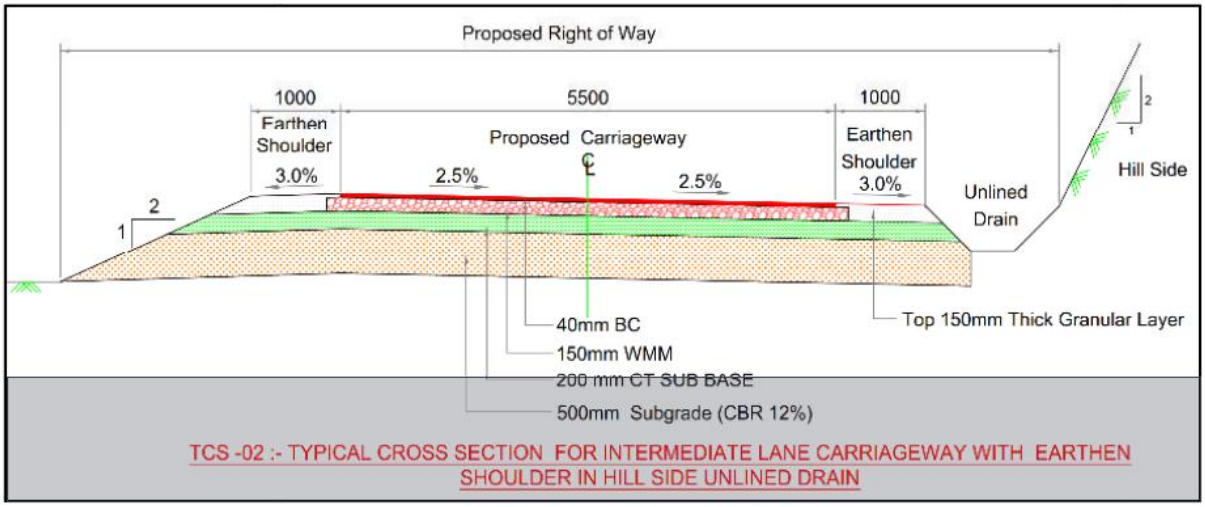
TCSNo.	Description	Net Length(m)	CD StructureLength(m)	TotalLength(m)
TCS-1	Typical Cross Section ForIntermediateLaneCarriageway With EarthenShoulderIn Open Area	1785.5	134.5	1920.0
TCS-2	Typical Cross Section ForIntermediateLaneCarriageway With EarthenShoulderIn Hill SideUnlinedDrain	11697.6	103.5	11801.0
TCS-3	Typical Cross Section	9944.8	115.2	10060.0

	ForIntermediateLaneCarriageway With EarthenShoulder InHill SidePCC Drain			
TCS-4	Typical Cross Section ForIntermediateLaneCarriageway With EarthenShoulderIn Valley SideGabion Wall	287.1	47.9	335.0
TCS-5	Typical Cross Section ForIntermediateLaneCarriageway With EarthenShoulder InValleySideREWall withGabion Facia (Both side)	372.9	87.1	460.0
TCS-6	Typical Cross Section ForIntermediateLaneCarriageway With EarthenShoulder InValleySideGabion Wall &In Hill SideUnlinedDrain	783.0	2.0	785.0
TCS-7	Typical Cross Section ForIntermediateLaneCarriageway With EarthenShoulder InHill Side PCC Drain AndValley SideGabion Wall	571.0	4.0	575.0
TCS-8	Typical Cross Section ForIntermediateLaneCarriageway With EarthenShoulder with both sideUnlined Drain	2586.0	4.0	2590.0
TCS-9	Typical Cross Section ForIntermediateLaneCarriageway With EarthenShoulder InHill SideDrain CumBreastWall and othersideUnlineddrain	598.0	2.0	600.0
TCS-10	Typical Cross SectionForIntermediateLaneCarriageway With EarthenShoulder InHill SideDrainCumBreastWall	1307.0	8.0	1315.0
TCS-11	Typical Cross SectionForIntermediateLaneCarriageway With EarthenShoulder InHill Side DrainCumBreastWall And Valley Side GabionWall	228.0	2.0	230.0
TCS-12	Typical Cross Section ForIntermediateLaneCarriageway With EarthenShoulder InHill SideDrain CumBreastWall and othersidePCC drain	1255.0	20.0	1275.0
TCS-13	Typical Cross Section ForIntermediateLaneCarriageway With BothSidePaverBlock In Built-Up Area	2837.0	18.0	2855.0
Total=	**34252.9**	**548.15**	**34801**	

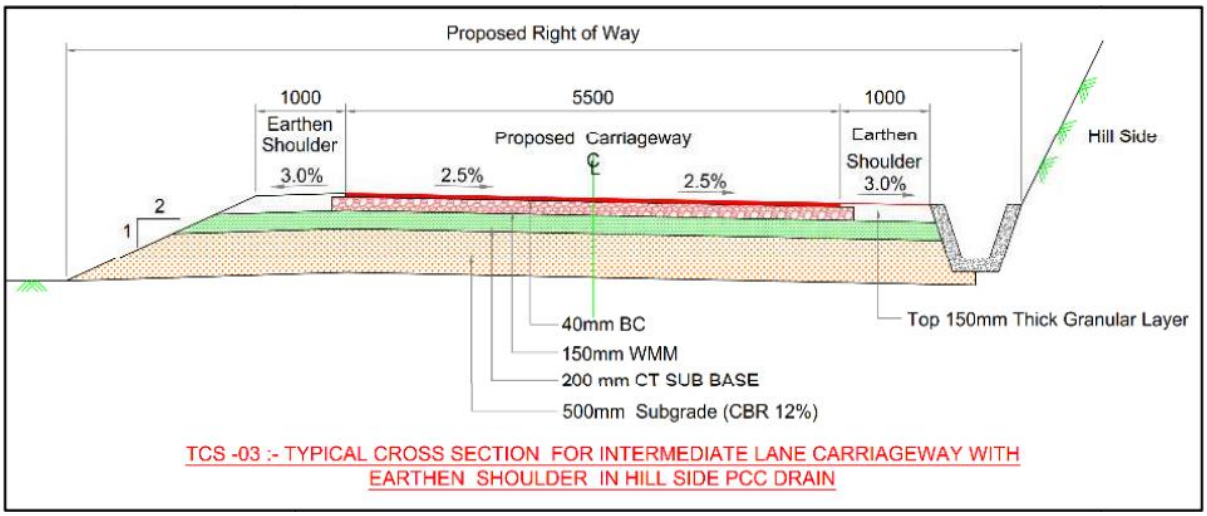
Typical cross sections (TCS) for various configurations proposed in built up area and open country area in rolling/hilly terrain are shown below:



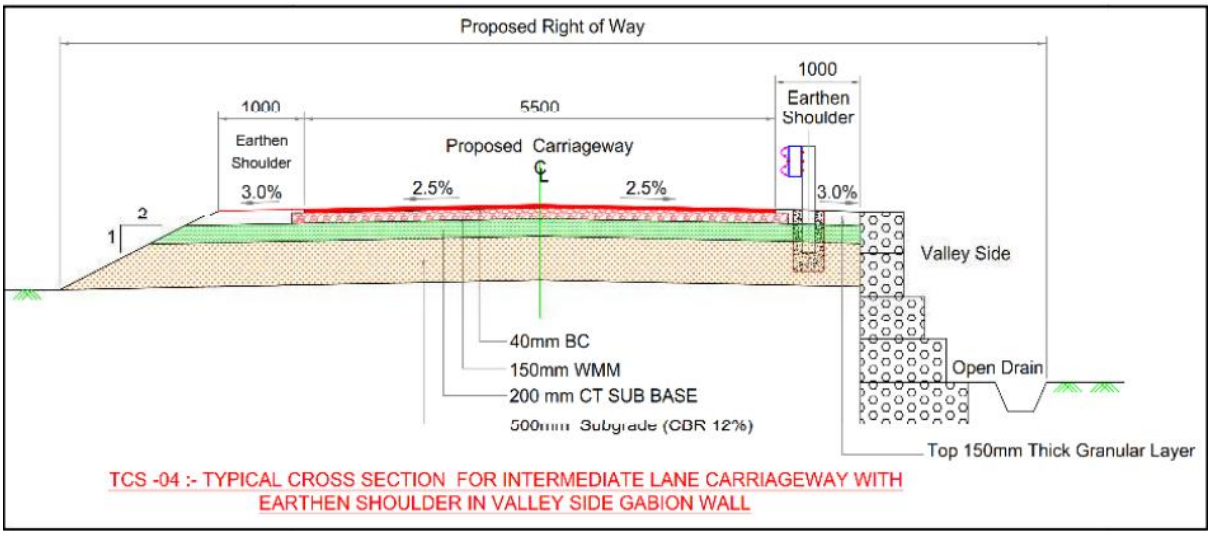
TCS -01 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN OPEN AREA



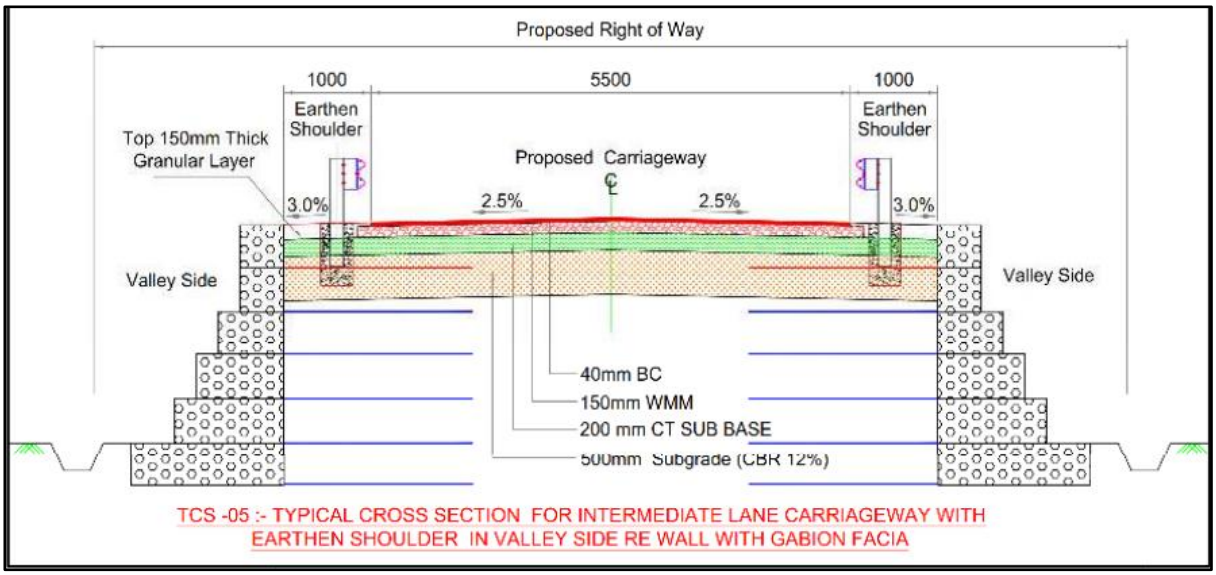
TCS -02 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN HILL SIDE UNLINED DRAIN



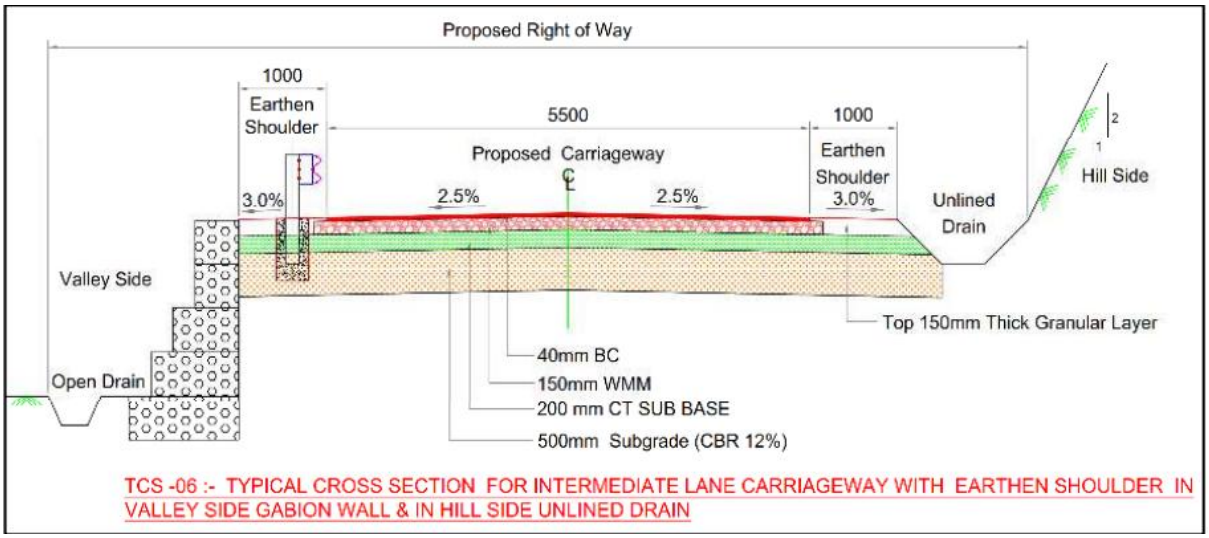
TCS -03 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN HILL SIDE PCC DRAIN



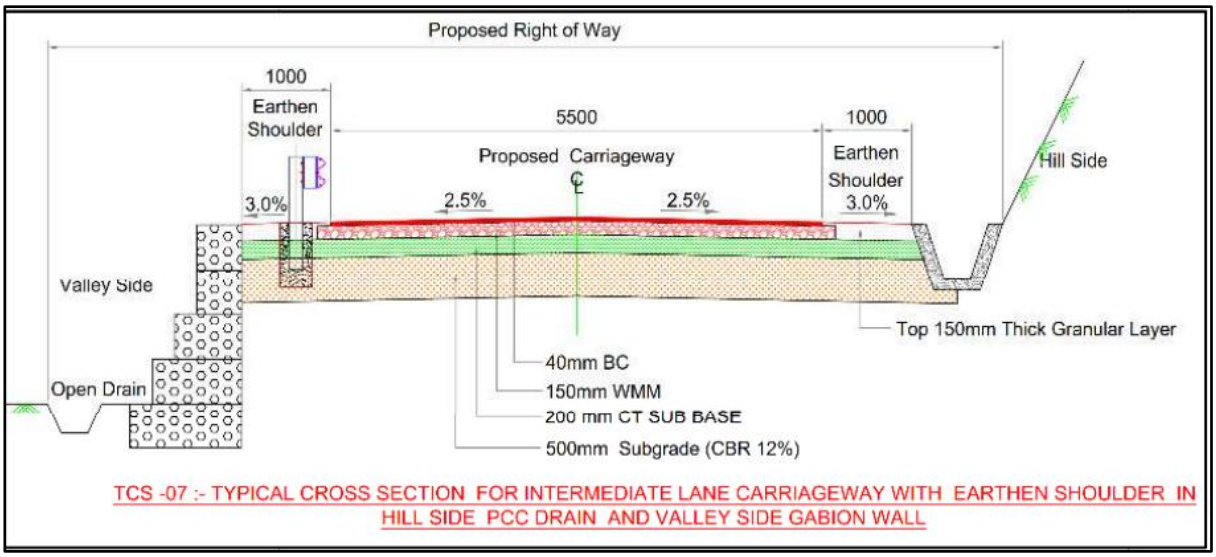
TCS -04 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN VALLEY SIDE GABION WALL



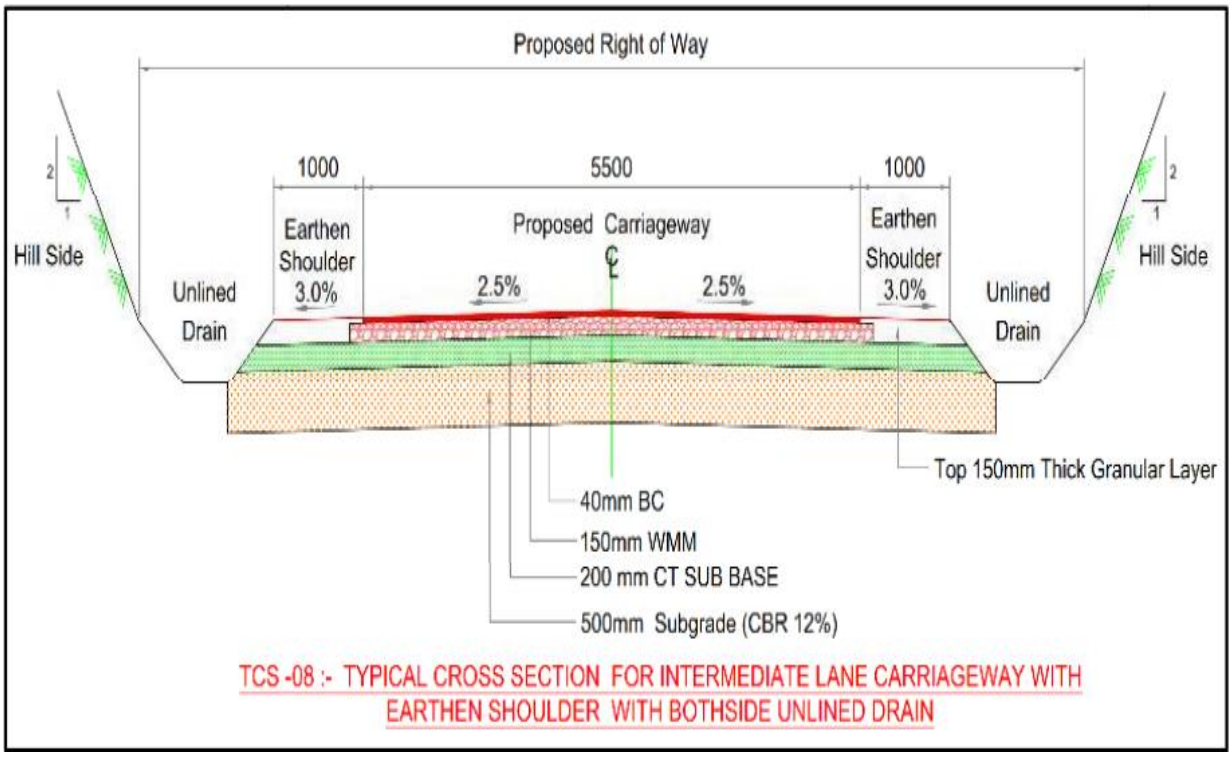
TCS -05 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN VALLEY SIDE RE WALL WITH GABION FACIA



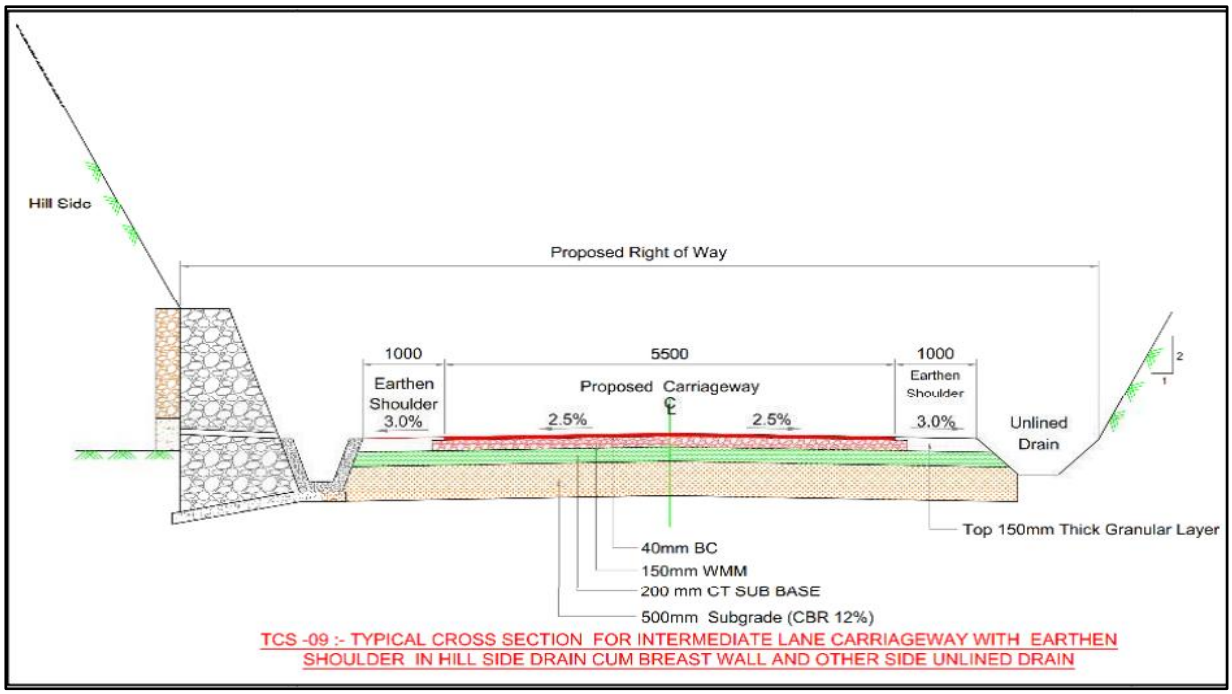
TCS -06 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN VALLEY SIDE GABION WALL & IN HILL SIDE UNLINED DRAIN



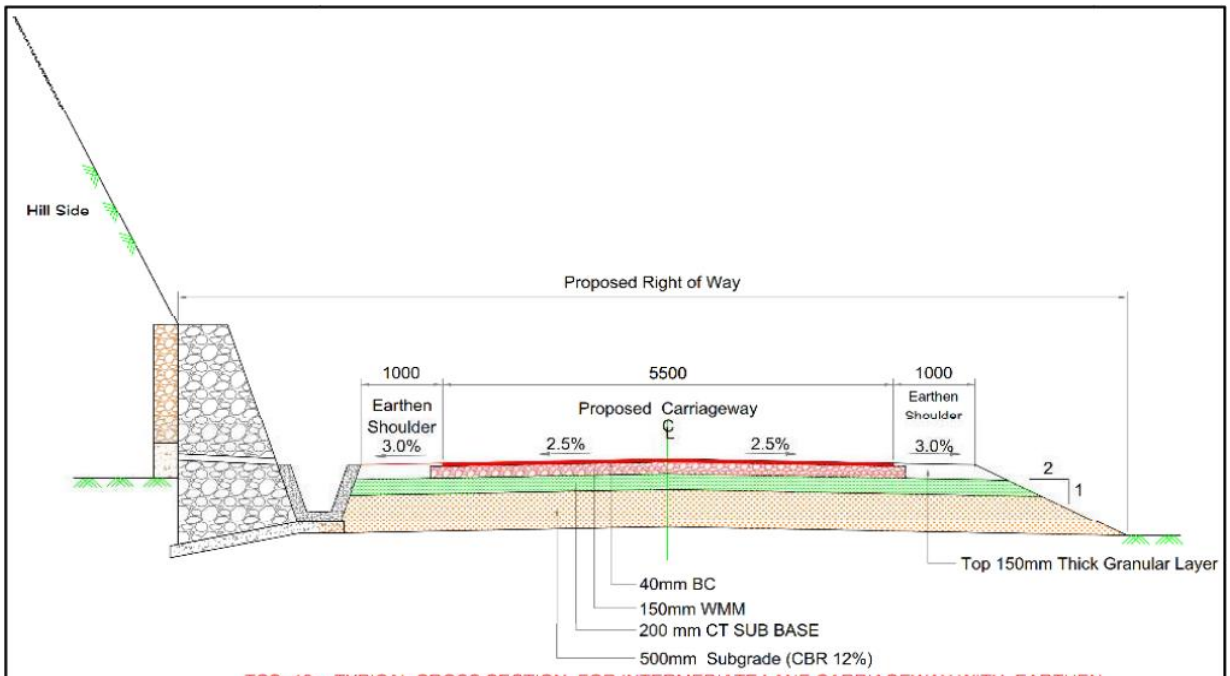
TCS -07 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN HILL SIDE PCC DRAIN AND VALLEY SIDE GABION WALL



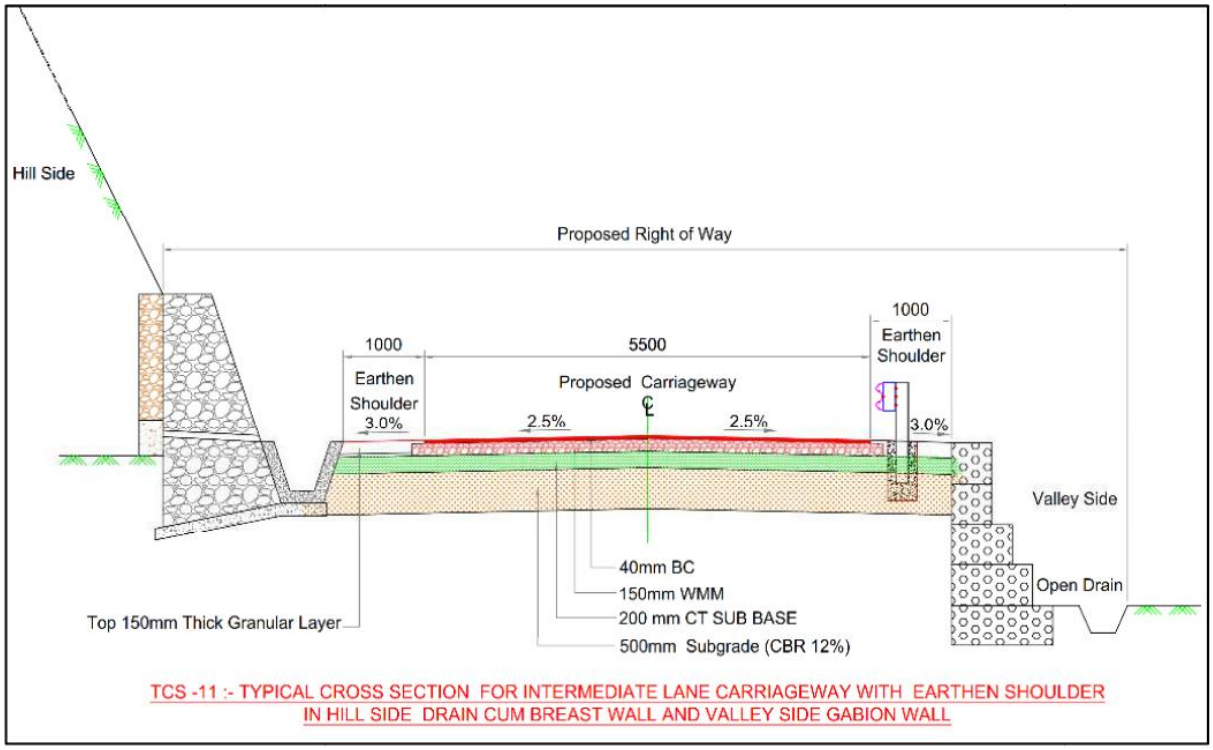
TCS -08 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER WITH BOTHSIDE UNLINED DRAIN



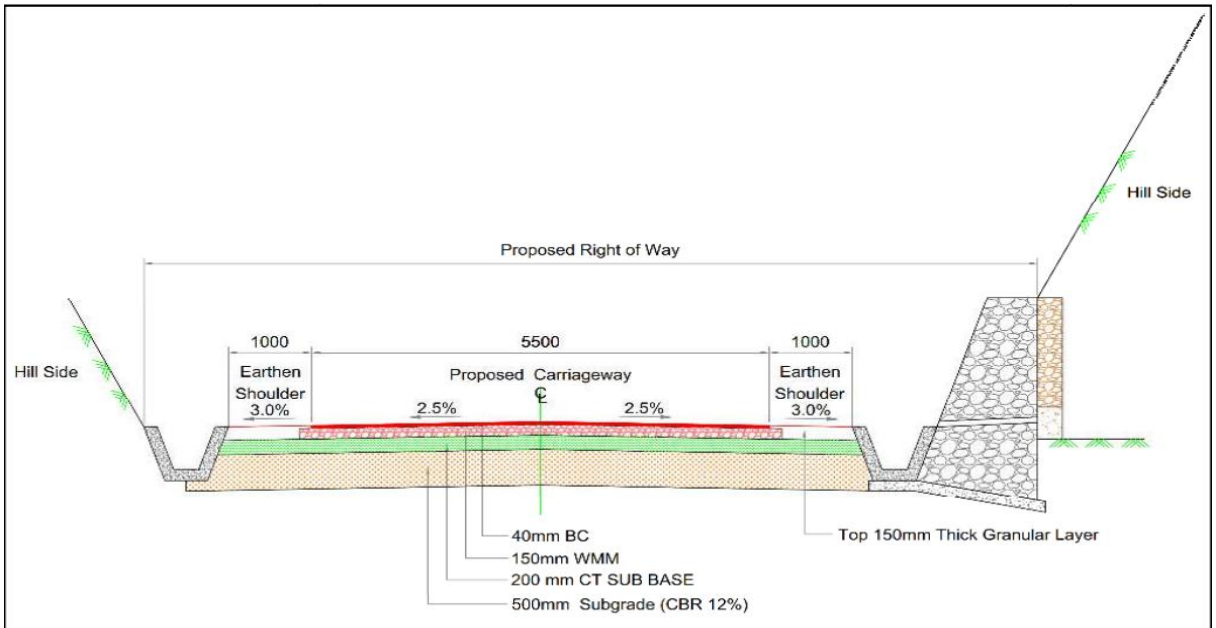
TCS -09 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN HILL SIDE DRAIN CUM BREAST WALL AND OTHER SIDE UNLINED DRAIN



TCS -10 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN HILL SIDE DRAIN CUM BREAST WALL



TCS -11 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN HILL SIDE DRAIN CUM BREAST WALL AND VALLEY SIDE GABION WALL



TCS -12 :- TYPICAL CROSS SECTION FOR INTERMEDIATE LANE CARRIAGEWAY WITH EARTHEN SHOULDER IN HILL SIDE DRAIN CUM BREAST WALL AND OTHER SIDE PCC DRAIN

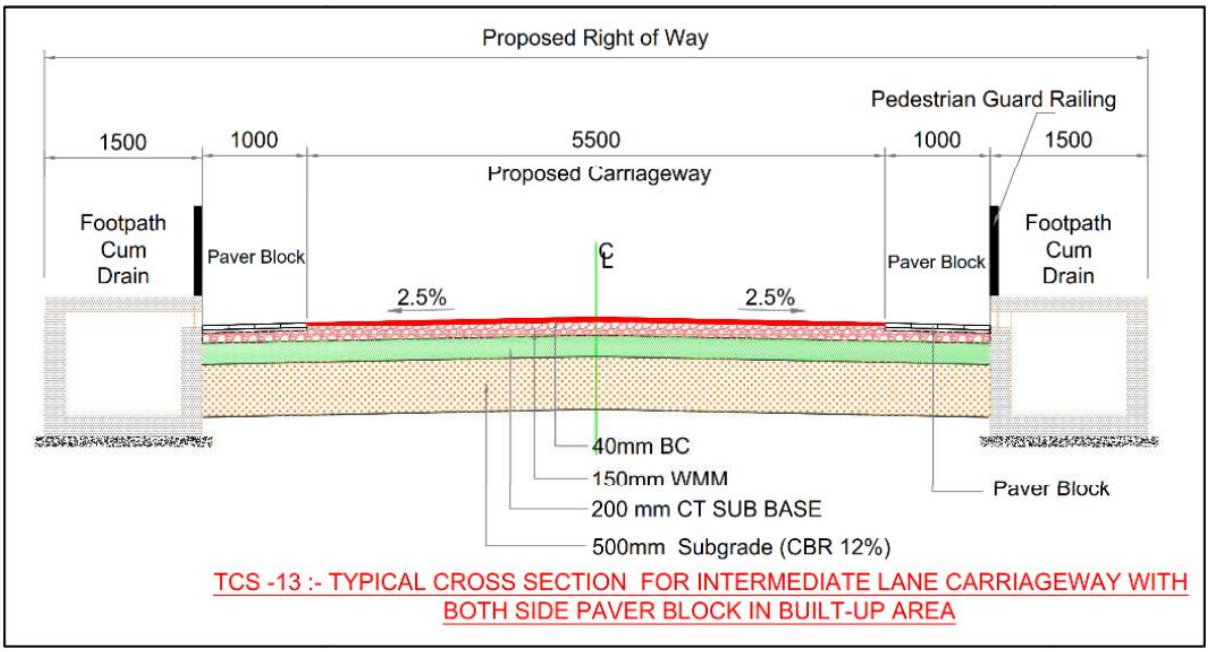


Figure 4:Typical cross sections

Current and Projected Daily Traffic

The traffic data used is taken fromthe survey conducted in April 2021 by PWD, Meghalaya at Thahkanar at km 6.000 and at Nonglyndoh at km 20.000 for 3days.

- **Average Daily Traffic**

Based on site visit observations, The AADT for 2 locations are given as follows:

Table 3: AADT at Thahkanar (6th Km)

Year	Growth Factors	AADT															TotalinNumbers	TotalinPCU
		Two Wheeler	Car/Jeep/ Van/Taxi/Auto	Mini/RTVsBus	Stand.Bus	LCV	2-Axle	3-Axle	Multi-Axle	Agri.Tract.WithTrailor	Agri.Tract. WithoutTrailor	Cycle	Cycle Rickshaw	HandCart	BullockCart	HorseCart		
2021	5.0%	5	52	2	2	40	638	106	0	8	0	0	0	0	0	0	853	2390
2022	5.0%	6	55	2	2	42	670	111	0	8	0	0	0	0	0	0	895	2509
2023	5.0%	6	57	2	2	44	703	116	0	9	0	0	0	0	0	0	940	2635
2024	5.0%	6	60	2	2	46	738	122	0	9	0	0	0	0	0	0	987	2766
2025	5.0%	6	63	2	2	49	775	128	0	10	0	0	0	0	0	0	1036	2905
2026	5.0%	7	66	3	3	51	814	135	0	10	0	0	0	0	0	0	1088	3050
2027	5.0%	7	70	3	3	54	855	142	0	11	0	0	0	0	0	0	1143	3202
2028	5.0%	8	73	3	3	56	897	149	0	11	0	0	0	0	0	0	1200	3363
2029	5.0%	8	77	3	3	59	942	156	0	12	0	0	0	0	0	0	1260	3531
2030	5.0%	8	81	3	3	62	989	164	0	12	0	0	0	0	0	0	1323	3707
2031	5.0%	9	85	3	3	65	1039	172	0	13	0	0	0	0	0	0	1389	3893
2032	5.0%	9	89	3	3	68	1091	181	0	14	0	0	0	0	0	0	1458	4087
2033	5.0%	10	93	4	4	72	1145	190	0	14	0	0	0	0	0	0	1531	4291
2034	5.0%	10	98	4	4	75	1202	199	0	15	0	0	0	0	0	0	1608	4506
2035	5.0%	11	103	4	4	79	1263	209	0	16	0	0	0	0	0	0	1688	4731
2036	5.0%	11	108	4	4	83	1326	220	0	17	0	0	0	0	0	0	1773	4968
2037	5.0%	12	114	4	4	87	1392	231	0	17	0	0	0	0	0	0	1861	5216
2038	5.0%	12	119	5	5	92	1462	242	0	18	0	0	0	0	0	0	1954	5477
2039	5.0%	13	125	5	5	96	1535	254	0	19	0	0	0	0	0	0	2052	5751
2040	5.0%	13	131	5	5	101	1611	267	0	20	0	0	0	0	0	0	2155	6039
2041	5.0%	14	138	5	5	106	1692	280	0	21	0	0	0	0	0	0	2262	6340
2042	5.0%	15	145	6	6	111	1777	294	0	22	0	0	0	0	0	0	2375	6658
2043	5.0%	16	152	6	6	117	1865	309	0	23	0	0	0	0	0	0	2494	6990
2044	5.0%	16	160	6	6	123	1959	325	0	25	0	0	0	0	0	0	2619	7340

Table 4: AADT at Nonglyndoh (20th Km)

Year	Growth Factors	AADT																
		Two Wheeler	Car/Jeep/Van/Taxi/Auto	Mini/RTVs Bus	Stand.Bus	LCV	2-Axle	3-Axle	Multi-Axle	Agri.Tract. WithTrailor	Agri.Tract. WithoutTrailor	Cycle	Cycle	HandCart	BullockCart	HorseCart	TotalinNumbers	TotalinPCU
2021	5.0%	5	42	2	2	40	637	102	0	7	0	0	0	0	0	0	838	2364
2022	5.0%	6	44	2	2	42	669	107	0	8	0	0	0	0	0	0	880	2483
2023	5.0%	6	46	2	2	44	703	112	0	8	0	0	0	0	0	0	924	2607
2024	5.0%	6	48	2	2	46	738	118	0	8	0	0	0	0	0	0	970	2737
2025	5.0%	6	51	2	2	49	775	124	0	9	0	0	0	0	0	0	1018	2874
2026	5.0%	7	53	3	3	51	813	130	0	9	0	0	0	0	0	0	1069	3018
2027	5.0%	7	56	3	3	54	854	137	0	10	0	0	0	0	0	0	1123	3168
2028	5.0%	8	59	3	3	56	897	144	0	10	0	0	0	0	0	0	1179	3327
2029	5.0%	8	62	3	3	59	942	151	0	11	0	0	0	0	0	0	1238	3493
2030	5.0%	8	65	3	3	62	989	158	0	11	0	0	0	0	0	0	1299	3668
2031	5.0%	9	68	3	3	65	1038	166	0	12	0	0	0	0	0	0	1364	3851
2032	5.0%	9	71	3	3	68	1090	174	0	13	0	0	0	0	0	0	1433	4044
2033	5.0%	10	75	4	4	72	1145	183	0	13	0	0	0	0	0	0	1504	4246
2034	5.0%	10	79	4	4	75	1202	192	0	14	0	0	0	0	0	0	1580	4458
2035	5.0%	11	82	4	4	79	1262	202	0	15	0	0	0	0	0	0	1659	4681
2036	5.0%	11	87	4	4	83	1325	212	0	15	0	0	0	0	0	0	1741	4915
2037	5.0%	12	91	4	4	87	1391	223	0	16	0	0	0	0	0	0	1829	5161
2038	5.0%	12	96	5	5	92	1461	234	0	17	0	0	0	0	0	0	1920	5419
2039	5.0%	13	100	5	5	96	1534	245	0	18	0	0	0	0	0	0	2016	5690
2040	5.0%	13	105	5	5	101	1611	258	0	19	0	0	0	0	0	0	2117	5975
2041	5.0%	14	111	5	5	106	1691	271	0	19	0	0	0	0	0	0	2223	6273
2042	5.0%	15	116	6	6	111	1776	284	0	20	0	0	0	0	0	0	2334	6587
2043	5.0%	16	122	6	6	117	1864	298	0	21	0	0	0	0	0	0	2450	6916
2044	5.0%	16	128	6	6	123	1958	313	0	23	0	0	0	0	0	0	2573	7262

Proposed Bridges and Culvert

4 Nos. of RCC bridges are found structurally sound with minimum 7.650m carriageway width and hence are proposed to be retained while the remaining 10 nos. wooden bridges need to be reconstructed.

Out of total 196 nos. of existing culverts, 45 nos. are Pipe Culvert, 1 no. is RSJ with WoodenDeck & 150 nos. are Slab culvert. All culverts present in the project road are either hydraulically inadequate or structurally unsafe & hence are proposed for reconstruction. Total 164 no. new culverts(41 Nos.Pipe Culvert and 123 Nos. Slab Culvert) are proposed to be reconstructed and remaining 32 nos. are not required due to realignment proposed at this location.

Proposed Roadside Drainage

To ensure effective drainage of water, road side drainage system has been provided throughout the project stretch. The details of the roadside drainage are shown in typical cross section and drawing volume. The summary of roadside drainage is shown in the table below:

Table 5:Summary of Proposed Drain

Sl.	Type	Length (m)
1	Unlined Drain	18251
2	PCC Drain	15159
3	RCCCoveredDraincum Footpath	5674

Trapezoidal drains have been proposed at the hill side locations. The details are as follows:

Table 6:Summary of Proposed PCC Trapezoidal Drain on road

Chainage(m)		Side	Length(m)	Length ofCD (m)	NetLength(m)
From	To				
5825	6175	Hill	350		350
6175	6410	Hill	235	2	233
6770	6875	Hill	105		105
6875	6920	Hill	45		45
6920	7025	Hill	105		105
7300	7650	Hill	350	4	346
8050	8675	Hill	625	8	617
9820	10755	Hill	935	34.24	900.76
11695	11975	Hill	280	4	276
12020	12335	Hill	315	2	313
12420	12450	Hill	30		30
12450	12495	Hill	45		45
12780	12930	Hill	150	2	148
12930	12990	Hill	60		60
12990	13110	Hill	120		120
13390	13460	Hill	70		70
13460	13560	Hill	100	2	98
13560	13620	Hill	60	2	58
14150	14180	Hill	30		30
14210	14250	Hill	40		40
14250	14350	Hill	100		100
16320	16440	Hill	120		120
16440	16925	Hill	485	15	470
17650	17975	Hill	325	4	321
17975	18075	Hill	100	2	98

Chainage(m)		Side	Length(m)	Length ofCD (m)	NetLength(m)
From	To				
18075	18750	Hill	675		675
18750	18820	Hill	70		70
19030	19175	Hill	145		145
19360	19590	Hill	230	2	228
19590	19640	Hill	50		50
19640	19760	Hill	120	2	118
20080	20290	Hill	210	2	208
20410	20460	Hill	50		50
20460	20490	Hill	30		30
20490	20530	Hill	40		40
20530	21040	Hill	510	6	504
21040	21090	Hill	50		50
21300	21400	Hill	100	2	98
21400	21475	Hill	75		75
21475	21550	Hill	75	2	73
21550	21580	Hill	30		30
21580	21630	Hill	50	2	48
21630	21910	Hill	280	2	278
21910	21980	Hill	70		70
21980	22030	Hill	50	2	48
22030	22075	Hill	45		45
22075	22380	Hill	305	2	303
22380	22420	Hill	40		40
22420	22470	Hill	50		50
22470	22530	Hill	60	2	58
22530	22575	Hill	45		45
22575	22610	Hill	35		35
22610	22660	Hill	50		50
22975	23030	Hill	55		55
23030	23100	Hill	70		70
23100	23140	Hill	40		40
23140	23200	Hill	60	2	58
23200	23260	Hill	60		60
23260	23575	Hill	315	2	313
24525	25050	Both	525	6	1038
25050	25175	Hill	125	2	123
25175	25310	Hill	135		135
26425	26725	Hill	300		300
27200	27275	Hill	75		75
27275	27630	Hill	355		355
27630	27660	Hill	30	2	28
27660	27700	Hill	40		40
27700	28125	Hill	425	2	423
28125	28190	Hill	65		65
28190	28925	Hill	735	2	733
28925	29675	Both	750	14	1472
29675	29800	Hill	125	2	123
31950	32410	Hill	460	2	458
32410	32460	Hill	50	2	48

Chainage(m)		Side	Length(m)	Length ofCD (m)	NetLength(m)
From	To				
32460	33000	Hill	540	6	534
TotalLength (m)					**15159**

Unlined drainsareprovidedon hill sideof theprojectroad as per requirement. Thedetails areasfollows:

Table:7Summary of Proposed Unlined Drain

Chainage(m)		Side	Length(m)	LengthofCD (m)	Net Length(m)
From	To				
330	880	One	550	6	544
880	950	One	70		70
950	1050	One	100	2	98
1050	1100	One	50		50
1100	1380	One	280	4	276
1450	1775	One	325		325
2200	2250	One	50		50
2250	2325	Both	75		150
2500	2570	Both	70		140
2570	2620	One	50		50
3300	3420	Both	120		240
3570	3640	Both	70		140
4410	4510	One	100		100
4510	4590	Both	80		160
4630	4675	One	45		45
4675	4780	Both	105		210
5080	5140	One	60		60
5190	5250	One	60		60
5250	5350	Both	100		200
5350	5410	One	60		60
5475	5510	One	35		35
5510	5600	Both	90		180
5650	5710	Both	60		120
5710	5775	One	65		65
5775	5825	Both	50		100
5825	6175	One	350		350
6410	6440	One	30		30
6440	6620	One	180		180
6650	6700	One	50		50
6700	6770	Both	70		140
6770	6875	One	105		105
6875	6920	One	45		45
7080	7300	One	220	2	218
7650	7905	One	255		255
8725	9400	One	675	6	669
9700	9760	One	60		60
9760	9820	Both	60		120
10755	10900	Both	145		290

Chainage(m)		Side	Length(m)	LengthofCD (m)	Net Length(m)
From	To				
10900	11125	One	225	4	221
11125	11200	Both	75		150
11275	11415	One	140		140
11415	11455	Both	40		80
11455	11625	One	170	4	166
12335	12420	Both	85		170
12495	12730	One	235		235
12730	12780	Both	50		100
13110	13210	One	100		100
13210	13350	One	140	2	138
13350	13390	One	40		40
13620	13720	One	100		100
13720	13750	One	30		30
13750	13860	One	110	2	108
13860	13890	Both	30		60
13890	14150	One	260	14.75	245.25
14180	14210	One	30		30
14350	14380	Both	30		60
14430	14470	One	40		40
14470	14570	Both	100		200
14650	14950	One	300		300
14950	15100	Both	150		300
15100	15150	One	50	2	48
15150	15200	Both	50		100
15200	15630	One	430	2	428
15630	15760	Both	130		260
15820	15960	One	140		140
15960	16020	Both	60		120
16020	16210	One	190	4	186
16210	16240	One	30		30
16240	16320	One	80	2	78
16925	17060	One	135	2	133
17060	17130	Both	70		140
17130	17650	One	520		520
18820	19030	One	210	2	208
19175	19360	One	185	4	181
19760	19850	One	90		90
19930	19980	One	50		50
20290	20360	Both	70		140
20360	20410	One	50		50
20410	20460	One	50		50
21090	21300	One	210		210
22660	22690	One	30		30
22690	22790	One	100		100
22790	22830	One	40		40
22830	22975	One	145		145
23575	23645	Both	70		140

Chainage(m)		Side	Length(m)	LengthofCD (m)	Net Length(m)
From	To				
23645	24330	One	685	10.7	674.3
24380	24525	Both	145	2	286
25430	25675	One	245		245
25730	25900	One	170	2	168
25900	25970	Both	70		140
25970	26020	One	50		50
26020	26240	Both	220	2	436
26240	26425	One	185		185
26725	27030	One	305	2	303
27030	27080	Both	50		100
27080	27200	One	120	2	118
29800	29875	One	75		75
29875	29940	One	65		65
29940	30000	One	60		60
30000	30310	One	310	6	304
30450	31250	One	800	10	790
31250	31310	One	60		60
31310	31340	One	30		30
31390	31750	One	360	2	358
32410	32460	One	50	2	48
33000	33630	One	630	4	626
34340	34801	One	461	2	459
TotalLength (m)					**18251**

Proposed Pedestrian and Animal Crossing

On the basis of site visit data and traffic data, no pedestrian underpass is proposed. There is no animal movement corridor along or across the project road. Therefore, no animal underpass is needed.

Wayside Amenities

- **Bus Shelters**

Passenger shelters have been proposed at 20 nos. of locations near built up areas (both side). The details are given in Table8.

Table 8:Details of Proposed Bus Shelters

Sl.	Chainage(km)	Side
1	0+370	Both
2	0+990	Both
3	1+850	Both
4	2+575	Both
5	3+460	Both
6	4+430	Both
7	5+400	Both
8	7+930	Both
9	9+220	Both
10	11+000	Both
11	14+220	Both
12	17+690	Both

Sl.	Chainage(km)	Side
13	19+750	Both
14	22+310	Both
15	24+225	Both
16	25+620	Both
17	30+235	Both
18	32+800	Both
19	33+915	Both
20	34+475	Both

- **Footpath**

Drain cum footpath facility has been provided in urban areas for the safety of pedestrians.

Table 9:Details of Footpath

Chainage(m)		Side	Length(m)	Lengthof CD(m)	Net Length(m)
From	To				
0	330	Both	330	2	656.0
1775	2200	Both	425	4	842.0
2620	3300	Both	680	6	1348.0
3700	4410	Both	710	4	1412.0
33630	34340	Both	710	2	1416.0
TotalLength					**5674.0**

- **Paver Block**

Paver blocks have been provided in urban areas as per the below table.

Table 10:Details of Paver Block

Chainage(m)		Side	Length(m)	Lengthof CD(m)	Net Length(m)
From	To				
0	330	Both	330	2	656.0
1775	2200	Both	425	4	842.0
2620	3300	Both	680	6	1348.0
3700	4410	Both	710	4	1412.0
33630	34340	Both	710	2	1416.0
TotalLength (m)					**5674.0**

Pavement Condition

The project stretch has bitumen surface throughout. The entire bituminous surface has stripped away as a result of water accumulation for long periods. Existing road is not motorable and thus 'poor' in condition. But some parts of the road is intact and motorable and in 'good' condition. The summary of the visual pavement condition survey (carried out in September 2021) of the project roads are given below:

Table 11:Summary of Pavement Condition

Nongstoin-MaweitRoad				
Sl.	From(Km)	To (Km)	Length (Km)	PavementCondition (Good/Fair/Poor)
1	0.000	0.060	0.060	Good
2	0.060	2.780	2.720	Fair
3	2.780	2.843	0.063	Good
4	2.843	4.175	1.332	Fair
5	4.175	35.312	31.137	Poor

Construction Material Requirement

- **Quarry and Crusher Information**

Stone quarry and crusher locations are located close to each other. The Crusher is located approximately 200 metres ahead of the Quarry location. Information is provided below:

Table 12:Details of Stone Quarry

Description	Location	Lead	Coordinates	
			N	E
Stone Quarry	Porsohsat	23.2 kms from the Centre Point of the total road to the Crusher	2824936	329266

- **Sand**

Table 13:Details of Sand Quarry

Description	Location	Lead	Coordinates	
			N	E
Sand	Jaidoh village on Nongkasen to Nongkhlaw Road	33.8 kms from the Centre point of the total road to the Quarry	334477	2819531
				
Stone Quarry (Crusher) at Porsohsat		**Fine aggregate - Sand quarry on Nongkasen Nongkhlaw Road**		

Figure 5: Photos of Aggregate, Borrow Area

Estimated Project Cost

The amount of each item is evaluated on the basis of relevant unit rates analyzed from Standard Data Book of Ministry of Road Transport and Highways (MoRTH). Summary of Preliminary Cost Estimate for all the improvement works is presented table below

Table 14:Summary of Project Cost

Bill No.	Description	Amount (Rs.)	Amount (Cr.)
1	SiteClearance	1,24,44,328	1.244
2	Earthwork	16,55,83,800	16.558
3	Sub BaseAndBaseCourses	46,99,73,398	46.997
4	BituminousCourses	11,75,81,632	11.758
5	Culverts		
5(a)	PipeCulvert	3,00,49,599	3.005
5(b)	Slab Culvert	15,69,86,689	15.699
6	Bridges		
6(a)	MajorBridges		
6(b)	MinorBridges	13,86,39,046	13.864
6(c)	RepairAndRehabilitation OfExistingStructures		
7	DrainageAnd ProtectiveWorks		

7A	DrainageWorks	10,96,13,899	10.961
7B	Breast Wall	7,58,68,600	7.587
7C	Gabion Wall	10,58,02,282	10.580
7D	Crash Barrier&Railing	2,96,96,026	2.970
7E	HydroSeeding With Jute Net	58,34,136	0.583
8	Traffic Signs, Markings,Safety DevicesAndRoad Appurtenances	4,16,44,742	4.164
9	Junction	2,01,06,668	2.011
10	Bus Shelter	1,40,00,000	1.400
11	Traffic Management DuringConstruction	1,01,06,368	1.011
12	Utility Shifting	1,00,00,000	1.000
13	Environmental Management Cost	29,02,000	0.2902
A	**TOTALCONSTRUCTION COST(Without GST)**	1,51,68,33,213	151.6802
B	**TOTALCONSTRUCTION COST(Including 12% GST)**	**1,69,88,53,199**	**169.88532**
1	Contingencies@1% of(A)above	15168332.13	**1.517**
2	Agency charges@3% of (A)	45504996.39	**4.550**
3	Supervision Charges@3% of (A)	45504996.39	**4.550**
4 4	MaintenanceCharges(2.5%of A)(Firstyear-Nil, 2 nd year-0.5%, 3rd year-0.5%,4th year-0.5%&5thyear1%.)	37920830.33	**3.792**
5	PriceEscalation @5% perannumfor1 yearof (F)	75841660.65	**7.584**
C	**TOTALPROJECTCOST**	**1,91,87,94,014**	**191.879**
D	**TOTALPROJECTCOSTPERKm**	**5,51,36,175**	**5.514**

Implementation Schedule:

Since as a widening proposal intermediate lane has been proposed a construction period of 730 days (2022-23, 2023-24) has been envisaged with a phasing of 60% & 40%respectively.

Sub-project Benefits

The Project Benefits comprise the cost saving in operation of vehicles and maintenance of the road between Without Project and With Project options. The Project Benefits results in the form of-:

- Savings in Vehicle Operating Costs (VOC)- Vehicle Operating Cost (VOC) will be reduced when riding quality of the road is improved
- Savings in travel time costs due to reduction in congestion and higher travel speeds as a result of improved roads - both in terms of capacity as well as riding quality;
- Savings in maintenance costs- Maintenance and Operation cost such as fuel consumption, wear and tear of tyres, will be sufficiently reduced. The vehicle operating cost shall be further reduced by improving the geometrics and design. The benefits perceived by the road user are in the form of lower expenditure
- The proposed project will also contribute to economic development by encouraging attraction of businesses to sites equipped with good access and by improving the travel efficiencies of existing businesses and to start a new avenue
- Reductions in adverse environmental impacts of transportations i.e. reduced traffic emissions, decrease in respirable suspended particulate matter and suspended particulate matter, reduced Noise and other impacts are also the direct benefits of proposed upgradation of the project road

CHAPTERIII:LEGAL FRAMEWORK

The following chaptersummarizes the legislative framework in which the present project will be addressed with respect to the environmental and social issues.

Acts & Regulation

The Government of India has laid down various policy guidelines, regulations, acts and legislations pertaining to sustenance of environment. The following table shows the relevant environmental legislations and implementing agencies.

Table 15:Applicable Acts & Regulations

Sl.	Act/Regulations	Main Objective	Applicability to thisProject	Implementation Agency
1.	Air (Prevention and Control of Pollution) Act, 1981	To control and monitor air quality as per prescribed limits.	For establishment and operation of Hot Mix/ Stone crusher/ Batching Plants during construction, etc. Batch Type Hot Mix – PM (mg/ Nm_3) – 150 SO_2 (mg/ Nm_3) – 250 NO_X (mg/ Nm_3) – 200	Contractor to: a) obtained COE (consent to establish); b) maintain pollution level below prescribed limit;
2.	The Water (Prevention and Control of Pollution) Act, 1974	To control and monitor water pollution as per prescribed limits	Yes, For establishment and operation of Hot Mix/ Stone crusher/ WMM/ Batching Plants during construction, etc. (Construction Stage)	State Pollution Control Board.
3.	Indian Motor Vehicles Act, 1988	To check vehicles for air and noise pollution	Yes, For construction vehicles (Construction Stage) Pollution Under Control Certificate	Motor Vehicles Department, Govt. of Meghalaya.
4.	The Forest Conservation Act, 1980	To check deforestation	166 no. of tree felling is required as per primary survey and site visit report.	Forest Department GOI and Government of Meghalaya & MoEF & CC
5.	National Forest Policy, 1988	To preserve and restore biological diversity	Applicable	Forest Department.
6.	Wild Life (Protection) Act, 1972	To protect and improve the overall wild life	No. No Wildlife Sanctuary or National Park/Tiger reserves lies within 10 kms of project boundary	Chief Conservator wild life, Forest Department, Meghalaya.
7.	Environment Protection Act, 1986	To protect and improve the overall environment	Yes, discharge Standards, Hazardous material management and handling Rules & Regulations (Construction Stage)	Dept. of Environment and Forest, Meghalaya.
8.	Ancient Monuments and Archaeological Sites and Remains Act,	Preservation of culture and historical remains	No. There is no cultural and historical place along the project road.	Indian Heritage Society, and Indian National Trust for Art and Culture Heritage

Sl.	Act/Regulations	Main Objective	Applicability to thisProject	Implementation Agency
	1958			
9.	EIA Notification, September 14, 2006	For all Development Projects	The Project does not require Environmental Clearance.	Ministry of Environment, Forest & Climate Change (MoEF & CC)
10.	National Environmental Appellate Authority Act, 1997	For Grievance Redress	No.	Ministry of Environment, Forest & Climate Change (MoEF & CC)
11.	Integrated Waste Management	Waste management and control.	Yes, it is applicable as domestic solid waste is generated from the canteens, residences located within the Construction camp.	Ministry of Environment, Forest & Climate Change (MoEF & CC) and State Pollution Control Board
12	Fly Ash Notification, 2011 and 2016	Asper the notification of MoEF&CC,it is mandatory to use fly-ash in the construction of road or flyover embankments within a radius of 300 km of a thermal power plant.	Yes. The NTPC Thermal Power Project in Dolaigaon, Assam, Bongaigaon Thermal Power Project lie within 300km radius of the project road.	MoEF & CC
13	Noise Pollution (Regulation and Control) Rules The Noise Pollution (Regulation and Control) Amendment Rules 2006	To regulate and control noise producing and generating sources with the objective of maintaining the ambient air quality standards in respect of noise	Yes applicable for construction phase	State Pollution Control Board
14	The Explosives Act (& Rules) Explosives Rules, 2008	An Act to regulate the manufacture, possession, use, sale, transport, import and export of Explosives (For transporting and storingdiesel, bitumen etc.)	Yes, if the storage quantityof Diesel and Bitumenexceeds the allowablelimit.	Petroleum & Explosives Safety Organization (PESO)
15	Ground Water (Management &Regulation) Act, 2019	For regulating ground waterabstraction and maintainingground water table.	Yes, NOC for establishing bore wells for abstraction of ground water for use of construction as well as domestic use.	State Ground Water Board

Sl.	Act/Regulations	Main Objective	Applicability to thisProject	Implementation Agency
16	The Petroleum Rules,2002	Delivery, dispatch or storage of petroleum products by authorized persons/organization	Yes	A person recognized by the Chief Controller

Clearance Requirement

During the construction stage, some of the key statutory requirements that need to be obtained by the Contractor as part of mobilization have been listed in the table given below:

Table 16:Applicable Acts & Regulations (Construction Phase)

Sl.	Clearance Required for	Statute under which clearance is required	Statutory Authority
1	Hot mix plants, Crushers, Batch Mix Plants & DG Sets.	Air (Prevention and Control of Pollution) Act, 1981 and Noise Pollution (Regulation and Control) Rules, 2000	State Pollution Control Board
2	Storage, handling and transport of hazardous materials.	Hazardous Waste (Management and Handling) Rules, 1989 and Manufacturing, Storage and Import of Hazardous Chemicals Rules, 1989.	State Pollution Control Board
3	Location/ layout of workers camp, equipment and storage yards	Environment Protection Act, 1986 and Manufacturing, Storage and Import of Hazardous Chemicals Rules, 1989	State Pollution Control Board
4	Quarries (Aggregates, Sand & Earth)	Environment Protection Act, 1986	MoEF&CC
5	Permission for withdrawal of groundwater and for construction purpose.	Environment Protection Act, 1986	CGWB
6	Disposal of bituminous wastes	Hazardous Waste (Management and Handling) Rules, 1989	As per state norm/ Local Civic Body
7	Pollution Under Control Certificate	Central Motor and Vehicle Act 1988	Department of Transport, State Government.
8	Storage of fuel oil, lubricants, explosives, diesel etc. at construction camp.	Manufacture, storage and Importof Hazardous Chemical Rules1989	State Pollution Control Board & PESO.

MoRTH & IRC Specifications

All road works in India are to be in accordance with the MoRTH specifications for Road and Bridge works and guidelines of Indian Roads Congress (IRC). The MoRTH specifications have special provisions towards protection of environment under Clause 501, Annexure A and the contractor has to satisfy the provisions. Apart from the Annexure A to clause 501, there are provisions for control of erosion, drainage, dust suppression, borrow area and haul road management under relevant sections. Provisions of clause 501 Annexure A, cover the environmental aspects.

Environmental Standards and Code of Practices

All the construction work will be carried out as per the Environment standards and guidelines of MoEFCC, CPCB & code of practices of IRC. Some of the codes used during the construction phase are listed below.

- Guidelines for use of Fly Ash in Road Embankments (IRC: SP: 58-2001)
- Guidelines for Environmental Impact Assessment of Highway Projects (IRC: 104-1988)
- Guidelines on Preparation and Implementation of Environment Management Plan (IRC SP 108-2015)

- Guidelines on Landscaping and Tree Plantation (IRC:SP-21-2009)
- Report containing recommendations of the IRC regional workshops on Highway Safety (IRC: SP: 27-1984)
- Recommended practice for Borrow pits for Road Embankments constructed by Manual operation IRC: 10-1961
- Road accident Forms (IRC: 53-1982)
- Guidelines for Use of Construction and Demolition Waste in Road Sector (IRC 121-2017)
- Road Transport Highway Safety Code (IRC: SP: 44-1996)
- Guidelines on Safety in Road Construction Zones (IRC: SP: 55:2001)
- Guidelines on Skill Development of Workmen in Road Sector (IRC 127-2018)
- Guidelines of WB&ADB.

Other Applicable Policies (Social Security & Labor Welfare)

Environmental and labour welfare issues during the construction stage generally involve equity, safety and public health issues. The different applicable policies are:

Table 17:Applicable Policies

Applicable Codes	Concerns	Remarks
The Code on Social Security, 2020	It consolidated The Employees' Compensation Act, 1923, The Employees' State Insurance Act, 1948, The Employees' Provident Funds and Miscellaneous Provisions Act, 1952, The Employment Exchanges (Compulsory Notification of Vacancies) Act, 1959, The Maternity Benefit Act, 1961, The Payment of Gratuity Act, 1972, The Building and Other Construction Workers Welfare Cess Act, 1996, Unorganised Workers' Social Security Act 2008.	Ministry of Labour and Employment
The Occupational Safety, Health And Working Conditions Code, 2020	It amalgamated The Factories Act, 1948, The Plantations Labour Act, 1951, The Mines Act, 1952, The Motor Transport Workers Act, 1961, The Beedi and Cigar Workers (Conditions of Employment) Act, 1966, The Contract Labour (Regulation and Abolition) Act, 1970, The Sales Promotion Employees (Condition of Service) Act, 1976, The Inter-State Migrant workmen (Regulation of Employment and Conditions of Service) Act, 1979 and The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996.	Ministry of labour and Employment
The Code on Wages, 2019	It consolidated the provisions of four labour lawsconcerning wage and bonus payments and makes universal the provisions for minimum wages and timely payment of wages for all workers in India. The Code repeals and replaces the Payment of Wages Act, 1936, the Minimum Wages Act, 1948, the Payment of Bonus Act, 1965, and the Equal Remuneration Act, 1976.	Ministry of labour and Employment

World Bank safeguard/ Operational policies

The World Bank policies and directives on environmental and social safeguards have adhered to the project roads. The applicability of the relevant policies of the project roads that are undergoing up-gradation (strengthening and widening) are summarized in the following table:

Table 18:Applicable World Bank Operational policies

OP 4.01 Environmental Assessment	The objective of this policy is to ensure that Bank financed projects are environmentally sound and sustainable. Help to ensure the environmental and social soundness and sustainability of investment projects. Support integration of environmental and social aspects of projects in the decision-

	making process. **OP 4.01 is applicable in this project**.~~The project is Classified as Category B project and EIA study is required.~~ MITP Projectis a "Category A" project as the sub-project sites are located in the hilly areas with fragile ecosystem, abutting forest and eco-sensitive zones as well as Wildlife Sanctuaries**. Thus, by default the sub-project "Category is A".**
OP 4.04 Natural Habitats	The policy recognizes that the conservation of natural habitats is essential for long-term sustainable development.Promote environmentally sustainable development by supporting the protection, conservation, maintenance, and rehabilitation of natural habitats and their functions. This policy may be triggered to improvement activity of road requiring forest/ wildlife lands, locating close to the natural habitats with the potential to cause significant adverse impact or degradation of natural habitats whether directly (through construction) or indirectly (through human activities induced by the project). The project does not pass through any reserved forest or natural habitat of wild animals or any eco sensitive zone therefore this operational policy is not applicable in this project.
OP 4.36 Forestry	Aims to harness the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively for sustainable economic development and protect vital local and global environmental services and values of forests. The widening of project road section will require felling of 166 numbers of trees within the existing ROW.Therefore, **OP 4.36 is applicable in this project.**
OP 4.09 Pest Management	The objective of this policy is to promote the use of biological or environmental control methods and to reduce reliance on chemical pesticides. This policy is not applicable in this project.
OP 4.12 Involuntary Resettlement	Avoid or minimize involuntary resettlement and, where this is not feasible, assist displaced persons in improving or at least restoring their livelihoods and standards of living in real terms relative to pre-displacement levels or to levels prevailing before the beginning of project implementation, whichever is higher. This policy OP 4.12 is not applicable in this project as the project does not involve any land acquisition. The existing ROW is encumbrance free.
OP 4.10 Indigenous People	Design and implement projects in a way that fosters full respect for indigenous peoples' dignity, human rights, and cultural uniqueness so that they i. Receive culturally compatible social and economic benefits, and ii. Do not suffer adverse effects during the development process. This OP 4.10 regarding Indigenous People is applicable only if any persons belonging to Indigenous community impacted by this project as Meghalaya is largely tribal state with more than 86% ST population. Hence, this policy will be triggered.
Physical Cultural Resources (PCR)	OP 4.11 Assist in preserving PCR and in avoiding their destruction or damage. PCR includes resources of archaeological, paleontological, historical, architectural, religious (including graveyards and burial sites), aesthetic, or other cultural significance. There are no PCR impacted under this project. Therefore OP.411 is not triggered.

Table 19Applicable Social Legal Framework for the entire Project

Sl.	Name of Act/ Rules	Purpose	Applicable/Not Applicable	Description	Responsible Agency
1.	The Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act	Grants Legal recognition to the rights of traditional forest dwelling communities.	Not Applicable	This Act is not applicableas there is no land acquisition. Thus, the rights of the forest dwelling schedule tribes & other traditional forest dwelling communities will not be impacted.	Tribal Affairs, Department of Tribal Welfare of State Government
2.	The Minimum Wage Act,1948	Payment of minimum rate of wages as fixed and periodically revised by the State Government	Applicable	Construction/ daily wageworkers who are involved in the project	District Labour Commissioner.
4.	Workmen Compensation Act, 1923	It provides for payment of compensation by Employers to their Employees for injury by accident i.e., personal injury or occupational disease.	Applicable	The Insurance Policy covers the compensation, hospitalization and transportation of workers /employees	District Labour Commissioner
5.	Inter-state Migrant Workers Act, 1979	It protects workers whose services are requisitioned outside their native states in India. Contractor who employs or who employed five or more Inter-State migrant workmen need to obtain registration under this act	Applicable	Construction workers involved in the project may or may not be from the neighboring state. Presently the construction workers are from within the state of Meghalaya.	District Labour Commissioner/ Govt. Of Meghalaya
6.	The Child Labour (Prohibition & Regulation) Amendment Act, 2016	It prohibits employment of children in certain specified hazardous occupations and processes and regulates the working conditions in others.	Applicable	No Child worker should be involved in the project.	District Labour Commissioner
7.	Building and Other Construction Workers Welfare Cess Act, 1996	An Act to provide for the levy and collection of a Cess on the cost of construction incurred by employers.	Applicable	Project involves employment of construction workers	District Labour Commissioner
8	The Sexual Harassment of Women at Workplace (Prevention, Prohibition,	Vishakha Guidelines are to be followed	Applicable	This act specially protects the rights of the women workers against any kinds of sexual harassment at the project, both at office and sites.	

Sl.	Name of Act/ Rules	Purpose	Applicable/Not Applicable	Description	Responsible Agency
	and Redressal) Act, 2013				
9	The Equal Remuneration Rules, 1976	Equal Remuneration for identical works	Applicable	Project should not discriminate between sex, race, caste or creed in payments to the employees	District Labour Commissioner
10	The Trade Union Act, 1926	Right to form Trade Union at the Workplace	Applicable	No trade union formed within the organization	District Labour Commissioner
11	Public Liability Insurance Act 1991	Provides immediate relief to the persons affected by accidents, occurring while handling any hazardous substance	Applicable	Project has been adhering to all the relevant provisions made under the act	District Labour Commissioner

Social Categorization:

All activities under the sub-projects are limited to the available RoW, thus no land acquisition and resettlement and rehabilitation are envisioned for these activities.The activities in this project will impact the tribal population as Meghalaya is largely tribal state with over 86% of the population belonging to the Schedule Tribes (ST) communities. The project will have positive impact on the tribal population Further the tribal community in Meghalaya have collective attachment to the landand if project have any impact on them would have trigger the Operational Policy OP 4.10 of the World Bank. Anticipated impact on livelihood of vendors is not there; however there would be minor impacts on some structures which will be reconstructed by the Contractor upon completion of work. Thus, a separate Abbreviated Resettlement Action Plan (ARAP) will not be requiredfor this sub-project.Apart from this, there would be some access restrictions to the structures along the roadfor 2-5 days and mitigation measures to address the access restriction issues has been suggested in ESMP.

CHAPTERIV:DESCRIPTION OF ENVIRONMENT

The present chapter describes the baseline environmental and social conditions within the project influence area of 10 Kmsof the project road. The baseline information on biophysical (air quality, water quality, noise, soil, ecology & biodiversity), social and economic aspects along the project roads has been collected applying primary surveys and referring to secondary sources.

Topography:

The project road passes mostly through hilly terrain and few stretches pass through rolling terrain. The existing road level varies from 1325 meter above sea level at start point to 720 meter above sea level at end point of the project road.

Soil & Geology:

Various types of soil are observed along the project road. At the beginning of the road typic Udorthents, typic kanhapludult soils are found. Major portion of the project road passes through the region where typic kanhapludult soils and typic dystrochrepts are present. Typic kanhapludult soils have a low cation-exchange capacity[2] and these soils are having less than 5 percent plinthite. Typic Udorthents soils comprise of moderately coarse textured soil material and a few small areas of medium textured material[3]. In the same line, pH of the dystrochrepts soils is acidic in nature[4] and it is also loamy – skeletal[5] soil.The soils along the project road are clayey silt with rock pieces or rock dust.

Soil Quality Monitoring

Soil is an important non-renewable resource to human life and terrestrial ecosystems. The key aim of soil monitoring is to understand the condition of soil in the project roads. The sampling was taken by a NABL Accredited Laboratory in the month of January. The concerned parameters are Nitrogen, Phosphorus, Potassium, pH, Nitrate etc. The sample collection, preservation, storage, transportation, and analysis were carried out as per the standard methods. Soil sampling locations are given in Table below

Table 20:Soil sampling locations along the project road

Sampling Location	Date of Sampling	Name of place	Distance	Coordinates	
				Latitude	Longitude
1	07/01/2022	Nongstoin, CH – 3 + 500	150 m	26.704350 N	94.440923 E
2	07/01/2022	Miangkain, CH – 24 + 250	150 m	26.704350 N	94.440923 E

Source: Environmental Baseline Monitoring

The soil quality along the project road is given in below

Table 21:Soil Quality along the Project Road

Sl.	Parameters	Test Method	Unit	Nongstoin	Miangkain	Standards/ Permissible (Limits Hand Book of Agriculture, ICAR, New Delhi)
1.	pH Value at 25°C	ITL/SOP/ENV/Soil/01	-	8.15	7.88	<4.5 Extremely acidic 4.51- 5.50 Very strongly acidic

[2] https://sites.google.com/site/dinpuithai/Home/taxonomy/h-ultisols/hc/hcd/hcdn

[3] https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/office/ssr12/?cid=nrcs144p2_016612

[4] http://isslup.in/wp-content/uploads/2018/09/Influence-of-plantation-crops-on-characteristics-of-soils-Typic-Dystrochrepts.pdf

[5] http://cgwb.gov.in/AQM/Meghalaya.pdf

Sl.	Parameters	Test Method	Unit	Nongstoin	Miangkain	Standards/ Permissible (Limits Hand Book of Agriculture, ICAR, New Delhi)
						5.51-6.00 Moderately acidic 6.01-6.50 Slightly acidic 6.51-7.30 Neutral 7.31-7.80 Slightly alkaline 7.81-8.50 Moderately alkaline 8.51-9.00 Strongly alkaline >9.00 Very strongly alkaline
2.	Conductivity at 25°C	ITL/SOP/ENV/Soil/02	µmhos/cm	677	714	Upto 1.00 Average 1.01-2.00 harmful to germination 2.01-3.00 Harmful to crops (sensitive to salts)
4.	Soil Texture	ITL/SOP/ENV/Soil/07	-	Silty Clay Soil	Silty Clay Soil	-
5.	Sand	ITL/SOP/ENV/Soil/06	% by mass	23.4	18.2	-
6.	Clay	ITL/SOP/ENV/Soil/06	% by mass	42.5	42.6	-
7.	Silt	ITL/SOP/ENV/Soil/06	% by mass	34.1	39.2	-
8.	Nitrogen	ITL/SOP/ENV/Soil/09	mg/kg	25.1	22.8	Upto 50 Very less 51-100 Less 101-150 Good 151-300 Better >300 Sufficient
9.	Potassium (as K)	ITL/SOP/ENV/Soil/11	mg/kg	73.1	68.4	Upto 15 Very less 16-30 Less 31-50 Medium, 51-65 On an avg. sufficient 66-80 Sufficient >80 More than sufficient
10.	Phosphorus	ITL/SOP/ENV/Soil/10	mg/kg	4.21	3.99	0 -120 Very less 120-180 Less 181-240 Medium 241-300 Average 301-360 Better >360 More than sufficient
11.	Organic Matter	ITL/SOP/ENV/Soil/17	% by mass	6.5	6.2	Upto 0.20: Very less 0.21-0.40: Less 0.41-0.50: Medium, 0.51-0.80: On an avg. sufficient 0.81-1.00: Sufficient >1.00 : More than sufficient
12.	Moisture Retention capacity	ITL/SOP/ENV/Soil/05	Inches/foot	1.22	1.17	-
14.	Sulphates	ITL/SOP/ENV/Soil/14	mg/kg	13.4	14.2	-
17.	Bulk Density	ITL/SOP/ENV/Soil/04	gm/cc	1.30	1.29	-

The important physical characteristics of soil are bulk density, porosity and texture. PH of soil in the proposed study area were found in the range of 7.88 to 8.15.The soil samples are, therefore, moderately alkaline. Conductivity of soils sample is found in the range of 677 to 714 Mhos/cm. Available phosphorous of soil samples along the proposed study area ranges from 3.99 to 4.21 mg/kg which is very less. Potassium content as K in soil samples along the proposed study area is found in the range of 68.4 to 73.1 mg/kg. Total organic matter in soil samples along the proposed study area is found in the range of 6.2– 6.5 %, therefore the soil is fertile in terms of productivity.

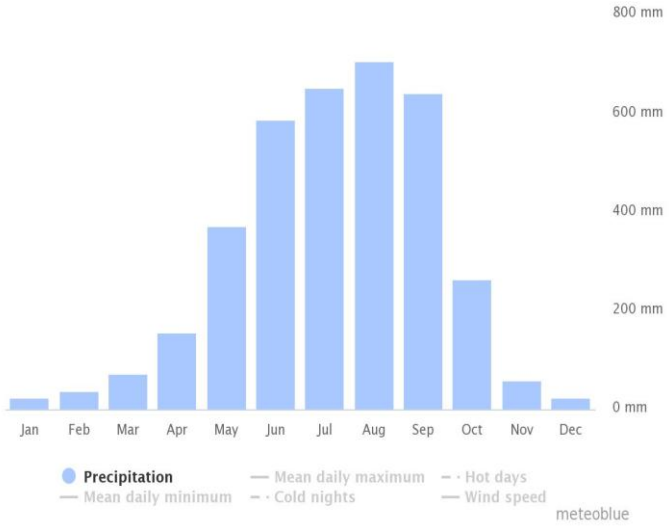
Climate:

In Nongstoin, the wet season is comfortable, muggy, and mostly cloudy and the dry season is cool and mostly clear.

Rainfall:In terms of precipitation received, August receives the most amount of rainfall, with an average of 27.6 days with at least 706 mm of precipitation. Driest month of Nongstoin district is

January withan average of 5.9 days with at least 23mmof precipitation.The study area is surrounded by hills and is subjected to a wet weather. The area experiences a lot of rainfall every year.

Figure 6: Precipitation in Nongstoin (Source-meteoblue)



Temperature:

The warm season lasts for 5.3 months, from May 20 to October 30. The hottest month of the year in Nongstoin is August, with anaverage temperature of 23°C. The cool season lasts for 1.7 months, from December 17 to February 8, with an average temperature below 19°C. The coldest month of the year in Nongstoin is January, with an average of 17°C.

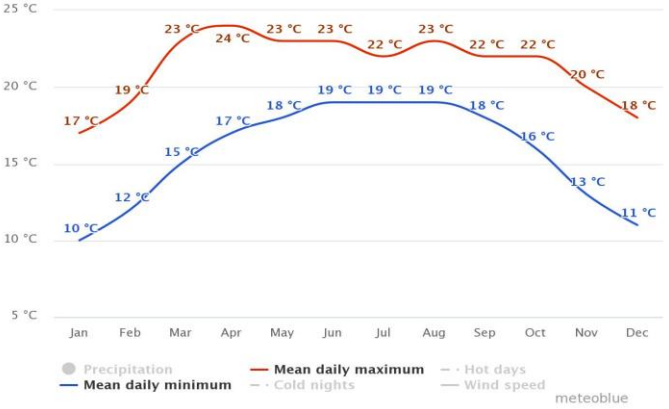


Figure 7: Average Temperature in Nongstoin

Wind Speed/Direction:

The average hourly wind speed in Nongstoin experiences significant seasonal variation over the course of the year. The windier part of the year lasts for 5.3 months, from March 25 to September 3, with average wind speeds of more than 6.4 miles per hour. The windiest month of the year in Nongstoin is July, with an average hourly wind speed of 8.4 miles per hourand so in these months there is a chance of soil erosion in this area. Potholes can also be created due to continuous soil erosion and water may get logged into the potholes during heavy rainfall which can ultimately led to the destruction of roads. The calmer time of year lasts for 6.7 months, from September 3 to March 25 and these months are the suitable for construction.

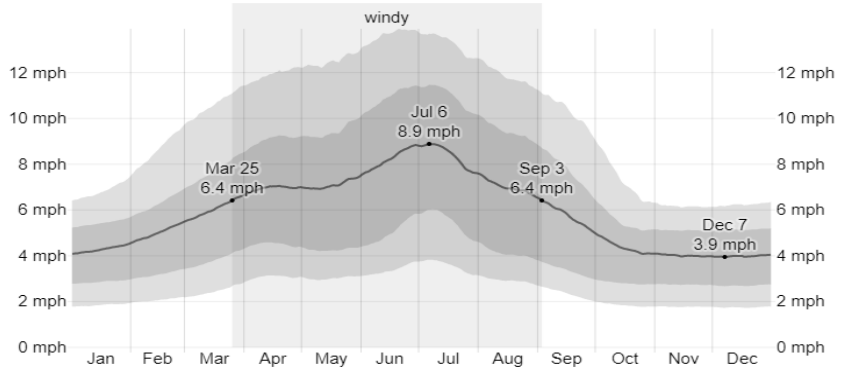


Figure 8: Average Wind Speed in Nongstoin

Source:https://weatherspark.com/y/111986/Average-Weather-in-Nongstoin-India-Year-Round

The wind is most often from the west for 2.5 months, from January 7 to March 23, with a peak percentage of 52% on March 2. The wind is most often from the south for 6.6 months, from March 23 to October 10, with a peak percentage of 87% on July 8. The wind is most often from the east for 2.9 months, from October 10 to January 7, with a peak percentage of 37% on January 1.Depending on the maximum flow direction of wind the setup of hot mix plant will be decided because the construction of roads should not affect the air quality of residential areas in the down wind direction.

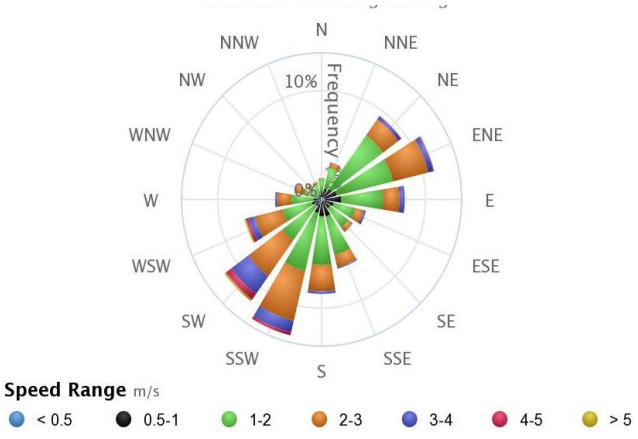


Figure 9: Wind Rose Diagram For Nongstoin

(Source:https://www.indianclimate.com/)

Relative Humidity:

The air is generally humid in this region during the monsoon reason when the maximum relative humidity was observed to be 95%. Similarly, the minimum relative humidity was observed to be 68%. Generally, the weather during other seasons was observed to be dry. The Relative Humidity is often associated with the working capacity of the labour force and shares an inversely proportional relationship. The higher the humidity, the less is the working capacity as

the body gets tired and fatigued easily. Hence, construction work will be done more comfortably during the months when the humidity is lower.

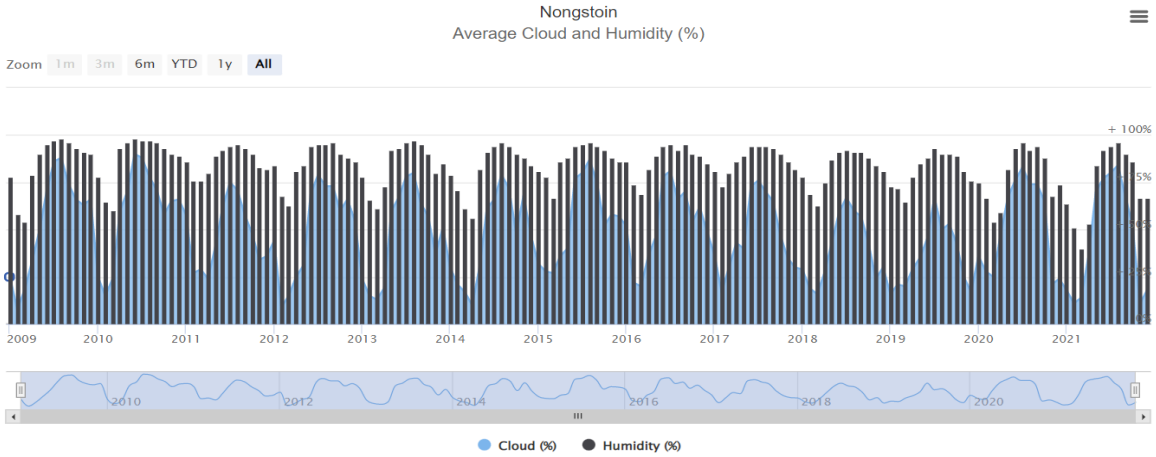


Figure 10: Average Humidity of previous 10 years

(Source: https://www.worldweatheronline.com/nongstoin-weather-averages/meghalaya/in.aspx)

Seismicity:

As per the 2002 Bureau of Indian Standards (BIS) map, the state of Meghalaya falls in a region of high to very high seismic hazard.All districts of the state of Meghalaya lie in Zone V. Considering high hazard seismic zone of the project road section area, design standards for structures stipulated in the clause under IRC: 6-2014 has been taken into account. The project area falls in a high earthquake prone zonealthough no such earthquake was recorded in Nongstoin-Maweti road.

Flood Hazard:

In Meghalaya, floods occur in river valleys when the flow exceeds the capacity of the river channel, particularly at bends or meanders. The plain areas of Meghalaya adjoining Assam are affected by flood due to the back flow of water from the River Brahmaputra during the flood season between June and October. Project district also fall under flood prone area. Flood prone area of Meghalaya is shown in the Figure below. The project area is not known to face significant impacts from monsoon floods. However, it does witness flash floods in certain low-lying areas. The patterns of floods cannot be forecasted.

Figure 11 :Flood Prone Zone Map of Meghalaya[7]

- **Landslide Hazard:**

The existing road section comes under high landslide zones.Nongstoin-Maweit project passes through hilly and rolling terrain with unstable slopes. Much of areas in this section are geologically young, resulting in soft/fragile substrates. These factors mean that project area conditions are amongst the most difficult in the region for road construction. Landslide prone and geologically weak zone along the project road are given below.

Chainage (KM)		
From	To	Length(KM)
5.825	6.920	1.095
12.450	12.990	0.540
14.150	14.250	0.100
17.975	19.590	1.615

[7]Source: http://www.mati.gov.in/docs/Academic%20Module%20-%202/PDF%20(3rd%20November%202021)/vulnerability%20profile%20of%20meghalaya%2018th%20October,2013-SDMA.pdf

Chainage (KM)		
From	To	Length(KM)
20.410	23.260	2.850
24.525	25.175	0.650
27.200	27.700	0.500
28.925	29.675	0.750
Total		8.100

Figure 12: Landslide Prone Location along the project road

- **Cyclone**

West Khasi Hill district and project road section also comes under high cyclonic zone. The Cyclone Zone map of Meghalaya indicating the location of the project stretch is shown inthe figure below.

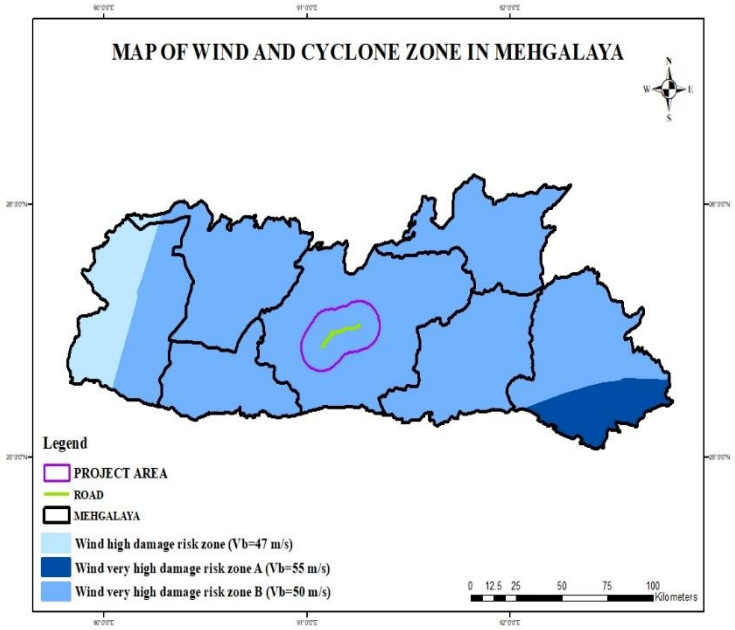


Figure 13: **Map of Wind and Cyclone Zone in Meghalaya showing the project road**

Land Use Pattern:

The project road passes mostly through hilly terrain and few stretches pass through rolling terrain. The adjoining land is generally hilly with vegetation. A combination of conversion of land use to agriculture and plantations, deforestation and periods of intense rainfall render several

tracts of land abutting the road to be erosion prone.The project corridor has scattered built up area named as Nongpyndeng, Mawlait, Nongthraw, Miangshiang, Nongsba, Nongpathar, Maweit etc.

Water Environment:

The Project area is rich in water sources. There are several major river/streams in the vicinity of the project corridor. All of these rivers are perennial. Ground water resources are used for drinking purpose by open wells, Bore wells, tube wells or installing hand pumps.The project corridor is dotted with a number of ponds along theProject road. Few of them are located in close to the RoW. The details of surface waterresources along the project road section are given in table below.

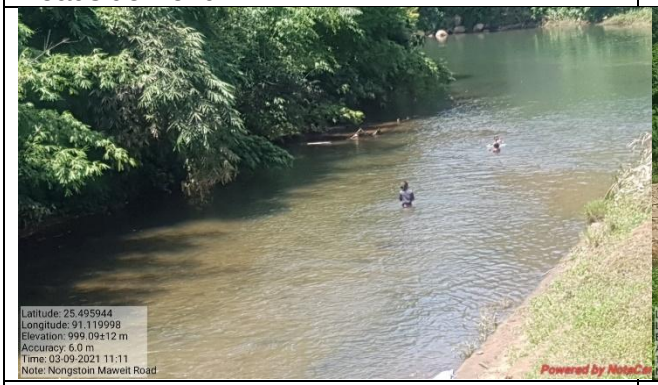
Table 22:Water Bodies along the Project Road

Sl.No	Water Body	Chainage	Distance from the road (m)
1.	Pond	Ch. 1.400 km,RHS	2.18
2.	Pond	Ch. 5.000 Km ,RHS	5.60
3.	Pond	Ch. 9.500 Km,LHS	12.16
4.	Pond	Ch. 19.900 km,RHS	4.65
5.	Pond	Ch. 25.750km,LHS	7.19
6.	Pond	Ch. 27.100 km,RHS	916.39
7.	Pond	Ch. 32.000km,RHS	6.36
8.	Risiang River	Ch.11.250km	
9.	Wahlyngdoh River	Ch. 20.100 km	
10.	Umiang River	Ch.30.380km	

Some photographs of road side ponds and rivers are shown in figure below

Roadside Pond

Roadside Pond



Roadside Pond

Roadside Stream

Figure 14 Photographs of few surface water bodies along the project road

Water Quality Monitoring

The grab sampling of ground and surface water was carried out in January2022 (winter period). The parameters analyzed, include pH, Electrical Conductivity (EC), Total Alkalinity (TA), Total

Hardness (TH), Nitrate (NO_3), and Fluoride (F). The sample collection, preservation, storage, transportation, and analysis were carried out as per the standard methods given in the manual of the American Public Health Association for the Examination of Water and Wastewater (APHA). The groundwater quality was checked against Indian standard code for drinking water (IS 10500-2012).The details of monitoring locations for assessing the groundwater quality are indicated in Table 24. The ground and surface water quality result of the project road is given in the Table 25.

Table 23:Groundwater sampling locations along the project road

Sampling Location	Date of Sampling	Name of place	Source	Distance (m)	Coordinates	
					Latitude	Longitude
1	08/01/2022	Nongstoin CH –3+ 700	Tube well	100	26.694302	94.413154
2	08/01/2022	Nonglyer Ch – 33 + 150	Hand pump	100	26.694302	94.413154

Table 24:Ground Water quality result of the project road

Sl.	Parameters	Unit	Limit (IS:10500-2012)		Result		WHO Drinking Water Standard (2011)
			Desirable Limit	Permissible Limit	Nongstoin	Nonglyer	
1	pH	-	6.5-8.5	No Relaxation	6.67	6.64	8.2-8.8
2	Colour	Hazen	5	25	<1	<1	Not Exceeding 5 hazen Unit
3	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Unobjectionable
4	Total Hardness (as $CaCO_3$)	mg/l	200	600	111	85	-
5	Chloride (as Cl)	mg/l	250	1000	21.4	18.4	-
6	Fluoride (as F)	mg/l	1	1.5	BDL	BDL	1.5
7	Calcium (as $CaCO_3$)	mg/l	75	200	22.4	16.8	-
8	Magnesium (as $CaCO_3$)	mg/l	30	100	13.5	10.5	-
9	Sulphate (as SO_4)	mg/l	200	400	36	32	-
10	Nitrate (as NO_3)	mg/l	45	No Relaxation	0.06	0.05	50
11	Alkalinity as ($CaCO_3$)	mg/l	200	600	109	92	-
12	TDS	mg/l	500	2000	232	185	-
13	Electrical Conductivity	Micromhos/cm	-	-	357	284	-
14	Sodium (as Na)	mg/l	-	-	24.1	20.9	40
15	Potassium (as K)	mg/l	-	-	11.2	8.4	-
16	Total Coliform	mg/l	Nil	Nil	Absent	Absent	Absent
17	Fecal Coliform	mg/l	Nil	Nil	Absent	Absent	Absent

Source: Environmental Baseline Monitoring

It can be seen from the results that the ground water quality meets the standards of IS:10500-2012 standards for drinking water irrigation water standards at all sampling locations.

The water samples from the following water sources were collected for assessing the physico-chemical characteristic of water.The analysis result of various quality parameters has been presented intable below.

Table 25:Surface water sampling locations along the project road

Sampling	Date of	Name of place	Source	Distance	Coordinates

Location	Sampling			(m)	Latitude	Longitude
1	07/01/2022	Nongstoin CH – 6+ 300	Road side pond	100	26.700120	94.437104
2	07/01/2022	Maweit CH – 31 + 700	Road side Pond	100	26.700120	94.437104

Source: Environmental Baseline Monitoring

Table 26:Surface Water quality result of the project road

Organoleptic & Physical Parameters

Sl.	Parameter	Test method	Unit	Result		Standards/ Permissible Limits	CPCB Surface Water Standard	
				Nongstoin	Maweit	WHO	Inland Surface water Tolerance Limits for Class -B	Inland Surface water Tolerance Limits for class -D
1	Colour	IS-3025 (P-04)	Hazen Unit	<1	<1	-	-	-
2	Odour	IS-3025 (P-04)	-	Agreeable	Agreeable	-	-	-
3	pH value	IS-3025 (P-04)	-	7.14	6.78	6-9	6.5 – 8.5	6.5 – 8.5
4	Total Dissolved Solid (TDS)	IS-3025 (P-04)	mg/l	156	133	-	-	-
5	Electrical Conductivity	IS-3025 (P-04)	µs/cm	240	204	-	-	1000
6	Total Suspended Solid	IS-3025 (P-04)	mg/l	4	6	-	-	-
7	Total Dissolve Oxygen	IS-3025 (P-04)	mg/l	6.2	6.5	-	5	4
8	Biological Oxygen Demand	IS-3025 (P-04)	mg/l	02	02	30	3	-
9	Chemical Oxygen Demand	IS 3025 (Part-I)	Mg/l	09	11			
10	Phosphate Content	IS-3025 (P-04)	mg/l	0.4	0.7	-	-	2
11	Total Ammonia	IS: 3025 (P- 34)	mg/l	0.28	0.24	-	-	-
12	Calcium (as Ca)	IS: 3025 (P- 40)	mg/l	15.2	14.4	-	-	-
13	Chloride (as Cl)	IS: 3025 (P- 32)	mg/l	16.2	12.4	-	-	-
14	Copper (as Cu)	IS: 3025 (P-42)	mg/l	BDL	BDL	-	-	-
15	Iron (as Fe)	IS: 3025(P-53)	mg/l	0.04	0.08	-	-	-
16	Magnesium (as mg)	IS: 3025	mg/l	8.4	6.1	-	-	-

Sl.	Parameter	Test method	Unit	Result		Standards/ Permissible Limits	CPCB Surface Water Standard	
				Nongstoin	Maweit	WHO	Inland Surface water Tolerance Limits for Class -B	Inland Surface water Tolerance Limits for class -D
		(P-46)						
17	Nitrate (as NO_3)	IS: 3025 (P- 34)	mg/l	1.2	1.5	-	-	-
18	Sulphate (as SO_4)	IS: 3025 (P- 24)	mg/l	34	28	-	-	-
19	Alkalinity (as Ca CO_3)	IS: 3025 (P- 23)	mg/l	71	64	-	-	-
20	Total hardness (as $CaCO_3$)	IS: 3025 (P- 21)	mg/l	72.4	61	-	-	-
21	Zinc (as Zn)	IS: 3025 (P- 49)	mg/l	0.6	0.8	-	-	-
22	Sodium (as Na)	IS-3025(P-45)	mg/l	16.5	15.2	-	-	-
23	Potassium (as K)	IS-3025(P-45)	mg/l	6.4	5.4	-	-	-

From above it is clear that at MaweitDO, COD and TSS value is higher than Nongstoin. BOD is same in all the sampling locations.CPCB and MOEF&CC has categorized the surface water into 5 different categories namely A, B, C, D and E (Ref: http://cpcb.nic.in/water-quality-criteria/). From **Error! Reference source not found.**it can be inferredthat in both thesurface water monitoring locations the pH values are between 6.5 – 8.5, dissolved oxygen level is above 4 mg/l and free ammonia is less than 1.2mg/l. Hence the surface water along the project road can be classified as Category A.

Table 27CategorizationofsurfacewaterbyCPCBandMOEF&CC

Designated-Best-Use	Class ofwater	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	Total Coliforms Organism MPN/100ml shall be 50 orless, pH between 6.5 and 8.5, DissolvedOxygen 6mg/lormore Biochemical Oxygen Demand 5 days 20C 2mg/l orless
Outdoor bathing (Organized)	B	Total Coliforms Organism MPN/100ml shall be 500 orless, pH between 6.5 and 8.5, Dissolved Oxygen 5mg/lormore Biochemical Oxygen Demand 5days 20C3mg/l or less
Drinking water source after conventional treatment and disinfection	C	Total Coliforms Organism MPN/100ml shall be 5000or less, pH between 6 to 9, Dissolved Oxygen 4mg/l ormore, Biochemical Oxygen Demand 5 days 20C 3mg/l orless
Propagation of Wild life and Fisheries	D	pH between 6.5to 8.5, Dissolved Oxygen 4mg/l or more, Free Ammonia (asN)1.2mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	pH between 6.0to 8.5, Electrical Conductivity at 25C micro mhos/cmMax.2250, Sodium absorption Ratio Max. 26, Boron Max.2mg/l

Other parameters analysed like chloride, sulphate, fluorides are found well within standards. The surface water quality in the region is reported to be well within the permissible limits and also found to be good by visual identifications. There are no reports of any water-borne diseasesin the region. People are using this water for various domestic purposes.

Air Environment:

During construction stage of the project, temporary air pollution arises due to movement of construction vehicles, operation of plants & machineries, dust emission due to excavation and demolition etc.
To study the baseline ambient air quality scenario within the project corridor the ambient airquality, air sampling was carried out in the month of January 2022.To generate post-monsoon airquality of the project area, samples of ambient air was collected from two (2) locations for twicea week for two weeks.

Table 28:Air Quality Monitoring locations along the project road

Sl.	Date of Sampling	Name of place	Distance (m)	Coordinates		Type of Area
				Latitude	Longitude	
1	03/01/2022 to 04/01/2022 07/01/2022 to 08/01/2022	**Nongstoin**	50	32°45'40.68''	28°23'188.13''	Residential cum commercial area
2	03/01/2022 to 04/01/2022 07/01/2022 to08/01/2022	**Miangkain**	50	32°45'40.68''	28°23'188.13''	Residential Area

Source: Environmental Baseline Monitoring

Ambient air quality monitoring results for $PM_{2.5}$, PM_{10}, SO_2, NO_X, and CO concentrations are given in Table 32 and summarized below. The monitored values are compared with National Ambient Air Quality Standards prescribed by Central Pollution Control Board (CPCB) and WHO Ambient Air Quality Guidelines (IFC EHS) for residential, rural, and other areas.

Table 29:Ambient Air Quality along the Project Road

	S. N.	Particulate Matter (PM_{10})	Particulate Matter ($PM_{2.5}$)	Sulphur Dioxide	Nitrogen Dioxide	Carbon Monoxide	Hydrocarbon (HC), µg/m³	Lead (Pb), µg/m³
National Ambient Air Quality Standard (CPCB) - Permissible limit		100	60	80	80	2	-	1
AAQM 1: Nongstoin								
Week 1	1	72	41	7.4	11.2	BDL	BDL	BDL
Week 2	2	76	42	8.1	12.1	BDL	BDL	BDL
AAQM 2: Miangkain								
Week 1	5	67	38	6.4	10.4	BDL	BDL	BDL
Week 2	6	69	39	6.1	11.1	BDL	BDL	BDL

The Ambient air quality levels meet the National air quality standards for the rural, residential area all along the project road. Concentrations of all the parameters at twolocations are within the National Ambient Air Quality Standard (CPCB) - Permissible limit.

Noise Environment:

Noise impacts can be of concern during construction and operational phases of the project. Noise quality is an issue particularly at congested locations due to heavy traffic jams, horns and slow-moving traffic. The educational institutions, health care facilities, court etc. along the project corridor comprise sensitive receptors with respect to noise pollution.The Ambient Noise Quality Standards with respect to noise have been stipulated by Govt. of India vide Gazette Notification dt.14.02.2000.

Table 30:Ambient Noise Standards

Area Code	Category of Area	Limits in dB (A), Leq	
		Day time	Night time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone*	50	40

* Silence zone is defined as an area up to 100 meters around such premises as hospitals, educational institutions and courts.

Noise Quality Monitoring

A preliminary reconnaissance survey was done to identify the major noise generating sources along the proposed alignment. The noise at different noise generating sources has been identified based on industrial, commercial, and residential activities, traffic, and noise at sensitive areas. Sound Pressure Level (SPL) measurements were undertaken at all locations, with an interval of about 5 seconds over 10 minutes per hour for 24 hr. The day noise level has been monitored from7 AM to 10 PM and night levels from 10 P.M. to 7 AM at 2locations. The Details of the monitoring locations are given in Table 34. Day and night-time Leq have been calculated from hourly Leq values and compared with the stipulated standards.

The monitored values are compared with CPCB Ambient Air Quality Standards in respect of Noise and Guidelines for Community Noise, World Health Organization for residential areas. The monitored levels meet the National as well as WHO standards for the residential area all along the project road.

Table 31;Noise Monitoring locations along the project road

Sampling Location	Date of Sampling	Name of place	Coordinates		Land use
			Latitude	Longitude	
1	03.01.2022-07.01.2022	**Nongstoin**	32°45'40.68"	28°23'188.13"	Residential cum Commercial area
2	03.01.2022-07.01.2022	**Miangkain**	32°45'40.68"	28°23'188.13"	Residential Area

Source: Environmental Baseline Monitoring

Table 32;Day and Night Time Leq in the Project Area

	Noise location1: Nongstoin		Noise location 2Miangkain	
Date	**03.01.2022**	**07.01.202**	**03.01.2022**	**07.01.2022**
Maximum	52.3	52.1	52.1	51.2
Minimum	35.2	36.4	37.9	38.2
Leqday	48.6	47.7	48.2	47.7
Leqnight	36.4	36.5	39.4	38.3
Leq	48	47.4	48.6	47.9
	Day–65	**Night-55**	**Day–55**	**Night - 45**

It can be seen from that at all the monitoring locations, the ambient noise levels are well within the permissible limits for residential areas prescribed by CPCB and also by World Bank EHS standards of 55 dB(A) and 45 dB(A) for day time and night time respectively.

Biological Environment:

Meghalaya falls under the Indo-Myanmar Biodiversity Hotspot zone.

Protected Areas of Meghalaya:

The protected area network in Meghalaya occupies 1133.9 Sq. Km area which constitute about 5.06 % of the State's Geographical Area. The Protected Area Network includes 2 national Parks, 4 wildlife Sanctuaries and 1 Biosphere Reserve playing an important role in in-situ conservation of Biodiversity. However, there is no protected forest areas within project AoI.
The nearest Protected area is Balpakram National Park, which is about 22km away from the project site and falls outside of the both Direct and Indirect impact zone.

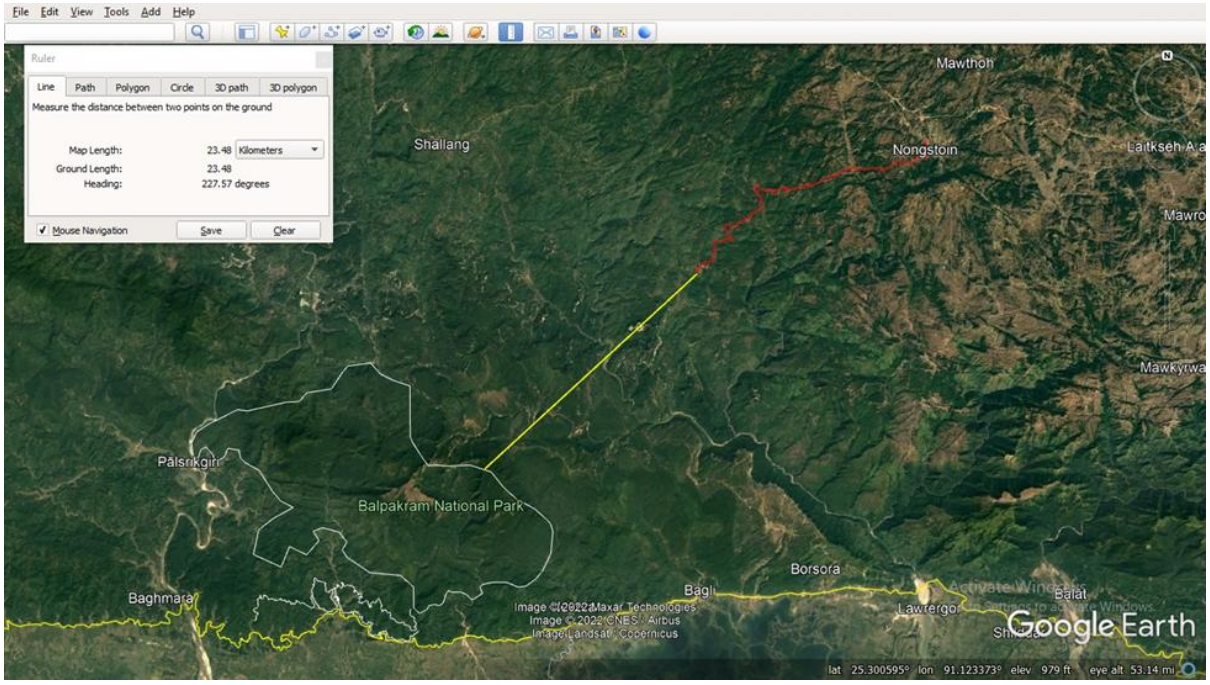


Figure 15; Distance between Balpakram National Park and project area

Elephant Reserves

The state has a substantial population of Asian elephant and due to this high density of elephants in the state, state has developed various policies for their conservation. For protection and conservation of elephants in Garo Hills area, Meghalaya government has notified (vide- No.132/2000/97 dated 31st October 2001) a 3500 km^2 area as Garo Hills Elephant Reserve under Project Elephant, MoEFCC, Govt of India. Nokrek and Balpakram National Park forms the core area (400 Km^2) of the Elephant Reserve and majority of the part of the Elephant Reserve is situated in East Garo and South Garo Hill Districts. West Khasi Hills district is not a part of any Elephant Reserve.

Figure 16 :Vegetation cover along the project road

Reserved Forests of Meghalaya State:

There are 24 Reserved Forests (RFs) in the state with area varying from 0.44 km^2 to 150 km^2 covering a total of 712.74 km^2 area. There is no Reserve Forest in the West Khasi Hills district.

Animal crossings & Migratory Routes

The project corridor is devoid of any reserved forest within the study area and there is no wildlifehabitat around the project. So there is no designated migratory route or animal crossing in theproject area.

Community Reserves:

Community Reserves or Conservation Reserves are special category of protected areas and it recognizes that local communities can participate in protection of threatened species and natural resources. Meghalaya has a large number of Community Reserves, the largest for any Indian state. The Govt. of Meghalaya has declared 73 private and community lands/forests into Community Reserves, to increase the area under protected networks for protecting flora, fauna and traditional or cultural conservation values and practices. There are two Community Reserves in West Khasi Hills. Both are situated away from the ROW.

Table 33: Details of Community Reserve

Sl.	District	Name of Community Reserve	Area (Ha)
1	West Khasi Hills	Kpoh Eijah	17
2		Miewsyiar	87
Grand Total			6293.382

Sensitive Ecological and cultural attributes:

The table below gives the ecological,historical and cultural profile near to the project road.

Table 34: Details of Ecological and cultural attributes

Ecologically/Culturally significant feature	Availability within project area
Wildlife Sanctuary	No
National Park	No. The nearest is Balpakram National Park, which is outside of direct influence zone of the ROW.

Ecologically/Culturally significant feature	Availability within project area
Ramsar Site	No As on Dec 2020, there is no declared Ramsar site in Meghalaya)
Biodiversity Heritage Site	No
Biosphere Reserve	No
Important Bird Area	No. The nearest is Balpakram National Park, which is outside of direct influence zone of the ROW.
Key Biodiversity Area	No. The nearest is Balpakram National Park, which is outside of direct influence zone of the ROW.
Wildlife Corridor	No
Elephant Corridor	No. The nearest is Balpakram National Park, which is outside of direct influence zone of the ROW.
Tiger Reserve	No
Reserve Forest	No
Elephant Reserve	No
Community Forests	No
Sacred Groove	No
Archeological Sites	No
Unprotected / Non Classified Forest	Yes, two community reserve forest
Major River	No
Fish Sanctuary	No
Surface water bodies	Yes. Small ponds mostly used for fishery.

Biodiversity Profile of the Study area:

Herpetofauna of study area:

Herpetofauna includes Reptiles and amphibian animals of a particular area.

Table 35: Details of Herpetofauna in the Study Area

Order	*Common Name*	*Scientific Name*	*Local availability*	*IUCN Status*	*WPA Status*
Agamidae	Garden Lizard	*Calotes versicolor*	Common	LC	IV
Gekkonidae	Indian House Gecko	*Hemidactylus sp*	Common	LC	IV
Scincidae	Common Skink	*Eutropis carinata*	Common	LC	IV
Varanidae	Common Indian Monitor	*Varanus bengalensis*	Rare	LC	I
Pythonidae	Burmese Python	*Python bivittatus*	Rare	VU	I
Typhlopidae	Brahminy blind snake	*Indotyphlops braminus*	Common	LC	IV
Colubridae	Common Wolf Snake	*Lycodon aulicus*	Common	LC	IV
Colubridae	Indian Rat Snake	*Ptyas mucosa*	Common	LC	IV
Colubridae	Checkered Keelback	*Fowlea piscator*	Common	LC	IV
Colubridae	Indo-Chinese Rat snake	*Ptyas korros*	Common	LC	IV
Elapidae	King cobra	*Ophiophagus hannah*	Very Rare	VU	I
Elapidae	Northeastern hill krait	*Bungarus bungaroides*	rare	LC	IV
Viperidae	Mountain Pit Viper	*Ovophis monticola*	Rare	LC	IV
Colubridae	Painted Bronzeback Tree Snake	*Dedrelaphis pictus*	Common	LC	IV
Turtles and Tortoises					
Testudines	Tricarinate Turtle	*Melanochelys*	Very Rare	EN	I

Order	*Common Name*	*Scientific Name*	*Local availability*	*IUCN Status*	*WPA Status*
		tricarinata			
Testudines	Yellow Tortoise	*Indotestudo elongata*	Rare	EN	IV
Amphibians					
Bufonidae	Common Asian Toad	*Duttaphrynus melanostictus*	Common	LC	~
Rhacophoridae	Terai Tree Frog	*Polypedates teraiensis*	Common	LC	~
Rhacophoridae	Common Tree Frog	*Polypedates leucomystax*	Common	LC	~
Rhacophoridae	Assam Tree Frog	*Polypedates assamensis*	Common	LC	~
Dicroglossidae	Indian Bull Frog	Hoplobatrachus tigerinus	Common	LC	IV
Dicroglossidae	Indian Skipping Frog	Euphylctis cyanophlyctis	Common	LC	IV
LC= Least Concern, EN= Endangered,NT= Near Threatened, VU= Vulnerable					

Educational Institutions / Hospitals

The educational institutions and hospital/health centres constitute the sensitive environmentalreceptors. The list of such features along the ROW along the project roads is presented intable 49. A total number of 11 educational institutions are located along the ROW. No health care centre was found within the project core zone which is 500m either side of the road.

Table 36:Sensitive receptors along the project road

Sl.	Receptor	Side	Chainage (Km)	Approx. distance from the edge of the road (m)	Physically impacted or not
1	Church	LHS	1+950	30.55	Not impacted at all
2	Church	RHS	2+800	42.92	Not impacted at all
3	School	RHS	2+900	28.74	Not impacted at all
4	School	RHS	3+050	22.53	Not impacted at all
5	School	RHS	3+050	45.54	Not impacted at all
6	Sibsing Memorial Government Secondary School	LHS	3+350	25.05	Not impacted at all
7	Institute	RHS	3+550	105.86	Not impacted at all
8	School	RHS	3+850	36.83	Not impacted at all
9	Church	LHS	4+250	12.71	Not impacted at all
10	School	LHS	4+250	21.38	Not impacted at all
11	School	RHS	4+300	24.52	Not impacted at all
12	Church	RHS	14+850	105.10	Not impacted at all
13	Graveyard	LHS	15+150	19.17	Not impacted at all
14	Church	RHS	20+300	64.32	Not impacted at all
15	School	LHS	34+050	17.85	Not impacted at all
16	School	LHS	34+100	11.96	Not impacted at all
17	School	LHS	34+150	22.74	Not impacted at all

Sl.	Receptor	Side	Chainage (Km)	Approx. distance from the edge of the road (m)	Physically impacted or not
18	School	LHS	34+250	67.04	Not impacted at all

Figure 17:Sibsing Memorial Government Secondary School' at 3+350 Km on left side of project road

School at 3+000 KM on RHS

School at 34+100 KM on LHS

Figure 18: Schools at 3+000 Km and 34+100 Km respectively

Social Environment

The State Profile of Meghalaya

The State of Meghalaya was carved out of Assam as an autonomous State in April 1970 and was declared a full-fledged State in January 1972. Meghalaya, situated in the north eastern region of India is a narrow stretch of land, running between Bangladesh on the South and West and Assam on the North and East, Meghalaya lies between 24° 58' N to 26° 07'N latitudes and 89° 48'E to 92° 51' E longitudes. It covers an area of 22,429 sq. km. The State has most of its land covered by hills interspersed with gorges and small valleys. Endowed with dense forests

and rivers cascading down undulating terrain, this region is one of the most scenic of the North Eastern States.

Thus, out of the total forest area of 15,657 sq. km in the State only 1,027.20 sq. km is under the control of State Forest Department, which constitutes only 4.58 % of the total geographical area of the State and 6.56 % of the total forest area of the State. Rest of the area is either private or clan /community owned and is under the indirect control and management of the Autonomous District Councils.

The population of Meghalaya is predominantly tribal, the main tribes are the Khasis, the Jaintias and the Garos besides other plain tribes such as Koch, Rabhas and Bodos etc The Khasis and the Jaintias predominantly inhabiting the districts towards eastern part of Meghalaya, belong to the Proto AustroloidMonkhmer race. The ESIA Study of the proposed Road lies under West Khasi. Hills.

District Profile:

West Khasi Hills is an administrative district in the state of Meghalaya in India. The West Khasi Hills district was carved out of the Khasi Hills district, which was divided into West and East Khasi Hills districts on 28 October 1976. The district headquarters is located at Nongstoin. The district occupies an area of 5247 km^2. Khasi society has greatly been transformed by many factors which have arisen in recent times. Adoption of the Western style of life, especially among the literate and educated, has been quite rapid although the matrilineal laws of inheritance and succession and the other cultural states are still retained.

West Khasi Hills District was carved out of the state of Meghalaya in the year 1976 on the 28 day of October which in fact is the largest of all the eleven districts in the state of Meghalaya and since its existence, it has been bifurcated into two Civil Sub-divisions and a new district in South West Khasi Hills. It spreads through the heart of the state running high with plateau ranges and low with rich plain lands.

Demographic Profile

Out of total population of Meghalaya, 54.75% people live in urban regions.The district occupies:

Table 37;Demographic Profile of West Khasi Hills District

Description	Census 2011	Census 2001
Total Population	383461	296049
Male	193715	150419
Female	189746	145630
Population Growth	29.53%	33.05%
Area Sq.Km	5247	5247
Density /Km2	73	56
Proportion to Meghalaya Population	12.92%	12.77%
Sex Ratio (Per 1000) Males	980	968
Average Literacy	77.87	65.10
Male Literacy	78.53	66.49
Female Literacy	77.19	63.65
No. of Blocks	6	NA
No. of Villages	232	NA

Source: Census 2011

As per 2011 census, 88.76% population of West Khasi Hills district lives in rural areas of villages. The total West Khasi Hills district population living in urban areas is 43105 of which males and females are 21335 and 21770 respectively. In rural areas of West Khasi Hills district, sex ratio is 974 females per 1000 males.

Table 38;Distribution of Rural and Urban Population

Description	Urban	Rural

Description	Urban	Rural
Population (%)	11.24%	88.76%
Total Population	43105	340356
Male Population	21335	172380
Female Population	21770	167976
Sex Ratio	981	974

Source: Census 2011

Schedule Castes and Schedule Tribes

The social stratification of the project area shows of Schedule Tribe population with 97.8% households. The second stratum of the social grouping in the area is of Schedule caste population of 0%.

Literacy Rate

The literacy rate in the district of West Khasi Hills is 77.87%, whereasthe literacy rate in the PIA is around 67.37%. The respective male and female literacy rate is 78.53% and 77.19% in the district of West Khasi Hills, whereas resembles 50.21% and 51.2% in the PIA.

Employment Pattern

Economic backwardness is the leading problem of the state as majority of the population is below the poverty line. Although the state is rich in mineral resources, the industrial linkages are virtually absent and government is the major source of employment in the organized sector. Activities like animal husbandry, fishery, poultry and horticulture have not been targeted as a major source of employment. Therefore, agriculture forms the only option for the people to seek gainful employment. This too is influenced by impediments such as shifting agriculture, poor productivity, land tenure system and traditional methods of cultivation. All these factors have resulted in poor land and labour productivity.

As unemployment and poverty are correlated, it becomes necessary to understand the occupationalpatternoflabourforceandstatusofemploymenttoanalysethedevelopmentinthe state.

Economic Development

Meghalaya has predominantly an agrarian economywith a significant commercial forestry industry. Meghalaya's gross state domestic product for 2012 was estimated at16,173 crore (US$2.5billion) in current prices.The state is geologically rich in minerals.The state has about 1,170km of national highways. It is also a major logistical centre for trade with Bangladesh.Meghalaya has an ideal location advantage for South East Asia Market. The neighbouring countries of India viz Bhutan, Bangladesh, Myanmar has been involved with the state for business and commerce. It has a huge potential to reach other South Asian countries as well. Meghalaya is also geographically rich in minerals and has the potential for industrial setups based on these mineral resources. Above all the Meghalaya Industrial Policy is framed for the ease of doing business and increase trade and commerce. The added advantage being the climate in Meghalaya is good for the development of electronics chips.

Different types of Industry that can be ideally formed in the state are Mineral based Industry, Horticulture and Agro-Based Industry, Electronics and Information Technology, Export Oriented Units, Tourism and besides these the recent development in the state has seen many upcoming service sectors on customer service, real estate’s etc.The State Government also provides various types of Central and State Incentives for the established Industrial Setups which includes Transport Subsidy, Income Tax Exemption, Excise Exemption, Capital

Investment Subsidy, Special Incentives for Food Processing,Subsidy on Comprehensive Insurance, Power Subsidy, Subsidy on Power Line (33 K.V. and above),Employment Subsidy, Refund of Central Sales Tax.Meghalaya is coming up with 150 LPM (Litres Per Minute) Oxygen Plant at Nongpoh Civil Hospital in RiBhoi district.

Although the district is endowed with many economically important minerals but the operations are limited mostly to the mining of these minerals. The minerals found in the district are coal, limestone, sillimanite and uranium, among these last two are major deposits in the district (coal mining is carried out at minor scale at shallang and rambari, Coalfields are mainly found and extracted in large scale from Nongri, Nonghyllam, Nongkulang areas). Mining of Uranium has not so far been undertaken due to opposition from the people. As per census, 2011, there are many small scale industries in the district.

Railway

Meghalaya has a railhead atMendipatharand regular train service connecting Mendipathar in Meghalaya andGuwahati inAssam. Guwahati is the nearest major railway station connecting the north-east region with the rest of the country through a broad-gauge track network.

Aviation

The state has an airport atUmroi which is at a distance of 30 kilometres from Shillong. There is also a helicopter service connecting Shillong to Guwahati and Tura. Baljek Airportnear Turabecame operational in 2008. Other nearby airports are in Assam, Borjhar, Guwahatiairport, about 124 kilometres (77 mi) from Shillong. Newly operational Rupsi Airport is also near to Tura.

Agriculture and Cropping Pattern

Agriculture is the main occupation of the people of the watershed areas. The principal agricultural crops are paddy, ginger, yam, chillies, turmeric etc. However, few horticultural crops like pineapple, arecanut, banana etc. are cultivated in the Watershed area.

Most of the forest species were extinct or not seen in the areas due to repeated jhumming. However, some forest species like Shorearobusta, Artocarpus heterophyllus, Albizzia species, Bahauniavariegetta etc. are seen in the Watershed Area.

More than 80% of the total population in West Khasi Hills is agrarian as theirmain backbone of livelihood is basically agriculture. Rice, Maize, potato and ginger are the main crops grown in West Khasi Hills. Agriculture is the main stay of the population in the district. As per census 2011, 52% of the population is engaged in agriculture and 22.8% of total workers population is engaged as agriculture labourers. The area is endowed with diversified climatic condition thereby offering good scope for cultivation of temperate and subtropical crops. Principal crops grown in the district are rice, maize, millets, oilseeds and pulses. Horticulture products include orange, pineapple and many local fruits. Vegetables like potato, cucumber, squash, beans etc. are also grown.

Animal Husbandry

Animal husbandry and Agriculture are related with the overall socio – economic conditions of rural tribal people of Meghalaya. Animal husbandry plays a significant role in overall farming system of the state. The total livestock and poultry population of the state are 15.51 lakhs and 28.20 lakhs respectively out of which Ri Bhoi district possesses 1.12 lakhs and 3.52 lacks respectively (Sample survey 2005- 06). The livestock availability in the district ranges from pig, cattle, buffalo, poultry, goat, rabbit and sheep. Although the district possesses a good number of livestock and poultry, the productivity of livestock and poultry is very poor due to stunted growth and low production of local breeds of livestock and poultry, non-scientific approach of livestock and poultry farming.

The Animal Husbandry and Veterinary Department was established in the District right from 1976-1977 with the main objective of combating diseases in livestock and to encourage and assist the people of the district to take up farming in livestock on commercial scale so as to

substantiate their income generating capacity. The people mostly rear local breeds of livestock characterized by low productivity in terms of meat, milk and meat.

Fishery

ThePIA has unique topographical condition. Consequently, the PIA is blessed with vast and varied water resources in the forms of rivers, reservoirs, beels, lakes, swamp, pond, mini barrages and low-lying paddy. The district shared maximum 20% in total area of pond/mini barrages of the state followed by 10.2, 9.23 and 2.46% in case of reservoirs, rivers, and beels, lakes etc. respectively, but no contribution in state in terms of paddy cum fish culture in the district, although it is a proven technology scope and potential of ornamental fish (Puntius bartissp) is not so much satisfactory.
The Government of Meghalaya has identified fisheries as a key sector and launched the Meghalaya State Aquaculture Mission (MSAM) in 2012. Under this mission, a large water area in the state has been brought for fish culture.

In West Khasi Hills District, the total water area assisted under MSAM is 99.5 ha which includes 970 nos. of individual ponds and 5 nos. of community ponds. There are 5 nos. of fish ponds under convergence of MSAM with other Departments covering an area of 3.5 ha which will be implemented shortly. The area covered under the 1000 ponds scheme of the Fisheries Department is 67.45 ha. There are 2 nos. of Govt. fish farm in the District. There are also 3 nos. of fish sanctuaries which aims at conserving the indigenous and endemic fish species. According to the Fisheries Department, fish production (2014-15) in the District is 386 MT.

Hospitals

The PIA has 1 hospital, 2 dispensaries, 8 primary health centres, 3 community health centres, 27 sub centres, 1 leprosy control unit, 1 set centre, 1 ayurvedic dispensary and 3 homeopathic dispensaries. Para medical personnel registered during the year for the service of the people of the district.

CHAPTERV: ANALYSIS OF POTENTIAL ENVIRONMENTAL& SOCIAL IMPACTS & MITIGATION- MEASURES

The potential environmental and social impacts due to project activities are discussed in this section. For the impact assessment, anArea of Influence (AoI) within 500 m road alignment has been considered.

Environmental Impacts and Mitigation Measures

The assessment of potential environmental impact consists of comparing the expected changes in the environment with or without the project. The analysis predicts the nature and significance of the expected impacts. The detail of potential impacts & mitigation measures is mentioned in the below.

Impacts During Design/ Pre-constructional Phase

Impact on Physiography

The Project is anexisting road corridors and all rehabilitation works, including improving geometric design will be carried out within the existing RoW of the road. Hence the Project will not have any impact on the topography orphysiography within the Project influence area.

Impact on Ambient Air Quality

Impact to air environment during pre-construction stage will be limited to activities such as setting of construction camp, unloading of materials, exhaust from Diesel Generators, etc.

Mitigation Measure:

- Consent to Establish for emission/continuation of emission under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 should be obtained for Diesel Generator Set (s) of > 15 KVA for Non-Industrial use from SPCB.
- Where possible water should be sprayed to reduce dust emissions.

Impact on Flora

166 number of trees are anticipated to be felled within toe line due to widening of the Project road.

Mitigation Measure:

- Obtain permission to fell trees from the Forest Department under the Meghalaya Tree Felling Act, 2016.
- Where possible transplant the matured tree at appropriateplace.
- Follow the instruction/ guidance provided in the NOC from the Forest Department of Meghalaya.

Impact on Fauna

There is no wildlife habitat located along the project area nor any migratory route/ animal crossingsin the project area. So, any risk or impact on wild animals or incidence of habitat fragmentation ordisturbances to the wildlife migration route due to project is not anticipated.

Impact on Ecologically Protected Area

The project road does not pass through any ecologically protected areas such as Wildlife Sanctuary, National Park, or any notified ecologically sensitive area not is located in any Eco-sensitive zone. Further no movement of wild animals has been reported near the project alignment. So, any impact on such feature due to the project is not envisaged.

Impacts during Construction Phase

Most of the adverse environmental impacts are related to construction works which are inevitable but are manageable through certain environmentally friendly practices.
The standard road construction works involve are site clearance, excavation, filling of earthmaterials and sub grade materials, laying of bituminous mixtures, handling of hazardous materialslike bitumen, diesel, etc., dumping of unusable construction debris and demolition waste, transportation of materials fromproduction site to construction site, and other constructional activities and associated works likemobilization of constructional equipment, setting up of different construction plants, setting up ofworkforce camps, quarrying, material storage etc. These activities have certain impacts of variousmagnitudes on different components of environment. The anticipated impacts from constructionactivities have been described below:

Contamination of Soil

Contamination of soil during construction stage may happen primarily due to: a) leakage spillage of fuel and lubricantsfrom construction vehicles parked and serviced and b) unwarranted disposal of construction spoil and debris. This contamination is likely to be carried over to water bodies in case of dumping near water bodies. Waste from off-spec hot-mix as wells as from the regular operations of the machinery e.g. layers and bitumen sprayers during the surfacing of the roads. The concrete wastes from the batching plant and transit mixer wash water would also be generated.The labour camps that would be setup for construction would generate municipal solid waste and hazardous waste (waste oil from the maintenance and operation of machinery). These wastes have potential to contaminate the soil around the site if it is not properly stored, handled and disposed.

Mitigation Measures:

- Construction equipment/vehicles should be routinely maintained to prevent leakage of fuels/ lubricants;
- Construction equipment/vehicles should be parked and maintained in designated areas on hard stand having perimeter drains to collect spilled liquids;
- Fuels and other liquid chemicals should be stored in designated storage areas with drip trays to collect leaked materials, if any.
- The Contractors shall ensure the use of a relatively new, well maintained hot mix plant (batch type) and maintenance of hot mix plants and batching plants should be regular and periodic to prevent any kind of oil leakage on soil surface.

Increased erosion and loss of top soil

The topsoil on the land parcels, which is either used for short term (e.g., borrow areas, construction camps etc.) or permanent use (expansion of the road alignment), would be lost unless the same is preserved. The alignment passes through areas which have sandy loam or sandy clayey loam. These soils are light textured and are thus prone to erosion by winds and during rain, gravity erosion. Further, the movement of vehicle over land next to existing road and to access the construction site would also cause compactions of soil and affect soil fertility.

If excess excavated material, construction and demolition wastes are disposed on agricultural land it may result in loss of productivity of land.

Mitigation Measures:

- The existing vegetation on slopes outside the immediate area of construction must remain undisturbed during construction and/or upgrading.
- Engineering and bioengineering techniques to be used to prevent barren slopes and to stop soil erosion and protect erosion prone areas from excessive grazing by animals;
- Slope failures should be monitored and remedial actions initiated at the earliest possible time
- Logging immediately above road should be restricted to reduce erosion/landslide potential;
- Retaining structures like gabion wall, breast wall and retaining wall, slope protection measures are provided to ensure stability of hill slope during and after the construction of

project road. Erosion protection measures identified to be undertaken in specific road sections are specified below:

Table 39: Details of proposed erosion protection wall

Chainage(m)		Side	CD Length(m)	Length(m)
From	To			
Gabionwallsofheight1.5m				
880	950	Valley		70
1050	1100	Valley		50
6410	6440	Valley		30
13210	13350	Valley	2	138
13390	13460	Valley		70
13560	13620	Valley	2	58
13720	13750	Valley		30
14180	14210	Valley		30
15790	15820	Valley		30
16210	16240	Valley		30
16320	16440	Valley		120
21910	21980	Valley		70
22380	22420	Valley		40
22470	22530	Valley	2	58
22575	22610	Valley		35
22660	22690	Valley		30
22790	22830	Valley		40
23030	23100	Valley		70
23200	23260	Valley		60
27630	27660	Valley	2	28
28125	28190	Valley		65
31250	31310	Valley		60
Gabion walls of height 2.0m				
15760	15790	Both		60
19590	19640	Valley		50
19760	19850	Valley		90
21550	21580	Valley		30
22030	22075	Valley		45
29800	29875	Valley		75
29940	30000	Valley		60
Gabionwallsofheight3.0m				
3420	3460	Valley		40
3640	3700	Valley		60
7905	8000	Valley		95
Gabion walls of height 4.0m				
19930	19980	Valley		50
Gabion walls of height 5.0m				
3460	3540	Both	2	156
9470	9580	Valley	47.88	62.12
19850	19930	Both	33.42	93.16
19980	20080	Both	18.24	163.52
31780	31950	Both	33.42	273.16
Proposed Breastwalls				
5825	6175	Hill		350
6770	6875	Hill		105
6875	6920	Hill		45
12450	12495	Hill		45

Chainage(m)		Side	CD Length(m)	Length(m)
From	To			
12930	12990	Hill		60
14150	14180	Hill		30
14210	14250	Hill		40
17975	18075	Hill	2	98
18750	18820	Hill		70
19030	19175	Hill		145
19360	19590	Hill	2	228
20410	20460	Hill		50
20490	20530	Hill		40
21040	21090	Hill		50
21400	21475	Hill		75
21580	21630	Hill	2	48
22380	22420	Hill		40
22470	22530	Hill	2	58
22530	22575	Hill		45
22975	23030	Hill		55
23030	23100	Hill		70
23100	23140	Hill		40
23200	23260	Hill		60
24525	25050	Hill	6	519
25050	25175	Hill	2	123
27200	27275	Hill		75
27660	27700	Hill		40
28925	29675	Hill	14	736
32410	32460	Hill	2	48

- Slope protection measures are to be provided along the project stretch in the form of erosion blanket with shrub plantation, Hydro seeding, interlink chain mesh with grass strips, shotcrete crib wall with vegetation and hedge brush layerWhere practicable, excavated areas should be backfilled at the end of the working day.

Guidance for establishment of construction camps, material storage or staging of plant and machinery.

Sites /land types to be avoided:

–Lands close to habitations

– Irrigated agricultural lands

– Lands belonging to small farmers

– Lands under village forests

– Lands within 100m of community water bodies and water sources as rivers to avoid contamination.

– Lands supporting dense vegetation and Forest with/without conservations status

– Low lying lands within 100m of watercourses

– Grazing lands and lands with or without tenure rights

– Lands where there is no willingness of the landowner to permit its use

– 2km from towns 500m from any villages

– Community land (Chruch, community forest) which is traditionally used as conservation areas

Land Types Preferred:

– Waste lands.

– Waste Lands belonging to owners who look upon the temporary use as a source of income.

– Community lands or government land not used for beneficial purposes.
– Private non-irrigated lands where the owner is willing.
– Lands with an existing access road.

Borrow Areas and Quarries

Need for opening borrows areas is anticipated. It may cause some adverse impacts if left un-rehabilitated. It may pose risk to people, particularly children and animals of accidentally falling into it as well as become potential breeding ground for mosquitoes and vector born diseases. Illegal quarrying may lead to unstable soil condition; destroy the landscape of the terrain, air and noise pollution.

Quarry material will be sourced from existing licensed quarries. The dredging and use of dredged material, if involved, may have its impact in terms of localized sedimentation level increase and dispersion of pollutants present in the dredged material in the river water.

A total number of 2 borrow areas have been identified around project road, one is at a distance of 23.3 Km and another is at 33.8 Km from the project stretch (refer to table 13 and 14). For meeting the required quantity of sand for construction, one sand quarryis available around the project area, which is located in Jaidoh village on Nongkasen. Details of borrow area is given in Section 0.

Mitigation Measures

- Borrow areas shall not be located near forest areas. The edges of borrow sites shall be no closer than 3 meters from any fence line or boundary. Borrow areas should not be located on cultivable lands except in the situations where land owner's desires to level the land.Borrow pits shall be selected from barren land/wasteland to the extent possible.Adequate clearance shall be provided for the construction of catch drains. Borrow sites shall have adequate drainage outlets unless the relevant landowner has agreed that the borrow area is to create a permanent tank or dam. Cut batter slopes shall not be steeper than 3 to 1 and shall be left by the Contractor in a tidy and safe condition to the satisfaction of the Engineer. Written clearance from the land owner/village head shall be obtained before leaving a site
- The top soil shall be preserved and depth shall be restricted to the desired level.
- Borrow areas should be excavated as per the intended end use by the owner.The Indian Road Congress (IRC):10-1961 guideline should be used for selection of borrow pits and amount that can be borrowed.

Ambient Air Quality

Construction stage activitieswill have adverse impacts on the workers as well as the settlements adjacent to the road, especially those in the down wind direction.

The adverse impacts on air quality during construction stage are classified and presented in the table below. There are two types of pollution i.e., dust pollution and pollution from harmful gases.

Table 40;Adverse impacts on air quality during construction stage

Sl.	Impact	Source
1	Generation of dust	Transportation and tipping of cut material - while the former will occur over the entire stretch between the cutting location and disposal site, the latter is more location specific and more intense;
		Transportation of raw materials from quarries and borrow sites
		Stone crushing, handling and storage of aggregates in asphalt plants
		Site levelling, clearing of trees, laying of asphalt
		Concrete batching plants;
		Asphalt mix plants – due to the mixing of aggregates with bitumen;
		Construction of structures and allied activities
2	Generation ofpolluting	Hot mix plants
		Large construction equipment, trucks and asphalt producing and paving

Sl.	Impact	Source
	gasesincluding SO_2,NO_x and HC	equipment
		The movement of heavy machinery, oil tankers etc.
		Toxic gases released through the heating process during bitumen production
		Inadequate vehicle maintenance and the use of adulterated fuel in vehicles.

The impacts are expected to be temporary (limited to construction period) and confined within construction areas.

Mitigation Measures:

- Vehicles delivering loose and fine materials shall be covered
- Limiting unnecessary idling of heavy machineries and other vehicles significantly reduce emission of polluting gases.
- Loading and unloading of construction materials in covered area or provisions of water fogging around these locations.
- Storage areas should be located downwind of the habitation area.
- Periodic water sprinkling needs to be done, wherever required.
- Regular maintenance of machinery and equipment needs to be done. Vehicular pollution check shall be made mandatory and renewed as per requirement.
- Hot mix plants and other plants should be located at least 1.5 km from the nearest habitation, school, hospital, archaeological site, forest, rivers, streams and lakes, 500 m from ponds, and national highway, 250 m from state highway, unless otherwise required by statutory requirements after securing a No-Objection Certificate (NOC) from the SPCB. Hot mix plant shall be fitted with stack of adequate height as may be prescribed by SPCB to ensure enough dispersion of exit gases.
- LPG should be used as fuel source in construction/labour camps instead of firewood.
- Mask and other PPE shall be provided to all the staffs/workers at construction site.
- Diesel Generating (DG) sets shall be fitted with stack/chimney of adequate height as per regulations (Height of stack = height of the building + 0.2 KVA). Low sulphur diesel shall be used in DG sets as well as machineries.
- Avenue plantation may improve the air quality during operation stage.
- Regular air monitoring shouldbe done to check the ambient air quality of the area.

Noise

The scale of the construction necessary to upgrade the road and the corresponding slight increase in traffic is not expected to generate adverse impacts. Ambient noise level may increase temporarily in the close vicinity of various construction activities, maintenance workshops, and vehicles and earthmoving equipment. These construction activities are expected to generate noise levels in the range of 80 – 95 dB(A) at a distance of about 5 m from the source.

Although this level of noise is higher than the permissible limit for ambient noise level for residential/commercial levels but will occur only intermittently and temporarily. This noise level will attenuate with an increase in distance from the noise source, decreasing by 10dB at a distance of about 55m and 20 dB at 180 meters. Impact due to noise during construction activities will be minimal near communities as construction camps are located at least 50 meters away from community areas.

Along the project road, noise-sensitive places are located which includes schools, hospitals, and religious places. Noise impacts during project construction will be significant on these but temporary.

Further, using the Inverse Square Law of noise propagation, anticipated noise at the sensitive areas are given below.

Table 41:Anticipated Noise due to construction in the sensitive receptor

Name of the Component	Description	Chainage	side of the road (L/R)	Distance from the road (m)	Noise Level (dB)
CHC	Church	1+950	LHS	30.55	75.27
CHC	Church	2+800	RHS	42.92	72.32
SCH	School	2+900	RHS	28.74	75.80
SCH	School	3+050	RHS	22.53	77.92
SCH	School	3+050	RHS	45.54	71.81
INS	Institute	3+550	RHS	105.86	64.48
SCH	School	3+850	RHS	36.83	73.65
CHC	Church	4+250	LHS	12.71	82.89
SCH	School	4+250	LHS	21.38	78.37
SCH	School	4+300	RHS	24.52	77.18
CHC	Church	14+850	RHS	105.10	64.54
GY	Graveyard	15+150	LHS	19.17	79.32
CHC	Church	20+300	RHS	64.32	68.81
SCH	School	34+050	LHS	17.85	79.94
SCH	School	34+100	LHS	11.96	83.42
SCH	School	34+150	LHS	22.74	77.84
SCH	School	34+250	LHS	67.04	68.45

From the above datait is observed that the range of noise level of maximum locations is exceeding the permissible limit. Thus, to avoid the impact of noise pollution following mitigation measures are mentioned below:

- Site Controls: Stationary equipment will be placed along un-inhabited stretches as per distance requirements computed above as far as practicable to minimize objectionable noise impacts. These locations should be away from known bird nesting areas.
- Scheduling of Project Activities: Construction activities will be scheduled to coincide with period when people would least likely to be affected. Construction activities will be strictly prohibited between 10 P.M. and 6 A.M. Near sensitive areas like schools', construction activities should be prohibited at the schooling hours. . Noisy operation near known nesting areas should be avoided during winter, typical breeding period of migratory birds.
- Protection devices (ear plugs or ear muffs) will be provided to the workers operating in the vicinity of high noise generating machines.
- Construction equipment and machinery should be fitted with silencers and maintained properly.
- Noise measurements should be carried out along the road to ensure the effectiveness of mitigation measures
- All construction equipment used for an 8-hour shift shall conform to a standard of less than 90 dB(A). If required, machinery producing high noise as concrete mixers, generators etc., must be provided with noise shields;
- At construction sites within 500m of human settlements, noisy construction activities shall be stopped between 9.00PM and 6.00AM and near sensitive locations such as schools' construction activities should not be done during the schooling hours.
- Vehicles and construction machinery shall be monitored regularly with particular attention to silencers and mufflers to maintain noise levels to minimum;

- Workers in the vicinity of high noise levels must wear ear plugs and should be engaged in diversified activities to prevent prolonged exposure to noise levels of more than 85 dB(A)per8-hourshift.

Surface Water Quality and Siltation

Construction activities may increase turbidity level in the surface water source located adjoining to the Project road, thereby increasing the sediment load. Sometimes contamination of surface water may take place due to accidental spills of construction materials, oil, grease, fuel, and paint. Degradation of water quality is also possible due to accidental discharges into watercourses from drainage of workers camps and from spillages from vehicle parking and/or fuel and lubricant storage areas. During construction phase, care would be exercised to control silt so that the water available in the ponds and wells especially those located very near to the ROW may not be contaminated.

Extraction of sand from the river bed will increase turbidity and affect propagation of fishes and other aquatic life mainly benthic organisms. The macro-benthic life which remains attached to the river bed material may get dislodged and carried away downstream by turbulent flow. Mining and dredging activities, poorly planned stockpiling and uncontrolled dumping of overburden, and chemical/fuel spills from equipment's and machinery involved in dredging may cause deterioration of water quality for downstream users, and poisoning of aquatic life. However, the river bed sand quarries identified for the project have no density and diversity of benthic fauna. Fishing is practiced in the water bodies intersecting the project road. There are several ponds adjacent to the proposed project road. Moreover, any extraction of river bed material is regulated by different authorities like State Environmental Impact Assessment Authority, State Pollution Control Board and State Mining Department with an objective to conserve top soil, avoid impact on aquatic biodiversity, hydrological regime etc. by haphazard and unscientific mining of minor minerals. The project will utilize river bed materials from existing licensed quarries with all stipulated conditions of above-mentioned authorities.

Mitigation Measure:

- Construction works near waterways/water bodies will not be undertaken during the monsoon season
- Retaining walls have been proposed to prevent erosion
- Installation of temporary silt traps or sedimentation basins along the drainage leading to the water bodies;
- No construction camp within 500m of any water body
- Locating all parking, repair and fuel and hazardous material storage area away from any water body. Vehicle parking and maintenance areas will have waterproof floors from which drainage is collected and treated to legal standards.
- Refuelling of vehicles only in dedicated areas with waterproof floors from which drainage flows to an oil/water separator before discharge
- Collection of all waste oil, store in sealed damage-proof containers and dispose it to recyclers.
- All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual clean-up.
- Installation of temporary retention ponds, interception drains, and silt traps to prevent silt laden water from entering adjacent water bodies/waterways;
- Modification and rechannelling of the slope of embankments leading to water bodies to prevent entry of contaminants.
- Compliance with requirements of the clearance issued by the relevant state authority formining in rivers
- No construction related activities of bridges during breeding season of fish and other aquatic species.

Impacts on natural drainage and watershed management (flooding)

Along the rivers and streams crossed by the road, there is a need for bank protection measures to avoid accelerated sedimentation that can affect drainage pattern as well as riverine habitats. The alignment follows the existing topography except for the location of the cross-drainage structure. There is no existing Major Bridge on the Project road section only 4 nos. of RCC Bridge and 11 nos. wooden bridges exist, and No additional bridges are proposed to be constructed. Out of the 196 nos. of existing culverts, 45 nos. are Pipe Culvert, 1 no. is RSJ with Wooden Deck & 150 nos. are Slab culvert. All culverts present in the project road are either hydraulically inadequate or structurally unsafe & hence are proposed for reconstruction.

Mitigation Measure

- At all locations where the preliminary design has indicated a raise in the level of the embankment, the final design should review the feasibility of the same and if possible, reduce the embankment height.
- At all location where the vertical profile has increased by 0.25 to 0.50 m or more protections of embankment is required.
- A slope protection measure that has been successful in Meghalaya has been the use of Vertiver as a Bio engineering measure. The basis of this technique is plantation of Vetiver plants of approved variety specifically designed as per the soil and site conditions. For controlling the underwater erosion, a flexible mattress is proposed to be used. This mattress made of waste/recycled items like empty cement bags which will remain intact for long periods under water has been found effective in controlling underwater erosion elsewhere in Meghalaya. The stretches along the river bank will also have a reed bed which will absorb the flow energy before the water current hits the bank.

Ground Water Quality

Water for construction purpose will be sourced mainly through major streams along the project road. Suitable arrangement for drinking water in the campsite will be managed by contractor without affecting availability to local community. The area is not classified as critical, semi-critical or overexploited by CGWB. However, uncontrolled drinking water abstraction can deteriorate the situation. Contamination of groundwater is not envisaged since all construction camps will have septic tanks or mobile toilets depending on the number of workers in each camp.

Mitigation Measures:

- Provision for adequate numbers of septic tank to avoid contamination of ground water.
- Requisite permission will be obtained for abstraction of groundwater.
- The contractor will make arrangements for water required for construction in such a way that the water availability and supply to nearby communities remain unaffected.
- Water harvesting structures shall be proposed for groundwater augmentation in the project area.
- No change in groundwater regime is envisaged hence no mitigation is proposed.

Construction and Demolition Waste

Construction and Demolition waste shall be generated during the project construction phase. A certain amount of waste will be generated. Those wastes shall be utilized by theContractor depending upon suitability. However, Contractor shall dispose unused C&D waste atdesignated disposal site as perConstruction and Demolition Waste Management Rules 2016.

Mitigation measures:

Contractor shall use the excavated road side material for construction of road. The rest unsuitable material shouldbe disposed suitably. The Contractor will not dispose the excavated unsuitable material generated from hill section to other side (valley side) of the project road.

Proper disposal plan will be prepared by the Contractor to dispose the unsuitable material generated from hill cutting/ road excavation.

Disruption of Community Services

Local services, including water supply lines, irrigation line, drainage, ditches, streets are commonlycut during road earthworks. These activities are required by the local people for crop production,drinking water supply and access, and have the potential to damage road work too. These servicesare often either inadequately reconnected or not reinstated at all

Mitigation Measures

- The Contractor will arrange their own source to cater for their water requirement for construction and other activities and will not interfere with the local water supply system
- All irrigation canals, water supply lines and stand pipes, drainage and streets will be maintained during construction or if necessary, temporary services shall be arranged of the owner/ user's permission for temporary cessation will be gained.
- All the Services will be progressively reinstalled as soon as road excavation has been completed.

Diversion of Traffic

Since the road upgradation works will be on the existing road only, therefore there will be direct interface with the road traffic. The Short term impacts associated with the project will be traffic diversion and management during construction phase. Construction activities will cause hindrance to the existing traffic flow. There is possibility of accident hazards during construction phase of the widening project. There will be requirement for diversion of existing traffic at various construction sites during construction phase. It needs to be mentioned that though there are no direct impactson the natural environment due to disruption/diversion of such services, but diversion can also leadto adverse impacts, if not planned properly. Rapid restoration of diverted services can help inminimizing the severity of impacts arising out due to diversions of existing services.

Mitigation Measures

- Reduce speed through construction zones.
- Construction of bridges/culverts will be carried out prior to construction of new carriageway at the first stage.
- Strengthening/raising of existing two lanes will be done only after the completion of the first stage.
- Proper warning signs will be displayed at construction sites.

Impacts on Occupational Health & Safety

The Construction workers are continuously exposed to dust and gaseous emission during construction activities. The construction industry falls in hazardous category and there are always risks of accidents to the labours. However, this type of risks of Occupational hazards can be managed with implementation of proper safety at site.

Mitigation Measures:

The Contractor will comply with the requirements of the Environmental, Health, and Safety (EHS), Guidelines of the World Bank, April, 2007 and all national, state and local core labor laws on working conditions and safety during construction.

The Contractor will Develop and implement site-specific Health and Safety (H&S) Plan including SoP for preventing spread of COVID-19 epidemic which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment; (c) H&S training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents

The Contractor will provide adequate good quality Personal Protective Equipment (PPE) to all the workers working at construction zones and Plant sites and will ensure that these PPEs are used by workers at all time during works.

Safe access to the work site and safe working conditions to be maintained throughout the working period.
Adequate drainage, sanitation and waste disposal will be provided at workplaces.
Proper drainage will be maintained around sites to avoid water logging leading to various diseases.
Adequate sanitation and waste disposal facilities will be provided at construction camps by means of septic tanks, soakage pits etc.
A health care system will be maintained at construction camp for routine check-up of workers and avoidance of spread of any communicable disease.
Readily available First Aid kit bearing all necessary first aid items will be proved at all the work sites and should be regularly maintained.
The Contractor will organize awareness program on occupational health and safety aspects as well as on HIV/AIDS and sexually transmitted diseases (STDs) and COVID-19 on periodic basis through authorized agency.
Preventive measures are required to be followed to avoid or minimize transmission of communicable diseases that may be associated with the influx of temporary or permanent project labour for workers on periodic basis.

Work Site Safety

Construction site safety is one of the most overlooked things during a construction project. In most workplaces accidents are common due to lack of work site safety. Accidents have the potential to be life-threatening and can be avoided through proper Work site Safety.

Mitigation Measures:

- Safe access to the work site and safe working conditions to be maintained throughout the working period
- Scaffolding to be used properly.
- Avoiding entering a trench that is unprotected.
- Avoiding ladders with metallic components near electrical work and power lines
- Head Protection, use helmet or body harnesses
- Construction workers should wear work boots with slip-resistant and puncture-resistant soles
- Hazard communication: Make information accessible to employees at all times in a language or formats
- Checking of all electrical tools and equipment regularly for defect
- The Contractor will comply with the requirements of the Environmental, Health, and Safety (EHS), Guidelines of the World Bank, April, 2007 and the statutory norms on safety during construction.

Anticipated Impact on Biological Environment:

Impact on Faunal and Terrestrial Ecology:

Most of the project road stretch passes through human habitation, agricultural area, built-up and degraded non classified forest areas without any National Parks, Wildlife Sanctuaries and other eco-sensitive areas nearby. During transect walk no Endangered or Schedule - I species has been located in the project area. There is a scope of slight impact to local domestic animals, which graze in the area especially after the road is constructed. Increased vehicle movement in the area might lead to accidents involving animals. Apart from this, micro-ecosystems developed on the roadside with the birds, animals and insects using the plantation over the years may be lost due to loss of their habitat.

Mitigation Measure

- The Contractor shall take reasonable precaution to prevent his workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal.

- Mandatory / Regulatory sign for entire section of project road, for every 2 km, on alternate sides is proposed.
- The compensatory plantation shall act as the new habitat for the birds, animals and insects species
- If any animal is found near the construction site at any point of time, the contractor shall immediately upon discovery thereof contact authorized wildlife rescuer or Forest Dept for rescue of snakes or other distressed wildlife.
- Special care of ponds shall be taken since the wildlife and public dependent on these water bodies.

Impact on Flora and Mitigation measures:

The project has a significant, direct and long-term impact on roadside trees in the Pre-construction stage. The cutting of trees shall have manifold impact. Most visible impact is the loss of shade. Also, there is a possibility of the local people being deprived of tree products, such as wood, fruits, leaves etc. Removal of roadside tress will reduce comfort levels for slow moving traffic and pedestrians.
Trees impacted due to the project shall only be cut after requisite permission from State Forest Department is obtained.

Trees impacted by the project shall be compensated by planting of endemic tree species which are highly tolerable to vehicular emissions and dust will be taken up as per IRC: SP 21.

All necessary measures such as siting of construction establishments away from human habitations; increase of stack height; regular maintenance of construction equipment's and vehicles; etc. shall be taken up to reduce the dust and gaseous emissions during construction activities.

The compensatory plantation shall act as the new habitat for avifauna, lesser mammals, herpetofauna & insects. List of species recommended for taking up compensatory afforestation has been presented in below tables. Local authority and populace may also be consulted for selection of species types.

All efforts shall be made for the survival of the planted trees. A Memorandum of Understanding should be signed with competent authority or agency to take up the plantation.

Table 42:Species Recommended for Plantation

Scientific Name	Role
Azadirachtaindica	Noise barrier, Pollution sink, Economic & Medicinal Value
Cassia fistula	Landscaping, Flowering plant, Pollution sink
Ficus bengalensis	Noise barrier, Pollution sink, Shade, Supports other species, Religious values
Ficus religiosa	Noise barrier, Pollution sink, Shade, Supports other species, Religious values
Magnifera indica	Noise barrier, Pollution sink, Shed, Economic & Medicinal Value
Syzygium cumini	Pollution sink, Economic Value (fruit bearing)
Terminalia arjuna	Noise barrier, Pollution sink
Terminalia chebula	Noise barrier, Pollution sink, Shed, Economic & Medicinal Value
Alstonia scholaris	Noise barrier, Pollution sink, Shade, Supports other species
Dillenia indica	Noise barrier, Pollution sink, Shed, Economic & Medicinal Value
Mimusops elengi	Noise barrier, Pollution sink, Shed, fruit
Lagerstroemia speciosa	Landscaping, Flowering plant, Pollution sink
Bombax ceiba	Landscaping, Flowering plant, Pollution sink
Mesua ferrea	Noise barrier, Pollution sink, Shed, Economic & Medicinal Value
Neolamarckia cadamba	Noise barrier, Pollution sink, Shed, Economic & Medicinal Value

Impact on Aquatic Ecology:

Impacts on the aquatic ecology during construction include increase in the silt inflow to the surface water bodies and disposal of liquid wastes and untreated sewage from construction camps and labour camps into the surface water bodies. There is no significant impact on aquatic ecology during operation stage as there is no major rivers or water body in the ROW. No negative impacts are envisaged on the aquatic ecology during the operational phase.

Mitigation measures

Construction of road embankments shall be doneadheringto specified norms as per slope ratio and turfing on the slopes will be done to reduce the embankment erosion. Construction of cross drainage structures will be taken up during lean flow period to avoid the silt inflow to the surface water bodies.

If any aquatic animals, such as turtles, are found near the construction site at any point of time, the contractor shall immediately upon discovery thereof contact authorized wildlife rescuer or Forest Dept. for rescue of said animals.

No fishing should be allowed by construction workers

Liquid wastes and sewage from the construction establishments will be treated to meet the CPCB standards before disposing it into water bodies.

Accidental chemical spills shall be handled by emergency spill procedure such as stopping the flow; removing ignition source; initiating emergency response; cleanup and safe disposal will be followed.

Provision for silt traps will be made at regular intervals, especially at major cross drainage structures, to trap the silt before it reaches the water bodies along the subproject road.

Management of Construction Debris/Waste

Construction debris/waste is generated due to demolition of existing structures, scarification of existing pavement and excavation at some section of the subproject road. Improper disposal of scarified bitumen causes decrease in soil fertility and water pollution. Careless disposal of debris can obstruct waterways causing siltation of reservoirs and reduce capacity. Unleaded demolition wastes will cause traffic blockage and dust causing inconvenience and health risks.

Mitigation measures

- During the site clearance and disposal of debris, the contractor shall take full care to ensure that public or private properties are not affected; there are no dwellings below the dumpsite and the traffic is not interrupted.
- The Contractor shall at all times ensure that the entire existing canal and drains within and adjacent to the site are kept safe and free from any debris.
- Construction waste debris shall be utilised for backfilling embankments, filling pits, construction of cross roads, approach roads and landscaping before being disposed into disposal pits.
- Debris disposal sites shall be sited away from sensitive locations like settlements, water body, forest areas and any other sensitive locations.
- The debris dumpsites have to be suitably rehabilitated by planting local species of shrubs and other plants so that the landscape is coherent with the local environment.
- Care should always be taken to maintain the hydrological flow in the area and dumping sites do not contaminate the water sources such as rivers and ponds.
- Public perception about the location of debris disposal site has to be obtained before finalizing the location. Permission from the Village/local community is to be obtained for the Disposal site selected.

Mitigation Measures for Bridge/Culvert Construction Sites

There is proposal for construction few major and minor bridges along the ROW. None of these bridges are situated on any major river or its tributaries. 11 numbers of bridges along the project road need to be reconstructed. All are either seasonal Nullah, Water logged area or Redundant part of old River channel. For construction of these bridges, following steps has to be adopted: -

Construction will be carried out during lean flow period as far as possible;

- All slopes will be stone or brick pitched as per design recommendations;
- Silt fencing will be provided at base of embankment of entire water body;
- Siltation of soil into water bodies will be prevented;
- All solid waste/ construction material will be properly disposed off from bridge sites;
- Contractor will ensure that construction material/ solid wastes are not disposed off in water body;
- No oil or lubricant will be discharged from construction yard or machinery into water body
- The Construction materials will be stored at a minimum distance of 500m from the water body.
- To maintain an efficient storm water flow, all drains will be regularly cleaned as part of regular maintenance.

Impacts during Operational Phase

During operation stage, the main sources of environmental impacts are the increased traffic volumeand speeds. The increase in traffic volume and speed may enhance the safety risk especially in therural area. No sudden change in the traffic volume is expected due to this road as the road isalready existing one and opened for public traffic.

Impacts on Water Quality and Resources

During the operation phase, the possibility of degradation of water quality is very remote. The impact on the surface water quality during operation can be expected due to accidental spillage. However the probability of such accidents are minimal since enhancement of road safety measures such as improvement of curves and widening of the roads and other pedestrian facilities are takencare of in the design stage. Periodic monitoring of water quality will be done at selective location of proposed project.

Impact on Air Quality

Vehicular emissions are the principal source of pollution during the operation stage. The subproject road being mostly located in adjacent to open agricultural land, adequate dispersion of gaseous pollutants is expected.

Mitigation Measures:

Implementation of stricter emission norms for the vehicles is the only mitigation measure that will have significant influence on the ambient air quality. In the year 2040, if 50% of the total vehicle turns into electric vehicle then the impact will be less. However, implementation of such norms for vehicles plying on the project road is beyond the control of the proponent.
Therefore, the proponent may take initiatives to raise the awareness of the road users.

Impact on Noise Quality

Noise level for the base year (2021) is mostly around 50 dB(A)except for a School where the noise level exceeds than those prescribed for Sensitive Receptors (. Also, during the year 2044, the ambient noise level near the road is predicted to bebelow 50 dB(A) except at the same School.Thus, a noise barrier needs to be installed in this location to reduce the impact of noise in the sensitive zone.Althoughas per IFC definition of significant noise impact is expected since the difference is more than 3dB(A) but exigence of regulatory limit of the specified land use is not anticipated.

Mitigation Measure

To reduce noise and vibrations, noise barriers in the form of compound wall is proposed. In case of space crunch, the use of concrete screens is also suggested. The noise barrier wall shall be constructed by excavation of foundation, laying of brick masonry wall up to a height of 2m aboveground, plastering and coping as per the direction of the engineer and as laid in the specification. Creepers and paints shall be used in consultation with thetemporarily affected community to give an aesthetic look. Shade and flowering trees shall be planted within the

boundary of the sensitive receptor, between the building line and the compound wall, wherever space shall be available, 5m centre to centre.
Themeasuresadoptedfornoiseattenuation isgivenbelow

- Plantationwithinthepremisesifspaceavailableforplantation
- Raisingof existingboundarywall/constructionof newwallupto2mheight
- Plantingcreeperstoprovideaestheticview

Inurbanareastheboundarywallcanbepaintedwithposterstoprovideaestheticviews.Theoption ofpostersorcreepersshallbeagreedbytheschool/hospitaladministrator.

Accidents Involving Hazardous Materials

Accidents involving hazardous chemicals will generally be catastrophic to the environment, though the probability of occurrence is low. Prevention of an accident involving hazardous material is a better way of minimising the impacts. The provisions mandated by 'The Hazardous Wastes (Management and Handling) rules, 1989' and “Manufacture Storage and import of Hazardous Chemicals Rules” 1989 under the Environmental (Protection) Act, 1986 will be complied with. Vehicles delivering hazardous substances will be printed with appropriate warning signs.

Social Impact Assessment

The project is associated with some adverse impacts as well as some benefits. All the construction activities will be carried out within the RoW which varies from 7m –20 m. To identify the impacts, Socio Economic survey was carried out in September, 2021. The ESIA was conducted during the pandemic situation in 2021, Socio-Economic Survey for the families who will be affected due to construction work, was conducted from 10th November to 20thDecember 2021.During the socio-economic survey, public consultations were alsocarried out.

Positive Impact

This sub-project aims to easy flow of traffic and reduce traffic congestion within the Nongstoin-Maweit road. The storm water drain improves the existing system of rain water flow as most of the drain chokes due to silting. The new design will make easy cleaning/desilting of the storm water drain and thus prevent the overflow of water on the black top. The footpath over the drain and utility corridor will reduce accident:

- People residing at the Nongstoin-Maweit road can easily travel within the area. It will give a major fillip to the quest for all weather good roads for the PIA.
- Lower accident and provide quick accessibility to services like hospital, market, office etc.

Impact on Land

The existing RoW for the sub-project varies from 7m – 20 m and all the construction activities will be carried out within the existing RoW. The proposed construction of Parking areas is within the available Government land. Thus,the project does not involve any land acquisition.

Impact on Structures

During the census survey the structures were also enumerated along the sub-project road. As per the social survey13 structuresfall within the existing RoW and will be impacted. All these structures belong to Non-Titleholders (NTH) and are mainlystaircases to houses & shops, chimney and boundary wall built by encroaching the RoW.

The detailed of the impacted structures is given below:

Table 43Impact on Structure in the Sub-Project

Sl.	Type of Ownership	No. of Structures
1	Temporarily Affected Structures	13
2	Non-Titleholders – Squatters	Nil
3	Petty shop keepers & Kiosk affected	Nil
4	Vendors affected	Nil
5	Title Holders	Nil
6	Non-Titleholders – Encroachers	Nil
7	BPL Families losing Commercial Properties	Nil
8	Total vulnerable families (including BPL)	Nil
9	Total Tribal Families	Nil

Source: SE Survey, September 2021

Table 44 Details of impacted structures

Sl. No.	Chainage	Side	Details of impacted Structuresl	Affected Area due to widening of ROW (approximate values)
1	1+813	RHS	Staircase and entrance of house	4m
2	1+840	RHS	Staircase & Entrance	4m
3	1+969	RHS	Boundary Wall	3m
4	2+050	RHS	Staircase & Shop's pole	4m
5	2+190	LHS	Boundary wall	3m
6	2+300	LHS	Stair to shop & Boundary Wall	0.7m
7	2+370	LHS	Stair to shop	2m
8	9+375	RHS	Stair to shop	3m
9	19+885	LHS	Unknown Concrete structure	-
10	19+875	RHS	Stair to shop	3m
11	20+080	RHS	Chimney	3 m
12	20+085	LHS	Boundary wall(Hume Pipe Cutting)	
13	20+200	RHS	Stairs	3.5m

Mitigation:

The structures which will be impacted shall be constructed without any delay after completion of construction activities at that site. The cost for reconstruction has been included as Bill Of Quantities (BOQ) item as civil cost. The minor repairing shall be done by contractors as an incidental cost to them. All safety precautions shall be taken.The contractor will provide temporary access to the structure losing staircases till the structures are reconstructed by the Contractor. The project will reconstruct the impacted structure upon completion of the construction activities at each site, so a separate Abbreviated Resettlement Action Plan is not being prepared for this road. The reconstruction of the 13 impacted structures has been included in the ESMP,implementation of which is the responsibility of the Contractor. The ESMP implementation will be monitored by the Project Management Unit (PMU) regularly.

Impact on Tribal People

Impact on Tribal families

Out of the 13 impacted structures, ___ structures belongs to ST families. As a mitigation measures, the contractor will reconstruct the structures upon completion of construction activities. Also, during the construction phase temporary access will be provided to these structures.

Impact on Community Property Resources

As revealed in social survey, there is no impact on the community structure or community land of cultural or religious sentiment of the ST Population in the Primary PIA. The proposed project will ensure that STs receive culturally appropriate social and economic benefits, do not suffer adverse impacts as a result of projects, and can participate actively in projects that affect them.There is no cultural heritage site which comes in the way of the road alignment.

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CHAPTERVI: CLIMATE CHANGE IMPACT & RISK

A rapid increase in the number of motor vehicles on road in Meghalaya has been observed over the past decade. Due to the lack of adequate public transport systems where buses comprise only 1% of the total population of vehicles on road, and due to the availability of easy loans, most of the people are aspiring to buy their vehicles. As a result, two-wheelers are 57% of the total vehicle mix in the State, and cars follow suit with a 21% share in 2013-14. The road transport sector is a direct consumer of fossil fuel and emits GHG into the atmosphere. With an increase in population and per capita rise in the number of personal vehicles, GHG emissions are likely to rise. The use of the public transport system needs to control emissions in the future and ease off the pressure of vehicles on the roads. This would require policy changes in the way lending is done by banks, enabling fuel mix with biofuels, and behavioural changes of the population whereby they use more and more non- motorized transport at short distances and public transport for long distances.

Climate Change Mitigation

The Transport Emissions Evaluation Model for Projects (TEEMP) developed by Clean Air Asia was utilized to assess the CO_2 gross emissions with and without the project improvements. The main improvement from the project that was considered for the model are better surface roughness with initially 6 m/km which may deteriorate over a period but not less than 2 m/km and widening of roads from the single/intermediate lane (3.5/5.5 m) to two lanes with paved shoulder (7 m). These were translated into impacts on traffic speed and hence fuel consumption. The model also allows for the inclusion of impacts related to traffic congestion with and without project through provisions for inserting data on the traffic numbers, lane width, number of lanes, and volume/capacity saturation limit.

Information that was fed into the model for projecting the CO_2 emissions are:

- The road configuration will change from an intermediate lane to two lanes with a carriageway width of 7 m with 1.5 m hard shoulder on both sides. The road will have an asphalt concrete surface.
- The surface road roughness is mostly 6 m/km and will be improved to 2.0 m/km, which may further reach up to 3.5 m/km during 5 years of road operations. Resurfacing of the road would be required after 5 years.
- The design life of the road is 20 years.
- Other improvements include the repair or reconstruction and improvement of culverts, longitudinal and cross drains, and removal of irregularities on the existing vertical profile and road safety appurtenances.

Table 456;Traffic Composition

Vehicle Type	Traffic Composition
2-Wheeler	0.6%
3-Wheeler	0%
PassengerCar+Mini LCV +Exempted Vehicles	6.1%
Mini Bus	0.2%
Standard Bus	0.2%
LCV	4.7%
2-Axle	74.8%
3-Axle	12.4%
MAV	0%
Tractors-With Trailer	0.9%
Tractors-WithoutTrailer	0%
TotalMT (Motorized Traffic)Traffic	**100.00%**
Bi-Cycle	0%
Cycle-Rickshaw	0%
Animal-Drawn	0%

Vehicle Type	Traffic Composition
Hand-Drawn	0%
TotalNMTTraffic (Non-motorized Traffic)	**0.00%**

Road capacity of 3,496 PCU/lane/day for was adopted for this project based on projection at the end of design year (2043). Emission factors were mostly taken from the CPCB/MOEF (2007) Draft Report on Emission Factor Development for Indian Vehicles, the Automotive Research Association of India, and C. Reynolds et.al (2011) Climate and Health, Relevant Emissions from in-Use Indian for three-wheelers rickshaw as presented in Table below. Emission factors were taken from the CPCB/MOEF&CC (2007) Draft Report on Emission Factor Development for Indian Vehicles, the Automotive Research Association of India, and C. Reynolds et.al (2011) Climate and Health Relevant Emissions from in-Use Indian for three-wheelers rickshaw as shown intable below

Table 46;CO_2 Emission Factors

VehicleType	Petrol	Diesel	LPG/CNG
2-Wheel	1.37kg/l		
3-Wheel	2.12kg/l	2.58kg/l	3kg/l
Cars/bus	2.24kg/l	2.58kg/l	

- All 2-wheel vehicles are run onpetrol; average fuele conomy:50km/litres
- All3-wheelvehicles are run on diesel; average fuele conomy:30km/litres
- 50%of the cars/bus are run on petrol while the remaining are run by diesel; average fuel economy:15km/litres

For 45.000 km of road construction would result in emission of approximately 4635 tCO2eq. (Source: Greenhouse Gas Emissions Mitigation in Road Construction and Rehabilitation - A Toolkit for Developing). This value if based on estimation of materials required to upgrade /construct of rural road which include cement, steel, gasoline, diesel, and bitumen etc.

Estimated carbon emissions:

Construction Phase

TheGHGemissionsduringaroadconstructionprojectinvolvethefollowingmajorsources:

12. Transportemissionsowingtotransportationofmanandmaterial
13. Materialemissionsowingtoextraction/productionofconstructionmaterials
14. Machinesemissionsowingto consumptionoffuelbyenginesusedin construction

A detailed study conducted for the World Bank titled “Greenhouse Gas Emissions Mitigation in Road Construction and Rehabilitation- A Toolkit for Developing Countries” established the typical GHG emission rate in terms of ton CO_2eq per km of road construction. According to this study, for Rural Road-DBST, GHG emissions due to material production is based on estimation of materials required to upgrade /construct of rural road which include cement, steel, gasoline, diesel, and bitumen etc. are the main contributor.

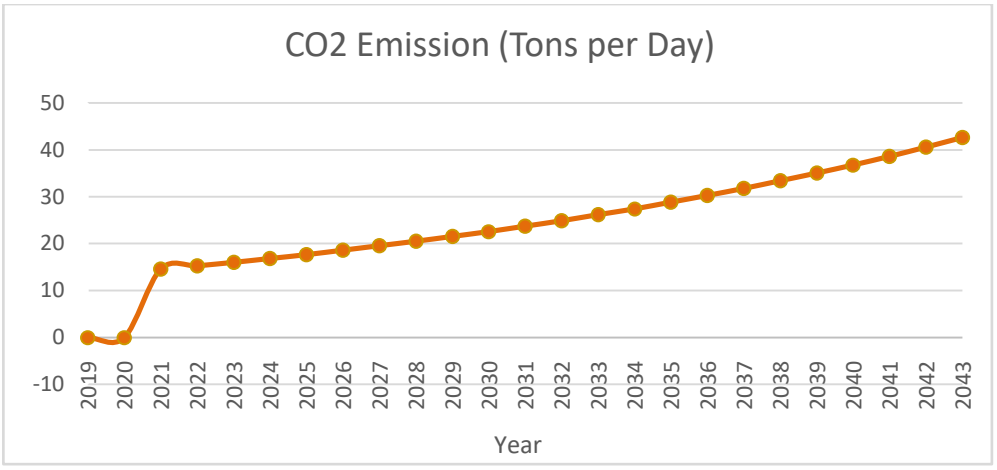
Type ofRoad	Transport emissions	Materiale missions	Machines emissions	Total (t $C0_2$ eq.)
Rural Road—DBST	26	62	14	103

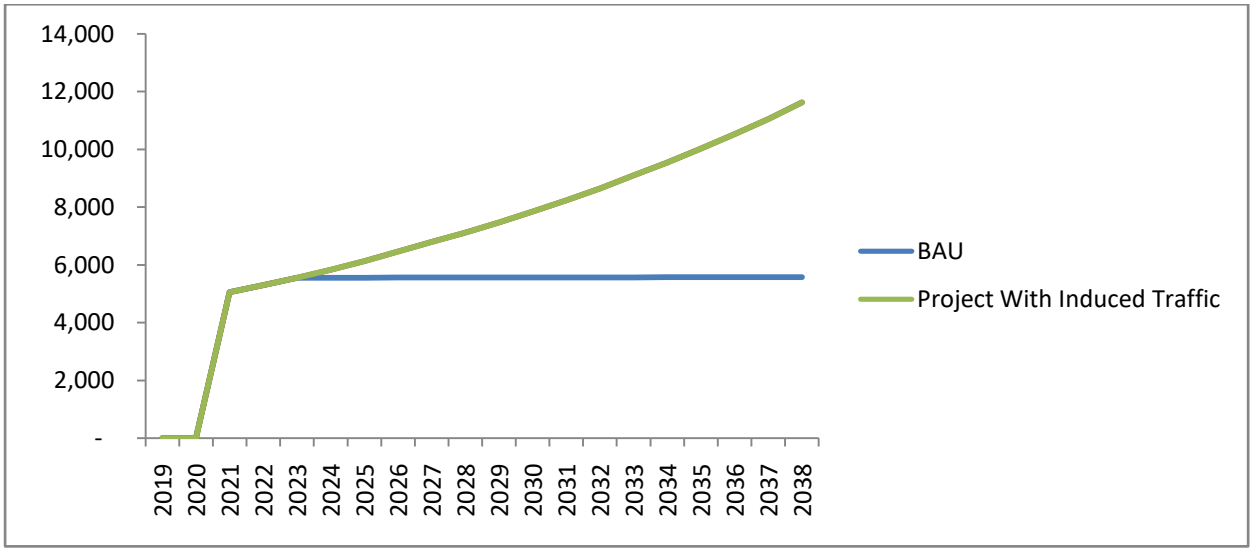
Source: Greenhouse Gas Emissions Mitigation in Road Construction and Rehabilitation-A Toolkit for Developing Countries

Therefore, for 34.801 km of road construction would result in emission of approximately 3584.50 tonCO2eq.

Operation Phase

The design life of the project road is 20 years. Total annual emission for each year starting from the base year -2019(i.e. without the project) till year 2043 is presented in the figure below.





(Both without and with induced traffic), there will be an increase in the CO_2 emission levels over the time due to the increase in the traffic volume, however, the emissions will be controlled by maintaining the road roughness below 3.0 m/km during the entire project life as well as the enhanced capacity of the road. This will result in annual CO_2 emissions of the project road much below the threshold limit of 100,000 tons/year.

Climate Change Impacts & Risks

In today's world, climate change is considered the most serious global challenge. Changes in the atmosphere have been detected that could drastically alter the climate system and the balance of ecosystems. Atmospheric changes are linked to an increase in greenhouse gases (GHGs), chiefly on account of anthropogenic releases attributed to fossil fuel consumption, land-use changes, deforestation, etc. Research has established that carbon dioxide (CO_2) levels in the atmosphere have risen by 35% since the pre-industrial era. Rising CO_2 concentrations increase the energy retention of Earth's atmosphere, leading to a gradual rise in average temperatures and global warming. Sector-specific climate risk screening has been done based on secondary sources to analyze the impact on road components due to likely change in climatic variables, mainly temperature and precipitation.

Temperature & Precipitation:

The temperature and precipitation pattern of the study area are given in **Error! Reference source not found.** and **Error! Reference source not found.** above in the baseline chapter. Increased temperature and precipitation will have the following impacts:

- **High Precipitation Impacting Roads /Bridge /Embankment**: Heavy rains can cause disruption of the road networks, decreased accessibility, erosion of roads and

embankments, surface water drainage problems, slope failures, landslides, among others. Increased river flow resulting from precipitation and storminess may result in damages to bridges, pavements, and other road structures. Bridge/culvert capacities are reduced or exceeded, causing upstream flooding to occur.

- **High Temperature Impacting Road Stability**: Extreme heat, combined with traffic loading, speed, and density can soften asphalt roads, leading to increased wear and tear. There would likely be concerns regarding pavement integrity such as softening, traffic-related rutting, embrittlement, migration of liquid asphalt. Additionally, thermal expansion in bridge expansion joints and paved surfaces may be experienced.
- **Earthquake**: All districts of the state of Meghalaya lie in Zone V. Centered across the state border in Assam, much of Meghalaya was severely jolted especially Shillong.
- **Drought**: The Average Annual Rainfall in Meghalaya is 2818 MM (source: rainwaterharvesting.org), whereas, Sohra or Cherrapunjee and Mawsynram in Meghalaya receive the highest rainfall in the world i.e. about 11000 mm annually, but this huge rainfall is concentrated only in monsoon months. 11, 667 sq km of the State drains into the Brahmaputra basin and the rest 10,650 sq km into the Barak Basin (Source: Central Water Commission). In less than 12 hours all the rainfall runoff water reaches the plains of Bangladesh and Assam taking along with-it top soil, boulders and logs besides creating flood-havoc in Bangladesh. In contrast during non-monsoon months, most of the rain-fed surface sources and spring sources get dried up, leading to water scarcity, which is a major problem as the people living in these areas with highly variable rainfall, experience droughts like situation and floods and often have insecure livelihoods. In many dire cases people do not even have regular access to water for drinking purposes.
- **Cyclone** Meghalaya is situated in the north eastern direction of Bangladesh which is highly prone to cyclone/ winds. Every year about 60% of the area is affected by cyclone in Bangladesh. The Districts of West Jaintia Hills and East Jaintia Hills may experience a wind speed of up to 55m/s. Occasional cyclones do occur in western Meghalaya, their severity being more during monsoon season. The districts close to Bangladesh like South West Garo Hills, South Garo Hills, South West Khasi Hills, West Khasi Hills, fall in very high cyclonic zone due to close proximity to Bay of Bengal (which is a cyclone basin). In this zone wind speed can reach up-to 50 m/s, which can cause large scale damages. The Bay of Bengal accounts for seven percent of the annual tropical cyclone activity worldwide; the recorded frequency of cyclones per year along the Bay of Bengal is four and inevitably one of the four transforms into a severe cyclone causing human and property losses
- **Flood**: The plain areas of Meghalaya adjoining Assam are affected by flood due to the back flow of water from the River Brahmaputra during the flood season between June and October. The tributaries like Krishnai, Jinari, Jingjiram, Rongai, Dudhnoi, Ringgi, Gohai, Dilni etc. cause flood in the plain areas of the State.

  Key engineering measures taken to address flood risks in the design are:

  - Increase in embankment height,
  - Construction of new side and lead away drains,
  - Construction of new culverts and widening of existing ones and iv) widening of bridges.

Cross drainage structures, embankment, and Roadside drains would have been considered anyway in the conventional design as the issue of flooding is a threat to the sustainability of the road. However, these measures also contribute to the adaptation of the roads for future increases in precipitation. This risk screening and risk identification exercise have helped to ensure that the project road with climate risks have adequate risk mitigation or adaptation measures. Provisions have also been made in the bidding documents for the Contractor to prepare contract package-specific EMP's based on the final detailed design to address a range of issues including climate-related risks and vulnerabilities.

Possible Climate Events, Risks and Adaptation Measures in Road Transport Infrastructure

The design objective included ensuring that current infrastructure assets are protected from the long term and acute effects of climate change, and wherever necessary upgrading to new infrastructure systems fit for changing climate conditions have been taken into serious consideration. Those adaptive measures to counter possible risks and their likely effects on project road infrastructure, as incorporated in the DPRs, are summarized in table below. It must be noted that all these events either simultaneously or in isolation can generate severe disastrous impacts on road infrastructure.

Table 58: Possible Climate Events, Risks, and Adaptation Measures

Sl.	Climate Change Events	Risks to the Road Infrastructure	Adaptation Measures incorporated in Detailed Design of Project Roads
1	Extreme rainfall events	i. Overtopping and wash away ii. Increase of seepage and infiltration pass iii. Increase of hydrodynamic pressure of roads iv. Decreased cohesion of soil compaction v. Traffic hindrance and safety	a. Certain critical sections affected by overland flooding of the road raised (vertical alignment, embankment improvement) to be free from the onslaught of flooding events under intense precipitation. b. Road asset survey has considered certain critical road sections where the sub-grade strength and integrity were found to be compromised; the sub-grade strength specification meeting the recent-most IRC specifications has been adopted. c. The highest assessment of design discharge for sizing culverts and bridges from among the several discharge methods as outlined in recent IRC guidelines has been adopted. d. In terms of floodwater conveyance to prevent stagnation, closed concrete drains in settlement pockets have been provided. e. Improved cross-drainage capacities required for the quick conveyance of floodwater by replacing small diameter pipes with box culverts with higher discharge openings has been considered. f. The bottom of the sub-grade has been kept 0.6m above HFL, to avoid over topping, water-logging of the road surface.
2	Changes in seasonal and annual average rainfall	i. Impact on soil moisture levels, affecting the structural integrity of roads, culverts, bridges standing water on the road base ii. Risk of floods from runoff, landslides, slope failures and damage to roads if changes occur in the precipitation pattern	
3	Increased maximum temperature and a higher number of consecutive hot days (heat waves)	i. Concerns regarding pavement integrity, e.g., softening, traffic-related rutting, cracking, fracture, etc. ii. Thermal expansion in bridge expansion joints and paved surfaces Temperature break soil cohesion and increase dust volume which caused health and traffic	a. An adequate binding layer thickness has been proposed to offset the wear, surface fatigue, and rutting under climate stresses. b. In terms of pavement integrity, the choice of viscosity grade VG30 has been maintained.

Sl.	Climate Change Events	Risks to the Road Infrastructure	Adaptation Measures incorporated in Detailed Design of Project Roads
		accidents	
4	Extreme wind speed under cyclonic conditions	i. The threat to the stability of bridge decks ii. Damage to signs, lighting fixtures and supports	Business As Usual

CHAPTERVII: PUBLIC CONSULTATION

Introduction

Public consultations or community participation is an integral part and process of any project which involves resettlement or rehabilitation issues. It helps to incorporate valuable indigenous suggestions and perceptions of development. In the process, stakeholders get the opportunity to address issues, which are resolved after making appropriate changes in design and alternative finalization. The stakeholders become aware of the development schemes and at the same time influence and share the control over these initiatives, decisions and resources. Community consultations also help to avoid opposition to the project, which is otherwise likely to occur.

During the course of the social impact assessment, consultation meetings were held to inform the communities and population about the positive as well as negative impacts of the road improvement scheme. Public Consultations were held along the subproject with the temporarily impacted households, local persons who will be benefitted from the project and other stakeholders of the sub project. Focus group discussions were held with the youth's group, women's group, farmers, shopkeepers, tenants, interest groups and organisation. Key Informant Interview took place with the village head men, village council members, head of households and important personalities. There was special consultation with the individual women, vulnerable affected persons and tribal persons. These meetings were used to get wider public input from both the primary and secondary stakeholders.

Objectives of the Public Consultation

Stakeholder Engagement Plan (SEP) is an integral part of the project planning and design. The consultations are carried out to develop community /stakeholder's ownership and support for the project; integrate and address their concerns through suitable measures in the project design and implementation. The objectives of undertaking public consultations are listed below.

- Dissemination of information to build awareness among them
- To incorporate community concerns in the project designs for minimizing potential conflicts and resultant delays in implementation
- To document road safety related issues for developing possible mitigation measures
- To appraise gender issues and accordingly incorporate views of women into the project design
- Tounderstandspecificissuesrelatedtotribalpeopleandthoseofvulnerablesections
- Tofacilitatedevelopmentofappropriateandacceptableentitlementoptions
- To understand the priorities / concerns of the communities and the likely adverse and positive socio-economic impacts
- To create a sense of ownership of the project for its sustainability.

Identification of Stakeholders

The stakeholders are all the people getting affected by the project or are responsible for the project, whether directly or indirectly. Primary stakeholders included those affected negatively or positively by the project, like the project beneficiaries and project implementing agencies. Secondary stakeholders included other individuals and groups, with an interest in the project, viz., the town/urban road users, Government Stakeholders and the line departments.

Project Stakeholders

Stakeholder analysis typically classifies stakeholders or all those who have an interest in the project, into three categories:

1. Primary stakeholders are those who are directly or indirectly affected by a project, such as the project beneficiaries and the people who are likely to be adversely affected by a project.
2. Secondary stakeholders are those who are involved in the delivery of the project outputs, such as the government, the implementing agency, the executing agency (e.g., contractors, consultants), if any and NGOs, etc.
3. External stakeholders are those who are the ambit of the project activities, but who can influence the outcome of the project, such as the media, politicians, religious leaders and other opinion leaders.

Stakeholders and their level of interest may change as the project progresses, depending on the impacts associated with each stage of planning, construction and post-construction. Table 77below provides a list of specific stakeholder's involvement and their level of impact and interest during project lifecycle.

Table 5947Consultation Methods

Sl.	Categories of Stakeholders	Involvement of Stakeholders		
		Planning	Construction	Post Construction
1	Impacted Persons (NTH in this sub-project)	Frequent	Frequent	On required basis
2	Local Communities	Frequent	Occasional	On required basis
3	Village Headmen & Gram Panchayat members (local elected representatives)	Frequent	Occasional	On required basis
4	Women's belonging to various socio-economic groups	Frequent	Occasional	On required basis
5	Other vulnerable groups	Frequent	Occasional	On required basis
6	Local Elected Members	Occasional	On required basis	On required basis
7	Concerned Officials from Government	Frequent	Occasional	On required basis
8	NGOs and CBOs	Occasional	frequent	As and when required

Methodology for Consultations

The different methods/tools that will be employed for stakeholder engagement to consult with each of the identified key stakeholder groups under the primary and secondary categories will be either one of the tools listed below or a combination of some of these depending on the category of stakeholders and the requirement of the project. The methods that will be used for obtaining the feedback of the different stakeholders are:

- Face to face discussions with individual stakeholders
- Public meetings/open house community forums like Gram Sabha, local health centres or the schools
- Formal closed-door meetings with the elected representatives or government functionaries

- Public notices through print in the form of flyers, posters, banners and public announcements**.**
- Formal correspondence through telephone or email

Engaging in an appropriate way and communicating adequately is fundamental for a good relationship. Engagement methods have been tailored according to the needs and influence of the two categories of stakeholders. A summary of the proposed level of engagement with stakeholders has been presented in table below**.**

Table 6048Consultation Methods

No.	Stakeholders	Dialogue Level	Issues for discussion	Frequency of Engagement	Form of Engagement
1	Landowner households	Proactive Information	Issues related to procurement of land on lease and resultant impacts like access, payment of lease rent, temporary employment opportunities etc.	Monthly	Open Dialogue with the affected households
2	Agricultural laborers	Proactive Information	Issues related to livelihood and livelihood and training opportunities in the project and through other programs under CSR	Monthly	Open Dialogue with the affected persons
3	Women and Girls	Direct Contact and discussions	Issues related to GBV, safety, sanitation, and hygiene. Vocational training for women empowerment	Monthly	Open discussions with women and girls through the ANM and school authorities
4	Indigenous people (ST Community)	Contact through the Gram Pradhan	Common interest with that of the local community	Quarterly	Open Dialogue
5	Contractors and Sub-contractors	Regular Direct Contact	Issues of common Interest in the day-to-day functioning of the project.	weekly	Regular Direct Contact
6	Unskilled and semi-skilled local labour	Regular contact through the labour supplier	Issues related to employment opportunities and payments	monthly	Information dissemination and redressal of payments related complaints raised by the laboures.
7	Surrounding Community	Regular Direct Contact	Common Interest on social and environmental issues	Monthly	Community event and open dialogue
8	Gram Panchayat	Regular Direct Contact	Common Interest on employment, livelihood trainings, CSR activities, and social & environmental issues	Monthly	Information dissemination and suggestions and feedback.
9	Tehsil/District Officials	Occasional Direct Contact	Documentation of land deeds and local permits	As required	Formal meetings
10	Central and State Level authorities	Occasional Direct Contact	Permits and clearances	As required	Formal meetings
11	Local Political groups	Occasional Direct Contact	Common interest with that of the local community and administrative issues	As required	Information dissemination

12	NGOs and CBOs	Occasional Direct Contact	Common interest with that of the local community	As required	Information dissemination

Source: Socio-Economic Survey on 2021

As the consultations were conducted in September 2021 during Covid-19 pandemic, as per the guidelines only five persons could be called for Consultation at Panchayat Office thus those are the Public Representatives, and the Public Consultation is rather Key Informant Interview in Nature. Informal FGDs have been done at the villages, marketplace and other common places to gather and disseminate information about the proposed project.

Consultation with Local People and Beneficiaries

The informal consultation was generally started with explaining the project, followed by an explanation of potential impacts. Participant's views were gathered with regard to all aspects of the environment which may have a direct or indirect impact on local people. Key Issues discussed are:

- Awareness and extent of the project and development components;
- Benefits of the project for the economic and social upliftment of community;
- Labour availability in the project area or requirement of outside labour involvement;
- Local disturbances due to project construction work;
- Need of tree felling etc. at project sites;
- Impact on water bodies, water-logging, and drainage problem if any;
- Environment and health;

Table 6149Brief Description of Public Consultation

Date / Place	No of Participants	Major Issues	Agreed upon	Mitigation Measures - Input to technical Design
Place: Barishisha Marbaniang Date: 03/09/2021	Total-3 Male-3 Female-0	Special attention is needed on the road crossings/intersections to avoid traffic snarls and accidents. Proper traffic signals and signboards should be present at strategic points not only for the sake of motorists but also for the pedestrians.	.Agreed on all the mentioned concern will be taken care of.	The demands of the local persons are already in development proposals
Place: Maweit, Date: 03/09/2021	Total-5 Male-3 Female-2	Existing condition of the present road which needs immediate upgradation/restoration not only to allow smooth flow of traffic but also to minimize the count of road accident.	Agreed on maintenance till the road go for final upgradation.	The people agreed to cooperate and help in all possible ways for the successful of the project.

Date / Place	No of Participants	Major Issues	Agreed upon	Mitigation Measures - Input to technical Design
Place: Umthli, Date: 03/09/2021	Total-5 Male-4 Female-1	A detailed public consultation was organized with the project affected persons, people's representatives, shopkeepers, businessmen, and others regarding the project benefits and vis-à-vis estimated loss	Combined effort of the local authorities with the Government officials as well as the other stake holders would remove all the obstacles for development and assured that the structures will not be impacted permanently but during actual construction period it might cause the accessibility impact for some time.	The local authorities also assured that they would help in development of road project. Road safety awareness campaign should be made at schools.
Place: Rimynniar Date: 01/09/2021	Total-5 Male-3 Female-2	A detailed public consultation was organized with the project affected persons, people's representatives, shopkeepers, businessmen, and others regarding the project benefits and vis-à-vis estimated loss.	The local people had agreed in the view of the proposed road project which will bring some hope to the movement of the heavy vehicles and development of the area but against any damages to the market structures.	The PWD officials had agreed to take special care for traffic movement and road safety.
In addition to the above specific public consultations and FGDs the peoples were also consulted. In the villages the impact of social and economic are more. In all the 7 (seven) villages the access to the market would increase and based on this the valuation of land and properties would also increase.				

Table 62:Pictures of the Site

		Special attention is needed on the road crossings/intersections to avoid traffic snarls and accidents. Proper traffic signals and signboards should be present at strategic points not only for the sake of motorists but also for the pedestrians. Place: Barishisha Marbaniang Dated: 03/09/2021 .
Electrical line (high voltage) and OFC cable lying along the road is of great concern for the local people. However, since the electrical line is very much accessible to all hence it can be of very fatal especially during the monsoon. Place: Rimynniar Dated: 03/09/2021		
		Existing condition of the present road which needs immediate upgradation/restoration not only to allow smooth flow of traffic but also to minimize the count of road accident. Moreover, the affected stretches of road turn into nightmare during monsoon. Place: Maweit Dated: 03/09/2021
Upgradation of this earthen portion of the project road is proposed by the local people as this is their only motorable way throughout the year. Moreover, proper signboards/display should be given at U-turns to avoid accidents. Place:NongstoinMaweit Road Dated:03/09/2021.		

		Squatters have been identified on different places on the project road that need to be vacated to upgrade/widen the project road. Place: Umthli Date: 03/09/2021
Renovation of bridge should be on top of the priority list as urged by the local commuters. Place:Nonglyer Dated: 03/09/2021.		

Note: Updated Stakeholders Consultation will be depicted in the Annexure.

Outcome of the Consultations

People were aware about the improvements proposed for the project road but were not aware about specific details of the PRoW, shift in centreline and the method of valuation for land and building, payment of compensation and other rehabilitation and resettlement measures. A detailed public consultation was organized with the potential impacted persons, people's representatives, shopkeepers, businessmen, and others regarding the project benefits and vis-à-vis estimated loss. The main point of discussions were minor realignments to save certain structures, compensation and assistance, road safety etc. It has been observed that the benefits of the proposed project area acknowledged by the local people but they want the Executing Agency, to take care of the implementation of the project to bring about promised benefits with proper safety measures.

The information and recommendations gathered from the various stakeholder consultations has been incorporated into the design of the project to ensure that the investments align with local priorities and development plans, and that they will deliver equitable socio-economic benefits to the intended project beneficiaries. The salient points of the consultations are summarised in the following table below

Table 6350Summary of Consultation Outcome

Issues Discussed	Outcome
Relocation Options Compensations/Assistance	Temporarily Impacted Persons whose residential/commercial structures are getting affected prefer not to get disturbed and if disturbance is not avoidable then they shall be relocated very nearby. Shop owners and workers raised the issue of loss of their livelihood during the resettlement period due to loss of business. During consultation they were convinced that there will be no permanent

Issues Discussed	Outcome
	impact but temporary impact during the active construction period. There will be economic displacement of petty shop owners and vendors, all private individuals who will be compensated and/or provided assistance as per the ESMF guidelines.
What are all the facilities provided through this project and to whom should we approach?	Facilities like bus shelters, rest rooms, pavements, drains etc would be provided. Officers such as PWRD Engineerscould be approached for grievances.
Safety due to alignment	People expressed their views on the risk if the road is widened at the dense settlement area affecting structures on both sides. The proposed project does not envisage any widening of the existing roads. Thus, there will be no damage to any structures beyond the existing RoW. About 13 families all private individuals doing business with the existing RoW will be impacted temporarily. During consultation they were convinced that there will be no permanent impact but temporary impact during the active construction period.
Could you inform us the time when our assets be removed?	Would be informed well in advance and compensation will be paid before vacating assets, if required.
Relocation of school buildings Relocation of Bus shelter/CPR	The boundary wall of one school will be impacted which will be compensated. There were differences in opinions among the villagers in demolishing/ shifting the Bus shelter. It was agreed that bus shelter has been proposed in the DPR.
Cross Drainage for alignment	People have shown their concern for the proposed drainage pattern for the alignment of a portion of the project road. In this regard the lined rectangular drains with proper outfall shall be planned as a part of the project design of the main carriageway. Adequate cross drainage structures are planned after study of hydrology of the Survey area.
Utilities and basic infrastructures	People showed their concern about what will happen with the utility lines if the road is widened. Adequate care shall be taken for the shifting of the utilities.
Employment during construction	People were of demand if the local people are given preference for employment during the construction phase of the project. Such options shall be explored to the extent possible and mostly the unskilled workers can be hired from nearby locality.
Why structures at places along the road were not measured?	If and only the structure to be impacted, measurements are required. Otherwise, there is no requirements of measurements of structures.
What about the loss of livelihood during active phase of construction?	The active phase of construction is planned in such a way that there will be minimum (temporary) loss of access and/or livelihood. If there is any inconvenience of access, loss or damage of structures of any immovable assets the Civil Contractor will provide necessary access and compensation of the same will be provided as per the ESMF in discussion with the affected party.

Table 64Consultation Conducted on Proposed Road 2nd Phase

Sl.	Location	Date	Participants	Issue discussed
1	Sibsing Memorial School	28.01.20222	2 all Male	The main issue of discussion was the compensation/re-construction of the boundary wall outside the existing RoW.

The project has immense acceptability among the local people. They perceive that in addition to providing all-weather connectivity, the subproject road will bring positive socioeconomic

changes in the area. Local people mainly discussed the issues related to flooding, rehabilitation, resettlement, and road safety issues.

Table 66Details of Public Consultation at Sibsing Memorial School on 2nd Phase

Date	Issues Discussed	Response	Participant
28.01.2022	• During school hours, presence of children are seen, thus must plan the work schedule avoiding the entry and exit timing of the students. • The boundary wall should be reconstructed. • Maximum students are coming from the Maweit area which takes a lot of time for the children. Thus, this road development will absolutely benefit the students of the school. • Noise must be monitored during school hours so that disturbance in class can be avoided	• It was assured that the construction work will be stopped during the school hours. • It was assured that the boundary wall will be reconstructed outside the RoW. • The Contractor will be persuaded to induct the local people as per their skills.	Total = 2 Male = 2 Female = 0

Figure 19: Public Consultation at Sibsing Memorial School

Table 67:Details of Public Consultation at DFO, Nongstoin

Date	Issues Discussed	Response	Participant

Date	Issues Discussed	Response	Participant
28.01.2022	• A joint survey is required to identify the way of the road during planning phase. During the implementation phase it is to be identified what trees are required to be felled under the forest sector area are to be surveyed and then finalized. • For involving the forest officers, Project award with alignment along with KML file must be submitted to the DFO office from PWD department for receiving the clearance. • No wildlife sanctuary is present in the area as the forests are mainly community forest and managed and maintained by local villagers. • No forest is involved in the Town roads modification, only in the Nongstoin- Maweit road there are some forests but all are of private in nature. • According to the meeting there are around 250 trees having DGH of around 15cm in where continuous 4 hectres are forest. • There are no recorded forest found in the Nongstoin-Maweit road according to the last census available. • As of wildlife availability, need to talk with Khasi hills Wildlife division, Social and Territorial section for more updates.	• A framework has to be develop to address this issues. • Alignment of the project road along with KML file will be submitted to DFO Office. • Afforestation activity will be done along the project road as per the ratio of 1:10.	1

Figure 20 Public Consultation at DFO Office

CHAPTER VIII: TRIBAL PEOPLE'S DEVELOPMENT PLAN

The Tribal People in India are categorized as indigenous community who often become vulnerable indevelopmentprojectsbecauseoftheirculturalautonomy,economicstatus,andenduringspecific disadvantages in terms of social indicators of quality of life, thus usually as subject of social exclusion. Because tribal communities live within varying and changing historical, cultural, political and economic contexts, no precise and coherent term has been found to define them. Under OP 4.10, the determination as to whether a group is to be defined as indigenous peoples is made by reference to the presence (in varying degrees) of four identifyingcharacteristics:

There is no impact on the community structure or community land of cultural or religious sentiment of the ST Population in the Primary PIA. The proposed project will ensure that STs receive culturally appropriate social and economic benefits, do not suffer adverse impacts as a result of projects, and can participate actively in projects that affect them.There is no cultural heritage site of the ST which comes in the way of the road alignment. The 13ST population among the Surveyed Families inthe PIA are living in the towns and intheduecourseoftimebecamethepartofthemainstreampopulation.Presentlythe temporarilyimpactedSTpopulationdoesnotfollowanycustomsthatareattachedtotheirlandornatural habitatwhichwillbeimpacted. Thus,therewillbenoculturalorsocialimpactontheSTpopulation.

CHAPTER IX: GENDER ACTION PLAN AND ROAD SAFETY

The tribal women in Meghalaya play an important role in the community and family development. Women normally constitutehalf of the total population. These women mostly work as agricultural labourers and share equal burden with men. Meghalaya being the state with matriarchal society, women are empowered but not necessarily well educated about human and tribal rights. Thus, there no specific requirement to create an institutional framework to make gender sensitive decisions. Women consulted within project associated villages and together identify awareness programs on “women’s role in development and maintenance of public assets”.

The tribes of Meghalaya whosesocieties are organized on matrifocal principleshave obtained much greater gender equality than the societies (e.g. Hindu and Muslim) that are organized on the patriarchal principles. answered, "Securing equal treatment for men and women in the workplace." Following measures are proposed as part of Gender Action Plan:

- **Road Side Safety Measures**

Indian Road Congress (IRC) codes will be followed in proposing and designing road safety features. Pavement markings will be done for traffic lane line, edge lines and hatching. The marking will be with hot applied thermoplastics materials. The pavement markings will be reinforced with raised RR pavement markers and will be provided for median and shoulder edge longitudinal lines and hatch markings. Highway lightings including high masts will be provided at intersections in order to improve the night time visibility.

All the urban locations as well grade separated structure locations will be provided lighting arrangements.

- **Recommendation for Gender Sensitization**

- Implementation of the Vishakha Guidelines as amended as The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013 in case of sexual harassment against women should be displayed at the project sites and other important location.
- Earmarked parts of parking bays for women two-wheeler drivers and women car drivers to ensure their security.
- Making Sulabh toilets for women workers, with fittings for pregnant and disabled women at the project site.
- Better maintenance of street lighting and roads, especially near education institutions and workplaces of informal sector workers.
- Provision of quality drinking water and sanitation services, including menstrual hygiene facilities for women workers at the project office and other site offices.
- Safer vending and market places at project sites and by the road side.
- Conduct regular trainings of drivers, conductors, auto-drivers and traffic police on sexual harassment in public spaces and what support systems can be accessed.
- Develop protocols and response systems to address sexual harassment in transport facilities and display police and women’s helpline numbers prominently in all project offices, public places and important junctions
- Ensure regular patrolling by PCR vans in highly vulnerable areas.

- Ensure presence of visible security, including CCTV at all important and vulnerable locations. Build trust and confidence among female citizens.
- Ensure effective operation of the women's helpline and registering FIRs and other complaints.
- Ensure effective functioning of Sexual Harassment Committees in all institutions and Local Complaint Committees at local, district level that can be accessed by women workers in the informal sector.

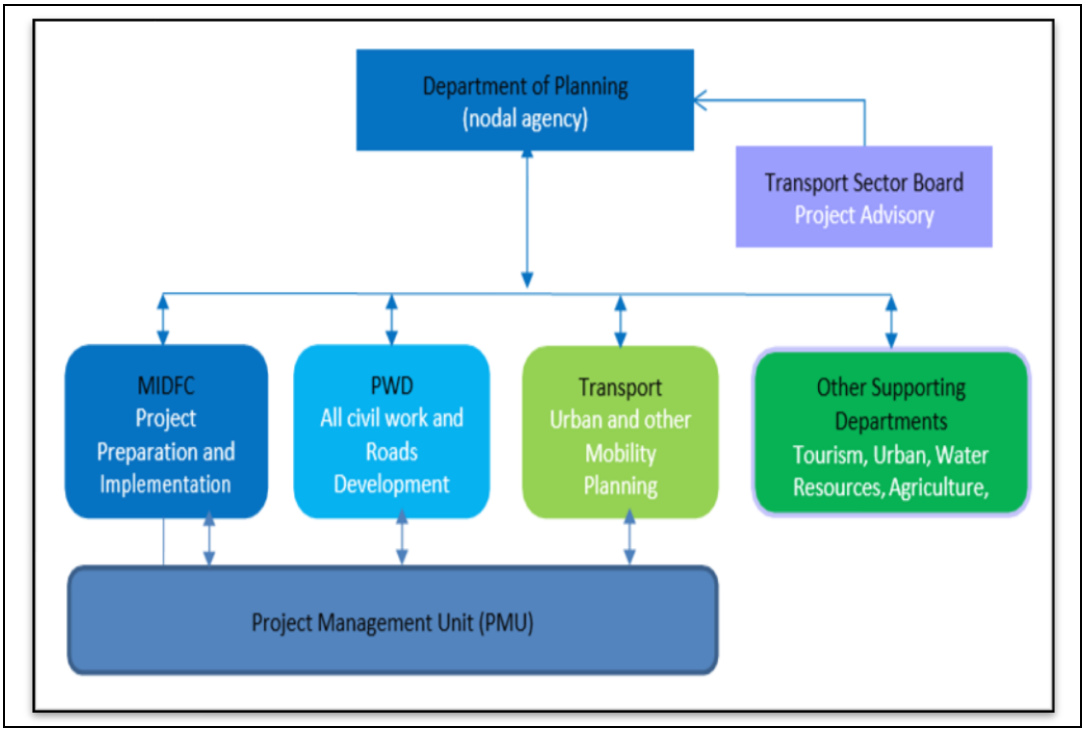
CHAPTER X: IMPLEMENTATION ARRANGEMENTS

The project activities will be implemented by many agencies: Public Works Department (PWD)and Community and Rural Development Department. Each of the mentioned departments, will depute a Project Director (PD) preferably at the level of a Chief Engineer/Superintending Engineer along with the required supporting staff with the overall responsibility for project implementation with the involvement of the various field divisions and other units at the head-quarters (HQ – Shillong).

PDswillworkundertheoverallguidanceandoversightofaProjectAdvisoryCommitteeheadedby the Secretary of the respective departments.

Meghalaya Infrastructure Finance Development Corporation (MIFDC) set up under the Planning Department will be responsible for overall planning, coordination, implementation and monitoring of the project along with various departments. It will also be responsible for mobilizing private sector finance for the development works. It will ensure that ESIA is conducted and ESMPs are prepared and that the ESMF is followed during project implementation. Additionally, a project management unit (PMU) will be mobilized under MIDFC to support the implementing agencies during project preparation and subsequent implementation. The overall institutional arrangement for the implementation of the project is outlined in the following diagram.

Figure 21: Project Implementation Arrangement



- **Project Management Unit (PMU)**

The Project Management Unit (PMU) will engage a consulting firm, as Project Management Consultant (PMC) for providing technical support to the project and facilitate implementation of project framed activities. The experts of the PMC will assist MIDFC in preparing and updating ESIA (including E&SMPs). The PMC will also assist MIDFC in preparing semi-annual safe guards monitoring reports. Specific roles of the PMC with regard to ESMF implementation would include the followings.

Preparatory Stage:

- Initial field visit to project sites and assessment of environmental and social aspects of project activities;
- Discussion with different stakeholders, including implementing agencies on safeguard measures and their expected role;
- Preparing / finalizing assessment framework in line with the Environment and Social indicators;
- Finalizing TOR of the contractors incorporating safeguard measures to be taken;
- Facilitate / organize training / workshops on safeguard measures for the stakeholders;
- Designing study / assessment tools for periodic assessment, its piloting and finalization.

Implementation Stage:

- Conductingperiodicsitevisitsandobservethemeasurestakenasperthesafeguardnorms;
- On the spot guidance to contractor/s / implementing agencies on safeguards;
- Preparation of site-specific reports and sharing with MIDFC;
- Documentation of learning cases for sharing and dissemination;
- Visual documentation of site-specific safeguard measures;
- Tracking activity specific environmental and social monitoring indicators;
- Organizing / facilitating refresher training courses for stakeholders;
- Monthly and quarterly progress report preparation and submission to MIDFC.

Post-Implementation Stage:

- Consolidation of periodic monitoring reports;
- Support in conducting environment and social audit;
- Consolidation of good practice documents and its submission to MIDFC;
- Final sharing workshop on environment and social safeguard practices and its outcome.

The PMU shall have following experts for implementation of ESMF and E&SMPs:

Social cum Gender Expert

The Social cum Gender Expert at the PMU level will guide the overall process related to social and gender aspects. The district/sub-district level implementing agencies will execute and monitor the social / gender components in consultation with the said Expert. She / he will be associated in the screening process of such activities that require acquisition of land and/or involvement of women and/or need special focus on tribal involvement. She/he will monitor the social processes followed in execution of the planned activities and realisation of the social / gender inclusion parameters. She / he will be looking after social / gender aspects of the project, including monitoring of social / gender indicators and coordinating with different agencies / institutions. The expert will be guided by the Project Director from MIDFC and reporting to the Project Director directly.

Environmental Expert

Theenvironmentexpertwilllookafterenvironmentalaspects.She/hewillguidetheprojectteam onenvironmentalaspectsandsupportinbuildingenvironmentalparameterstobebuiltinthebids. She / he will also guide the contracts and monitor their works from time to time. In case of requirement, she/he will prepare a detail environment management plan for different activities to be executed by the project. The expert will be guided by the MIDFC Project Director and reporting to the Project Director directly.

- **Capacity Building Strategy**

The concerned officials within the project implementation agencies will be oriented on different social and environment aspects by which they will be equipped well to manage the related issues effectively and efficiently.

- **Institutional Capacity to Manage Social Development Aspects**

Autonomous District Councils

As mentioned earlier, ADCs were established under the Sixth Schedule of the Constitution of India (Articles 244(2) and 275(1)) with a view to preserve and protect tribal institutions. It is a system of local administration to give greater autonomy to tribal societies, to preserve and safeguard tribal groups'traditionalpracticeandtoactasaconduitbetweentheformalstategovernmentandthe informal grassroots tribal institutions.

The Project lies within the Khasi Hills Autonomous District Councils. TheADCwith the village councils or looks after the administration of the Council areas.

Grassroots Institutions

The third centre of authority is the grassroots tribal institutions and practices. In the Khasi and Jaintia Hills, these are powers that rest at the village level's elected members to govern the village.

- **Grievance Redressal Committee (GRC)**

- **Grievance Redress Mechanism**

Effective grievance redressal mechanism gives an opportunity to the organization to implement a set of specific measures to ensure good governance accountability and transparency in managing andmitigationofenvironmentalandsocialissueofaparticularproject.Thisconsistsofdefiningthe process for recording/receiving complaints and their redressal in respect of environmental and socialmatters.

An integrated system will be established with Grievance Redressal Cell (GRCs), with necessary officers, officials and systems at MIDFC. Grievances, if any, may be submitted through various mediums, including in person, in written form to a noted address, e-mail, or through direct calls to concerned official/s. The Social and Environmental Expert within PMU shall be responsible for coordination of grievance/complaints received.

Thegrievanceredressmechanismshouldbeinplaceatthetimeofinitiatingtheimplementationof ESMFandcivilconstructionactivitiesintheprojectarea.Aplatformforgrievanceredressalshould be organized and its regular meetings may be conducted so as to allow people to put forth their grievances. It will help the appropriate authority to find solutions and amicably address the issues. Theproject,apartfromweb-basedmechanism,willhavethree-tiregrievanceredressalmechanism, i.e., (1) at the project site level, (2) State level (PMU level) and (3) Judiciarylevel.

Web based grievance mechanism[11]: In case of grievances received through toll free number or web-based system, a person should be made in-charge of screening and resolution of the same/communicatingwiththeconcerneddivisionsforresolutionofthesame.Thepersonin-charge based on nature of complaint, should forward the same to the concerned official. A ticket or a unique number will be generated for all such complaints. The complainant should follow up based on that unique number. All calls and messages should be responded within 15 days. If

response is not received within 15 days, the complaint should be escalated to the ProjectDirector.

Tier I: Under this project, the local VECs and community level organizations will serve as the first- tiermechanismtohandlecomplaintsandgrievances.ThelocalHeadmanwillbethefocalpointwho will receive, address, and keep record of the complaints and feedbacks. The grievance focal point willfirstreviewthegrievancessubmitted.IfgrievancesordisputescannotbesolvedattheVEC's level within 30 days of the submission of the grievances, the issue will be brought to PMU level for mediation. PMU is expected to inform aggrieved persons or parties to disputes of the resolution in 30 days.

Tier II: If the aggrieved person is not satisfied with the verdict of site level grievance cell, he or she can escalate the grievance to state level grievance cell. The tier II cell will be under the ChairmanshipofSecretary,DepartmentofPlanning.TheothermemberswillincludeChiefEngineer; Project Director and Social Expert of the Project. The second level of grievance cell will provide its view within 30 days of receiving thegrievance.

TierIII:TheaggrievedpersonifnotsatisfiedwiththeverdictgivenbyStatelevelgrievancecell,will have the right to approach the Judiciary. Project will help the aggrieved person in all respect if person wants to approach the judiciary. This would include the District Commissioner and Legal courts. If the issue cannot be addressed or is outside the purview of the GRC, then it may be taken by the Office of the District Commissioner or a Legal Court.

- **Grievance management through Electronic Mode**

A simplified mobile based technology feedback system can be used at community level to capture and feed data into the Management Information System of the PMU. A toll-free Helpline number will also be established to make the mechanism widely accessible and gender friendly.

- **Grievance Redressal Mechanism**

There Grievance Redressal Committee (GRC) at the PMU level is in process of formation. Consultation for the formation of GRC for this project at city/ward level is currently being undertaken. Before the start of civil contractor appointment, the GRC at project level will be formed with consultation with the people living near to the road alignment and Beneficiaries so that the grievances are resolved at the project site only. There should be a Women Cell at the PMU. The contractor and the other stakeholder's office will display the Vishaka Guidelines at their Notice board. The Women helpline Number should be displayed in the Bus Stand, Ticket Counter, all commercial vehicles and any other place as required.

Table 68Details of contact for Grievances

Description	Contact details
Company:	PWD, Meghalaya
To:	Chief Engineer-cum-Project Director
Address:	HV9P+GFJ, Lachumiere, Shillong, Meghalaya 793001
E-mail:	cenhpwd@gmail.com
Website:	http://megpwd.gov.in/contacts.html
Telephone:	Tel: 0364-2224561
Fax:	-

- **Disclosure of Project Information**

In order to make the ESIA implementation process transparent, salient features of ESIA shall be translated in Khasi and disclosed on the Project Authority's website. The documents available in the public domain will include ESIA (summary in Khasi). Copy of all documents will

be kept in PMU for ready reference. As per Access to Information Policy of the World Bank, all safeguard documents will also be disclosed and available at the World Bank's Portal.

CHAPTERXI: MONITORING & EVALUATION

The M&E framework of ESMF is designed to assess the progress and achievements against the said management plans – both Environment and Social plans. By providing a feedback loop, the M&E plans enable decision makers to take up mid-course corrections if required. The M&E framework is designed to measure the impacts that have taken place, ensure compliance with the legal obligations, evaluate the performance of the mitigation measures applied, and suggest improvements in management plans, if so required.
The M&E is to be undertaken at two levels:

- Monitoring and Evaluation of the ESMF application: i.e. the application and effectiveness of ESMF elements including screening, assessment, formulation and implementation of the ESMPs, monitoring, capacity building and institutional arrangements;and
- Monitoring and Evaluation of E&S management plans at each project site: i.e. to monitor the effectiveness of implementation of the identified mitigation measures, the environmental quality parameters and social management plans relevant to each projectactivity.

M&E of the ESMP application

The PMU's Social cum Gender Expert and Environment Expert will undertake ongoing monitoring of the ESMF implementation in order to identify issues, good practices and required actions. Reports based on the monitoring will be prepared by the PMU at least every quarter and submitted to the Project Director. The reports will be shared with the other implementing agencies. The monitoring of the ESMF implementation will cover the following aspects:
Screening of project activities:

- Hasthecategorizationoftheprojectactivitiesbeendoneaccuratelyandorchanged(Ato B)?
- Has the Environmental and Social Screening Checklist been used in all applicableactivities?
- Has the scoping for further assessment been done comprehensively for all applicable activities?

Monitoring of E&S aspects in project activities:

- Arethecontractorsandimplementingagenciesundertakingperiodicandregularmonitoring of the E&S implementation in the projectactivities?

Capacity building arrangements for management of E&S aspects:

- What training programs on E&S aspects have been organized for the staff of implement agencies?
- What training programs on E&S aspects have been organized for thecontractors?

M&E of E&S Management Plans

Monitoring and evaluation of the project is significant for achieving the project development objective (PDO) within the stipulated time period. The key environmental and social aspects, those that have been highlighted in each E&SMPs at site level are to be monitored periodically. The approved E&SMPs will give the direction and indicate the milestones achieved as per the national / state benchmarks / norms. The following specific environmental and social parameters should bequantitatively and qualitatively measured and compared over a period of time to understand the impacts.

The PMU through the respective district level offices of PWD will monitor all projects roads to ensure conformity to the requirements of the ESMF. The monitoring will cover all stages of planning and implementation. The monitoring will be carried out through the safeguard compliance reports that will form a part of Quarterly Progress Reports (QPR) for all sub projects and regular visits by the Social cum Gender and Environmental specialists of the PMU.

Concurrent Monitoring

The PMU's Social cum Gender Expert and Environment Expert will undertake ongoing monitoring of the ESMF implementation in order to identify issues, good practices and required actions. Reports based on the monitoring will be prepared by the PMU at least every quarter and submitted to the Project Director. The reports will be shared with the other implementing agencies.

The PMU will review these reports and identify technical, managerial, policy or regulatory issues with regards to the ESMF compliance. The identified technical issues will be duly incorporated. Policy and regulatory issues will be debated internally by PMU and the need for appropriate interventions will be determined. These interventions could include appropriate revision of ESMF in consultation with the Bank or suitable analytical studies to influence policy or programs of the state, if found necessary / warranted. The table below provides the milestones and process to be followed for monitoring at different stages of project:

Periodic Evaluation

An external evaluation of the safeguard implementation prepared for sub projects will also be undertaken twice during the implementation of the project – midterm and at the end of the implementation. During implementation, meetings will be organized by PMU inviting all PIUs for providing information on the progress of the project work.

Mid-term Assessment Study – this would be undertaken mid-way through the project to ascertain the progress achieved and any mid-course corrections which need to be introduced. It would include indicators to measure progress towards log frame goals and objectives.

End-Term Assessment Study – this will be undertaken at the end of the project period (around the time of project completion) and will assess the achievement of the project during the tenure.

Arrangements for Monitoring

Monitoring is an integral part of successful implementation of the ESMP activities. Internal monitoring will be carried out by the Social Development Expert, PMU and/or the ULB under the supervision of Project Director/Chairman of ULB. Data collected for monitoring activities shall be suitably analysed for project management's learning and experience. Key progress indicators (indicative) for monitoring ESMP implementation are as given below:

- Structural development of the impacted structures, if any
- establishment of grievance redressal mechanism (including processes and timeline for redressal of grievances),
- consultation meetings with persons living near the road and communities regarding resettlement and rehabilitation issues,
- MIDFC website will include a link where affected person(s) can register their complaints online. A telephone number will also be on the website of MIDFC and the project sites, so that the general public can register their complaint with the PMU office.
- income restoration of affected persons,
- training of the interested people living near the road alignmnet
- grievance handling mechanism

Project monitoring will be the responsibility of the PMU who will submit Quarterly Progress Reports. The reports will compare the progress of the project to targets set up at the commencement of the project. The list of impact performance indicators will be used to monitor

project objectives. The socio-economic survey conducted will provide the benchmarks for comparison.

CHAPTERXII: ENVIRONMENT AND SOCIALMANAGEMENT PLAN

The environmental and social management measures shall be implemented during the various stages of the project viz: Pre-construction Stage, Construction Stage and Operational Stage. The environmental and social management plan for the project is described below.

Objectives of EMP

The Environmental Management Plan (EMP) consists of a set of mitigation, monitoring and institutional measures to be taken during the design, construction and operational phases of the project to eliminate adverse environmental impacts, to offset them, or to reduce them to acceptable levels. The main aim of the Environmental Management Plan is to ensure that the various adverse impacts are mitigated and the positive impacts are enhanced. A description of the various management measures against each activity suggested for construction stage is provided in this chapter.

Pre-Construction Stage

Pre-construction activities by PIU/Independent Consultant

Prior to the contractor mobilization, the PIU will ensure that a hindrance free corridor is handed over to enable the start of construction work. Clearance involves for the following activities:

- Felling and removal of trees, which should be minimal with due permission.
- Relocation of common property resources and community assets like temples, telephone poles, electric poles and hand pumps etc;
- Modification (if any), of the contract documents by the Engineer of the Independent Engineer.

Pre-construction activities by Contractor

- Pre-construction stage involves mobilisation of the contractor and the activities undertaken by the contractor pertaining to the planning of logistics and site preparation necessary for commencing construction activities. The activities include:
- Joint field verification of EMP by the Environment Expert of the Independent Engineer/Authority Engineer and Contractor.
- Identification and selection of material sources (quarry and borrow material, water, sand etc.).
- Procurement of construction equipment / machinery such as crushers, hot mix plants, batching plants and other construction equipment and machinery.
- Selection, design and layout of construction areas, hot mix and batching plants, labour camps etc.
- Apply for and obtain all the necessary clearances/ NOC's/ consents from the agencies concerned.
- Planning traffic diversions and detours including arrangements for temporary land acquisition (if required).

Construction Stage

Construction activities by the Contractor

Construction stage is the most crucial stage in terms of activities that require careful management to avoid environmental impacts. There are several other environmental issues that have been addressed as part of good engineering practices, the costs for which have been accounted for in the Engineering Costs.

Construction activities by the PIU/ Authority Engineer / Independent Consultants

The PIU/Independent Engineer shall be involved in the smooth execution of the project and assisting the contractor during this phase. Their work shall include but not limited to:

- Monitoring and guiding the contractor on adopting good environmental and engineering practices;
- Arrangement of plantation through the Forest Department;
- Arranging training to the contractor and other stakeholders according to the needs arising; and
- Implementation of Environment Management and Monitoring Plan.
- Making changes in the design if need so arises.

Operation Stage

The operational stage involves the following activities by PIU:

- Monitoring of environmental conditions through approved monitoring agency; and
- Monitoring of operational performance of the various mitigation/enhancement measures carried out.

Table 69:Environment and Social Management Plan (ESMP)

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
PRE-CONSTRUCTION STAGE					
P1	Alignment,	The alignment as finalized by shifting / adjusting the centerline of the road, adopting of suitable cross-sections and adjustment of the median width to minimize land acquisition, loss of settlements and to avoid environmentally sensitive features compatible with project activities.	Throughout Corridor	PIU, Revenue Dept. NGOs Collaborating Agencies	-
P2	Land Acquisition	The same alignment will be followed for improvement from existing single lane with earthen shoulder to standard single **lane configuration with paved shoulder and geometric correction at few locations. The widening will be generally restricted within the existing ROW, except few locations.The land acquisition for this project not required**. PIU has to ascertain that any additional environmental impacts resulting from acquisition of land are addressed and integrated into the EMP and other relevant documents.	Throughout Corridor	PIU, Revenue Dept. NGOs Collaborating Agencies	
P3	Preservation of Trees	All efforts will be made to preserve trees including evaluation of minor design adjustments/ alternatives to save trees. Specific attention will be given for protecting giant trees, and	Throughout Corridor	PIU Forest Department Contractor	

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		locally important trees (religiously important etc.). The amount of tree within toe line due to widening of highway is 166 trees. These trees will betransplanted along the project stretch to restore the green cover In the event of design changes, additional assessments including the possibility to save trees shall be made. Stacking, transport and storage of the wood will be done as per the relevant norms.			
P4	Relocation of Utilities and Common Property Resources (CPR)	All utilities and CPRs i.e., water supply lines, religious structures, hand pumps will be relocated before the construction starts. The PIU will relocate these properties in consultation and written agreement with the agency/ owner/community. Environmental considerations with suitable/required actions including health and hygiene aspects will be kept in mind while relocating all utilities and CPRs. The boundary wall of one school will be impacted which will be compensated. There were differences in opinions among the villagers in demolishing/ shifting the Bus shelter. It was agreed that bus shelter has been proposed in the DPR. There are 12 educational institute (ref to table 49) and 6 religious structure are found in this project road which are away (minimum 10 m) from project road and not impacted by the project	Throughout Corridor	PIU Concerned Agencies Contractor	
P5	Orientation of Implementing Agency and Contractors	The PIU shall organize orientation sessions and regular training sessions during all stages of the project. This shall include on-site training (general as well as in the specific context of the sub-project). These sessions shall involve all staff of Authority Engineer, field level implementation staff of PIU and Contractor. The contractor will ensure that his staff including engineers, supervisors and operators attend the training sessions.	Throughout Corridor	PIU Concerned Agencies Contractor	
P6	Joint Field Verification	The Environmental Expert of AE and the Contractor will carry out joint field	Throughout out Corridor	Contractor and Environmental	PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		verification to ascertain any additional possibility to saving trees, environmental and community resources. The verification exercise should assess the need for additional protection measures or changes in design/ scale/ nature of protection measures including the efficacy of enhancement measures suggested in the EMP. Proper documentation and justifications/reasons shall be maintained in all such cases where deviation from the original EMP is proposed.		Expert of AE	
P7	Assessment of Impacts due to Changes/Revisions/Additions in the Project Work	The Environmental Expert of AE will assess impacts and revise/ modify the EMP and other required sections of the project documents in the event of changes/ revisions (including addition or deletion) in the project's scope of work.	Throughout out Corridor	Contractor Environmental Expert of AE	PIU
P8	Crushers, Hot-mix plants and Batching Plants Location	Hot mix plants and batching plants will be sited sufficiently away from settlements and agricultural operations or any commercial establishments. Such plants will be located at least 1 Km away from the nearest village/ settlement preferably in the downwind direction. The Contractor shall submit a detailed layout plan for all such sites and approval of Environmental Expert of AE/PMC shall be necessary prior to their establishment. Arrangements to control dust pollution through provision of windscreens, sprinklers, and dust encapsulation will have to be provided at all such sites. Specifications of crushers, hot mix plants and batching plants will comply with the requirements of the relevant current emission control legislations and Consent/NOC for all such plants shall be submitted to the "PIU through Environmental Expert of AE/PMC. The Contractor shall not initiate plant/s operation till the required legal clearances are obtained and submitted. The engineer will ensure that the regulatory and legal requirements are being complied	Throughout out Corridor	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		with.			
P9	Other Construction Vehicles, Equipment and Machinery	All vehicles, equipment and machinery to be procured for construction will confirm to the relevant Indian Standard (IS) norms. The discharge standards promulgated under the Environment Protection Act, 1986 will be strictly adhered to. Noise limits for construction equipments to be procured such as compactors, rollers, front loaders concrete mixers, cranes (moveable), vibrators and saws will not exceed 75 dB (A), measured at one meter from the edge of the equipment in free field, as specified in the Environment (Protection) Rules, 1986. The Contractor shall maintain a record of PUC for all vehicles and machinery used during the contract period, which shall be produced for NH verification whenever required. Mobile equipment shall be placed at least 100 m away from the nearest dwelling.	Throughout out Corridor	Contractor	Environmental Expert of AE and PIU
P10	Borrow Areas	Finalizing borrow areas for borrowing earth and all logistic arrangements as well as compliance to environmental requirements, as applicable, will be the sole responsibility of the contractor. The Contractor will not start borrowing earth from selected borrow areas until the formal agreement is signed between landowner and contractor and a copy is submitted to the PIU/Environmental Expert of AE through the Engineer. Locations finalized by the contractor shall be reported to the Environmental Expert of AE and who will in turn report to PIU. Planning of haul roads for accessing borrow materials will be undertaken during this stage. The haul roads shall be routed to avoid agricultural areas as far as possible (in case such a land is disturbed, the Contractor will rehabilitate it as per Borrow Area Rehabilitation Guidelines) and will use the existing village roads wherever available. In addition to testing for the quality of	Along the Project Influence Area	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		borrow materials by the AE, the environmental personnel of the AE will be required to inspect every borrow area location prior to approval The AE will make sure that each such site is in line with IRC and other project guidelines. Necessary clearances need to be obtained prior to operation of Borrow areas.			
P11	Quarry	Authorized Quarries that meet environmental and social standards and the necessary technical specifications will be identified by PIU in the project area Quarries must adhere to World Bank Environmental Health and Safety Guidelines In case of new Quarries, they must have permission from the Department of Mining and Geology and have the necessary clearances from Pollution Control Board and Forest Department and a valid Environmental Clearance from the State Environmental Impact Assessment Authority (SEIAA); Quarry should not be operating in any sites of valuable critical or natural habitat Quarry should not be operating in landslide or erosion prone zones Quarry should not disrupt drainage pattern or cause water pollution Quarry should not be operating on the road where operations can disrupt traffic or pose safety risks Quarry workers must have access to Personal Protective Equipment during operations Contractor will finalize the quarry for procurement of construction materials after assessment of the availability of sufficient materials and other logistic arrangements In case the contractor decides to use quarries other than recommended by DPR consultant, then will be selected based on the suitability of the materials. The contractor will procure necessary permission for procurement of materials from Mining Department, District Administration and State Pollution Control Board and shall submit a	Along the Project Influence Area	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		copy of the approval and the rehabilitation plan to the PIU through Engineer. Contractor will also work out haul road network and report to Environmental Expert of AE and will inspect and in turn report to PIU before approval.			
P12	Arrangement for Construction Water	To avoid disruption/disturbance to other water users, the contractor will extract water from fixed locations and consult the Environmental Expert of AE before finalizing the locations. The contractor will not be allowed to pump from any irrigation canal and surface water bodies used by community. The contractor will need to comply with the requirements of the State Ground Water Department and seek their approval for doing so and submit copies of the permission to AE and PIU prior to initiation of any construction work.	Along the Project Road	Contractor	Environmental Expert of AE and PIU
P13	Labor Requirements	The contractor preferably will use unskilled labor from local communities to give the maximum benefit to the local community.	Along the Project Area	Contractor	Environmental Expert of AE and PIU
P14	Construction Camp Locations – Selection, Design and Lay-out	Sitting of the construction camps will be selected by the contractor as per the guidelines. Construction camps will not be proposed within 500 m from the nearest settlements to avoid conflicts and stress over the infrastructure facilities with the local community. Location for stockyards for construction materials will be identified at least 1000 m from watercourses. The waste disposal and sewage system for the camp will be designed, built and operated such that no odor is generated.	Along the Project Road	Contractor	Environmental Expert of AE and PIU
P15	Arrangements for Temporary Land Requirement	The contractor as per prevalent rules will carry out negotiations with the landowners for obtaining their consent for temporary use of lands for construction sites/hot mix plants/traffic detours/borrow areas etc. The Contractor will submit a copy of agreement to the Environmental Expert of AE. The Environmental	Along the Project Road	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		Expert will be required to ensure that the clearing up of the site prior to handing over to the owner (after construction or completion of the activity) is included in the contract.			
P16	Implementation - Information Meetings	The contractor will organize at least 2 implementation information meetings in the vicinity of Project Site (minimum one in each section) for general public to consult and inform people about his plans covering overall construction schedule, safety, use of local resources (such as earth, water), traffic safety and management plans of debris disposal, drainage protection during construction, pollution abetment and other plans, measures to minimize disruption, damage and in convenience to roadside users and people along the road. The first Implementation information meeting be conducted within four weeks of mobilization. The people should be informed about the date, time and venue at least 7 days prior to meetings. Public shall be informed about the meeting through display of posters at prominent public places (panchayat offices, offices of Market committees, Notice board of religious places etc.) and distribution of pamphlets along roadside communities or in any manner deemed fit. The contractor will maintain a channel of communication with the communities through his designated Environment and Safety Officer to address any concern or grievances. Periodic meetings will also be conducted during the construction period to take feedback from communities or their representatives to ensure minimum disturbance. The mechanism and contents for disclosure shall be approved by PIU prior to the meetings.	Along the Project Road	Contractor	Environmental Expert of AE and PIU
P17	Disaster Management and Emergency Response Plan	The Contractor will develop and maintain emergency response systemin order to address any accidents or other emergency situation or disaster at site such as fall of workers from height, collapse of pier,flood, earthquake, accident, etc.	For entire project stretch including bridge locations, camp site and platsite	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
P18	Chance Finds Procedure	As unknown features/objects could be encountered during works, earthworks, a "chance finds procedure" shall be in place to stop works and require investigation by an archaeologist in case of such findings and involvement of relevant state entities	Along the Project Road	Contractor	Environmental Expert of AE and PIU
CONSTRUCTION STAGE					
C1	Clearing and Grubbing	Vegetation will be removed from the construction zone before commencement of construction. All works will be carried out such that the damage or disruption to flora other than those identified for cutting is minimum. Only ground cover/shrubs that impinge directly on the permanent works or necessary temporary works will be removed with prior approval from the Environmental Expert of AE. The Contractor under any circumstances will not cut trees other than those identified for cutting and for which he has written instructions from the PIU. The PIU will issue these instructions only after receiving all stages of clearances from the Forest Department/ MoEF& CC. Vegetation only with girth of over 30 cm will be considered as trees and shall be compensated, in the event of PIU's instruction to undertake tree cutting. The sub grade of the existing pavement shall be used as embankment fill material. The existing base and sub-base material shall be recycled as sub-base of the haul road or access roads. The existing bitumen surface may be utilized for the paving of cross roads, access roads and paving works in construction sites and campus, temporary traffic diversions, haulage routes etc.	Along the work in progress	Contractor	Environmental Expert of AE and PIU
C2	Disposal of debris from dismantling structures and road surface	The contractor shall identify disposal sites. The identified locations will be reported to the Environmental Expert of AE. These locations will be checked on site and accordingly approved by Environmental Expert of AE prior to any disposal of waste materials. All arrangements for transportation	Along the work in progress	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		during construction including provision, maintenance, dismantling and clearing debris, will be considered incidental to the work and will be planned and implemented by the contractor as approved and directed by the Environmental Expert of AE. The pre-designed disposal locations will be a part of Comprehensive Solid Waste Management Plan to be prepared by Contractor in consultation and with approval of Environmental Expert of AE. Debris generated from pile driving or other construction activities shall be disposed such that it does not flow into the surface water bodies or form mud puddles in the area.			
C3	Other Construction Waste Disposal	The pre-identified disposal locations will be a part of Comprehensive Waste Disposal Management Plan to be prepared by the Contractor in consultation and with approval of Environmental Expert of AE. Location of disposal sites will be finalized prior to initiation of works on any particular section of the road. The Environmental Expert of AE will approve these disposal sites after conducting a joint inspection on the site with the Contractor. Contractor will ensure that any spoils of material unsuitable for embankment fill will not be disposed off near any water course, agricultural land, and natural habitat like grass lands or pastures. Such spoils from excavation can be used to reclaim borrow pits and low-lying areas located in barren lands along the project corridors (if so desired by the owner/community and approved by the Environmental Expert of AE). All waste materials will be completely disposed and the site will be fully cleaned and certified by Environmental Expert of AE before handing over. The contractor at its cost shall resolve any claim, arising out of waste disposal or any non-compliance that may arise on account of lack of action on his part.	Along the Road	Contractor	Environmental Expert of AE and PIU
C4	Stripping, stocking and preservation of	The topsoil from all areas of cutting and all areas to be permanently covered will be stripped to a	Along the Road	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
	top soil	specified depth of 150 mm and stored in stockpiles. A portion of the temporarily acquired area and/or Right of Way will be earmarked for storing topsoil. The locations for stock piling will be pre-identified in consultation and with approval of Environmental Expert of AE. The following precautionary measures will be taken to preserve them till they are used: Stockpile will be designed such that the slope does not exceed 1:2 (vertical to horizontal), and height of the pile is restricted to 2 m. To retain soil and to allow percolation of water, silt fencing will protect the edges of the pile. Stockpiles will not be surcharged or otherwise loaded and multiple handling will be kept to a minimum to ensure that no compaction will occur. The stockpiles shall be covered with gunny bags or vegetation. It will be ensured by the contractor that the topsoil will not be unnecessarily trafficked either before stripping or when in stockpiles. Such stockpiled topsoil will be utilized for - covering all disturbed areas including borrow areas only in case where these are to be rehabilitated as farm lands (not those in barren areas) top dressing of the road embankment and fill slopes, filling up of tree pits, in the median and in the agricultural fields of farmers, acquired temporarily.			
	Impact on structures	13 structures are being impacted due to the construction activities. The type of structures are ramps, staircases, boundary wall and chimney. The contractor will reconstruct all these affected structures within 15 days of completion of work at these sites.	Along the Road	Contractor	**Social cum Gender Expert, PIU**
C5	Accessibility	The contractor will provide safe and convenient passage for vehicles, pedestrians and livestock to and from roadsides and property accesses connecting the project road, providing temporary connecting road. The contractor will take care that schools and religious places are	Along the Road	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		accessible to Public. The contractor will also ensure that the work on / at existing accesses will not be undertaken without providing adequate provisions and to the prior satisfaction of Environmental Expert of AE. The contractor will take care that the cross roads are constructed in such a sequence that construction work over the adjacent cross roads are taken up one after one so that traffic movement in any given area not get affected much.			
C6	Planning for Traffic Diversions and Detours	Temporary diversions will be constructed with the approval of the Resident Engineer and Environmental Expert of AE for which contractor will seek prior approval for such plans. Detailed Traffic Control Plans will be prepared and submitted to the Resident Engineer for approval, seven days prior to commencement of works on any section of road. The traffic control plans shall contain details diversions; traffic safety arrangement during construction; safety measures for night – time traffic and precautions for transportation of hazardous materials. Traffic control plans shall be prepared in line with requirements of IRC's SP- 55 document and The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. The contractor will also inform local community of changes to traffic routes, conditions and pedestrian access arrangements with assistance from AE and PIU. The temporary traffic detours will be kept free of dust by sprinkling of water three times a day and as required under specific conditions (depending on weather conditions, construction in the settlement areas and volume of traffic).	Along the Road	Contractor	Environmental Expert of AE and PIU
C7	Earth from Borrow Areas for Construction	No borrow area will be opened without permission of the Environmental Expert of AE. The location, shape and size of the designated borrow areas will be as	Borrow Areas	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		approved by the Environmental Expert of AE and in accordance to the IRC recommended practice for borrow pits for road embankments (IRC 10: 1961). The borrowing operations will be carried out as specified in the guidelines for sitting and operation of borrow areas. The unpaved surfaces used for the haulage of borrow materials, if passing through the settlement areas or habitations; will be maintained dust free by the contractor. Sprinkling of water will be carried out twice a day to control dust along such roads during their period of use. During dry seasons (winter and summer) frequency of water sprinkling will be increased in the settlement areas and Environmental Expert of AE will decide the numbers of sprinkling depending on the local requirements. Contractor will rehabilitate the borrow areas as soon as borrowing is over from a particular borrow area in accordance with the guidelines for Redevelopment of Borrow Areas or as suggested by Environmental Expert of AE. The final rehabilitation plans will be approved by the Environmental Expert of AE.			
C8	Quarry Operations	The contractor shall obtain materials from quarries only after the consent of the Department of Mining / SPCB (both the states) / District Administration or will use existing approved sources of such materials. Copies of consent/ approval/ rehabilitation plan for opening a new quarry or use of an existing quarry source will be submitted to Environmental Expert of AE and the Resident Engineer. The contractor will develop a Comprehensive Quarry Redevelopment plan, as per the Mining Rules of the state and submit a copy to PIU and AE prior to opening of the quarry site. The quarry operations will be undertaken within the rules and regulations in force in the state. Sand, Stone and Aggregate will be from authorized sources that adhere to state regulations as well as World	Quarry Areas	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		Bank Environmental Health and Safety Guidelines and Safeguard standards as outlined in Annexure 7.			
C9	Transporting Construction Materials and Haul Road Management	Contractor will maintain all roads (existing or built for the project), which are used for transporting construction materials, equipment and machineries as précised. All vehicles delivering fine materials to the site will be covered to avoid spillage of materials. All existing highways and roads used by vehicles of the contractor or any of his sub-contractor or suppliers of materials and similarly roads, which are part of the works, will be kept clear of all dust/mud or other extraneous materials dropped by such vehicles. Contractor will arrange for regular water sprinkling as necessary for dust suppression of all such roads and surfaces with specific attention to the settlement areas. The unloading of materials at construction sites/close to settlements will be restricted to daytime only.	All Roads Used	Contractor	Environmental Expert of AE and PIU
C10	Construction Water	Contractor will arrange adequate supply and storage of water for the whole construction period at his own costs. The Contractor will submit a list of source/s from where water will be used for the project to 'PIU' through the Engineer. The contractor will source the requirement of water preferentially from ground water but with prior permission from the Central Ground Water Board. A copy of the permission will be submitted to 'PIU' through the Engineer prior to initiation of construction. The contractor will take all precaution to minimize the wastage of water in the construction process/ operation.	Along the Project	Contractor	Environmental Expert of AE and PIU
C11	Disruption to Other Users of Water	While working across or close to any perennial water bodies, contractor will not obstruct/ prevent the flow of water. Construction over and close to the perennial streams shall not be undertaken in any season. The contractor will take prior approval of the River Authority or Irrigation Department for any such	All Water Bodies Used	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		activity. The PIU and the Engineer will ensure that contractor has served the notice to the downstream users of water well in advance.			
C12	Drainage and Flood Control	Contractor will ensure that no construction materials like earth, stone, ash or appendage is disposed off in a manner that blocks the flow of water of any water course and cross drainage channels. Contractor will take all-necessary measures to prevent any blockage to water flow. In addition to the design requirements, the contractor will take all required measures as directed by the Environmental Expert of AE and the 'Resident Engineer' to prevent temporary or permanent flooding of the site or any adjacent area. Contractor will take all necessary measures to prevent the blockage of water flow. In addition to the design requirements, the contractor will take all required measures as directed by the Environmental Expert of the PIU to prevent temporary or permanent flooding of the site or any adjacent area To maintain the surface water flow/drainage, proper mitigation measures will be taken along the road, like: Drainage line will be constructed all along the project road. Good engineering and construction practice should be followed Use of sediment traps, silt fencing, oil and grease turfing etc. to minimize of the soil movement. Although, effective drainage of water from road side drainage system has been provided throughout the project stretch	Drainage line along the road	Contractor	Environmental Expert of AE and PIU
C13	Siltation of Water Bodies and Degradation of Water Quality	The Contractor will not excavate beds of any stream/canals/ any other water body for borrowing earth for embankment construction. Contractor will construct silt fencing at the base of the embankment construction for the entire perimeter of water bodies (including wells) adjacent to the ROW and around the stockpiles at the construction sites close to water bodies. The fencing will be provided prior to commencement of earthwork and	All Surface Water Bodies Along the Road	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		continue till the stabilization of the embankment slopes, on the particular sub-section of the road. The contractor will also put-up sedimentation cum grease traps at the outer mouth of the drains located in truck lay byes and bus bays which are ultimately entering into any surface water bodies / water channels with a fall exceeding 1.5 m. in present case three Sedimentation Cum Grease Trap are proposed, However the item has been kept in case need arises during construction. However, all the water bodies are minimum 2.18 m away from the project road(Refer to Table 24) Contractor will ensure that construction materials containing fine particles are stored in an enclosure such that sediment-laden water does not drain into nearby watercourse.			
C14	Slope Protection and Control of Soil Erosion	The contractor will take slope protection measures as per design, or as directed by the Environmental Expert of AE to control soil erosion and sedimentation. Slope protection shall be provided on embankments abutting water bodies by providing stone pitching for slopes b/w 1:4 (V:H) to 1:2 (V:H). Retaining walls shall be provided at high embankments. All temporary sedimentation, pollution control works and maintenance thereof will be deemed as incidental to the earth work or other items of work and as such as no separate payment will be made for them. Contractor will ensure the following aspects: During construction activities on road embankment, the side slopes of all cut and fill areas will be graded and covered with stone pitching, grass and shrub as per design specifications. Turfing works will be taken up as soon as possible provided the season is favorable for the establishment of grass sods. Other measures of slope stabilization will include mulching netting and seeding of batters and drains immediately on completion of earthworks.	Along the Roads	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		In borrow pits, the depth shall be so regulated that the sides of the excavation will have a slope not steeper than 1 vertical to 2 horizontal, from the edge of the final section of the bank. Along sections abutting water bodies, stone pitching as per design specification will protect slopes.			
C15	Water Pollution from Construction Wastes	The Contractor will take all precautionary measures to prevent the wastewater generated during construction from entering into streams, water bodies or the irrigation system. Contractor will avoid construction works close to the streams or water bodies. All waste arising from the project is to be disposed off in the manner that is acceptable and as per norms of the State Pollution Control Board. The Environmental Expert of the PIU will certify that all liquid wastes disposed off from the sites meet the discharge standards.	Along the road	Contractor	Environmental Expert of AE and PIU
C16	Water Pollution from Fuel and Lubricants	The contractor will ensure that all construction vehicle parking location, fuel/lubricants storage sites, vehicle, machinery and equipment maintenance and refueling sites will be located at least 500 m from rivers and irrigation canal/ponds. All location and layout plans of such sites will be submitted by the Contractor prior to their establishment and will be approved by the Environmental Expert of AE and PIU. Contractor will ensure that all vehicle/machinery and equipment operation, maintenance and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. Oil interceptors will be provided for vehicle parking, wash down and refueling areas as per the design provided. Oil and grease traps will be provided at fuelling locations, to prevent contamination of water. 'Oil interceptors' shall be provided in wash down areas and re-fuelling areas In all, fuel storage and refueling areas, if located on agricultural land	Along the Roads	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		or areas supporting vegetation, the top soil will be stripped, stockpiled and returned after cessation of such storage. Contractor will arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites (list to be submitted to AE and PIU) and approved by the Environmental Expert of AE. All spills and collected petroleum products will be disposed off in accordance with MoEF&CC and state PCB guidelines. Environmental Expert of AE and Resident Engineer' will certify that all arrangements comply with the guidelines of PCB/ MoEF&CC or any other relevant laws.			
C17	Dust Pollution	The contractor will take every precaution to reduce the level of dust from crushers/hot mix plants, construction sites involving earthwork by sprinkling of water, encapsulation of dust source and by erection of screen/barriers. All the plants will be sited at least 1 km in the downwind direction from the nearest human settlement. The contractor will provide necessary certificates to confirm that all crushers used in construction conform to relevant dust emission control legislation. The suspended particulate matter value at a distance of 40m from a unit located in a cluster should be less than 500 g/m3. The pollution monitoring is to be conducted as per the monitoring plan. Alternatively, only crushers licensed by the SPCB shall be used. Required certificates and consents shall be submitted by the Contractor in such a case to the Environmental Expert of AE through the 'Engineer'. Dust screening vegetation will be planted on the edge of the ROW for all existing roadside crushers. Hot mix plant will be fitted with dust extraction units.	Along the Roads, Construction Site/ Camps	Contractor	Environmental Expert of AE and PIU
C18	Emission from Construction Vehicles, Equipment and Machineries	Contractor will ensure that all vehicles, equipment and machinery used for construction are regularly maintained and confirm that pollution emission levels comply with the relevant requirements of SPCB.	Along the Roads , all vehicles used/ Camps	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		The Contractor will submit PUC certificates for all vehicles/ equipment/machinery used for the project. Monitoring results will also be submitted to 'PIU' through the 'Engineer'.			
C19	Noise Pollution: Noise from Vehicles, Plants and Equipments	The Contractor will confirm the following: All plants and equipment used in construction shall strictly conform to the MoEF& CC/CPCB noise standards. All vehicles and equipment used in construction will be fitted with exhaust silencers. Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced. Limits for construction equipment used in the project such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB (A) (measured at one meter from the edge of equipment in the free field), as specified in the Environment (Protection) rules, 1986. Maintenance of vehicles, equipment and machinery shall be regular to keep noise levels at the minimum. At the construction sites within 150 m of the nearest habitation, noisy construction work such as crushing, concrete mixing, batching will be stopped during the night time between 10.00 pm to 6.00 am. No construction activities will be permitted around educational institutes/health centers (silence zones) up to a distance of 100 m from the sensitive receptors i.e., school, health centers and hospitals between 10.00 pm to 6.00 am. Monitoring shall be carried out at the construction sites as per the monitoring schedule and results will be submitted to Environmental Expert of AE through the 'Engineer'. Contractor will provide noise barriers to the suggested locations of select schools (at km 2+900, 3+050, 34+050, 34+100&34+150) because	Along the Roads , all vehicles used/Camps	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		in these locations during the construction noise level will be very high (Refer to Table 56). No noisy construction activities will be permitted around educational institutes/health centers (silence zones) up to a distance of 100 m from the sensitive receptors i.e., school, health centers and hospitals between 9.00 am to 5.00 pm			
C20	Personal Safety Measures for Labour	Contractor will provide: Protective footwear and protective goggles to all workers employed on mixing asphalt materials, cement, lime mortars, concrete etc. Welder's protective eye-shields to workers who are engaged in welding works Protective goggles and clothing to workers engaged in stone breaking activities and workers will be seated at sufficiently safe intervals Earplugs to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation. Adequate safety measures for workers during handling of materials. The contractor will comply with all regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe means of entry and egress. The contractor will comply with all the precautions as required for ensuring the safety of the workmen as per the International Labor Organization (ILO) Convention No. 62 as far as those are applicable to this contract. The contractor will make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to. The contractor will not employ any person below the age of 14 years for any work and no woman will be employed on the work of painting with products containing lead in any form. The contractor will also ensure that no paint containing lead or lead	Along the Roads, all vehicles used/Camps	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		products is used except in the form of paste or readymade paint. Contractor will provide facemasks for use to the workers when paint is applied in the form of spray or a surface having lead paint dry is rubbed and scrapped. The Contractor will mark 'hard hat' and 'no smoking' and other 'high risk' areas and enforce non-compliance of use of PPE with zero tolerance. These will be reflected in the Construction Safety Plan to be prepared by the Contractor during mobilization and will be approved by AE and PIU.			
C21	Traffic and Safety	The contractor will take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, markings, flags, lights and flagmen as proposed in the Traffic Control Plan/Drawings and as required by the Environmental Expert of AE and 'Resident Engineer' for the information and protection of traffic approaching or passing through the section of any existing cross roads. The contractor will ensure that all signs, barricades, pavement markings are provided as per the MOSRT&H specifications. Before taking up of construction on any section of the existing lanes of the highway, a Traffic Control Plan will be devised and implemented to the satisfaction of Environmental Expert of AE and ' Resident Engineer'	Along the Roads, all vehicles used/Camps	Contractor	Environmental Expert of AE and PIU
C22	Risk from Electrical Equipment(s)	The Contractor will take all required precautions to prevent danger from electrical equipment and ensure that: No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. All necessary fencing and lights will be provided to protect the public in construction zones. All machines to be used in the construction will conform to the relevant Indian Standards (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the 'Resident	Along the Roads	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		Engineer'.			
C23	Risk Force Measure	The contractor will take all reasonable precautions to prevent danger to the workers and public from fire, flood etc. resulting due to construction activities. The contractor will make required arrangements so that in case of any mishap all necessary steps can be taken for prompt first aid treatment. Construction Safety Plan prepared by the Contractor will identify necessary actions in the event of an emergency.	Along the Roads, construction Camps	Contractor	Environmental Expert of AE and PIU
C24	First Aid	The contractor will arrange for - a readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital Equipment and trained nursing staff at construction camp.	Along the Roads, construction Camps	Contractor	Environmental Expert of AE and PIU
C25	Informatory Signs and Hoardings	The contractor will provide, erect and maintain informatory/safety signs, hoardings written in English and local language, wherever required as per IRC and MoRT&H specifications.	Along the Roads, construction Camps	Contractor	Environmental Expert of AE and PIU
C26	Road side Plantation Strategy	The contractor will do the plantation at median and/or turfing at embankment slopes as per the tree plantation strategy prepared for the project. Minimum 90 percent survival rate of the saplings will be acceptable otherwise the contractor will replace dead plants at his own cost. The contractor will maintain the plantation till they handover the project site to NHAI. Environmental Expert of AE will inspect regularly the survival rate of the plants and compliance of tree plantation guidelines.	Along the Roads	Contractor	Environmental Expert of AE and PIU
C27	Flora and Fauna	The contractor will take reasonable precaution to prevent his workmen or any other persons from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body and hunting of any animal. If any wild animal is found near the construction site at any point of time,	Along the Roads	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		the contractor will immediately upon discovery thereof acquaint the Environmental Expert of AE and carry out the AE instructions for dealing with the same. Environmental Expert of AE will report to the nearby forest office (range office or divisional office) and will take appropriate steps/ measures, if required in consultation with the forest officials. All efforts during the design stage should be made to minimize the tree felling requirement Compensatory plantation should be started during construction phase parallel to the construction activities.			
C28	Chance Found Archaeological Property	All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as per provisions of the relevant legislation. The contractor will take reasonable precautions to prevent his workmen or any other persons from removing and damaging any such article or thing. He will, immediately upon discovery thereof and before removal acquaint the Environmental Expert of AE of such discovery and carry out the AE instructions for dealing with the same, waiting which all work shall be stopped. The AE will seek direction from the Archaeological Survey of India (ASI) before instructing the Contractor to recommence the work in the site.	Along the Roads, construction sites/Camps	Contractor	Environmental Expert of AE and PIU
C29	Labour Accommodation	Contractor will follow all relevant provisions of the Factories Act, 1948 and the building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labor camp. The location, layout and basic facility provision of each labor camp will be submitted to AE and 'PIU' prior to their construction. The construction will commence only upon the written approval of the Environmental Expert of AE. The contractor will maintain necessary living accommodation and	Along the Roads, construction Camps/site	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		ancillary facilities in functional and hygienic manner and as approved by the AE. The sewage system for such camps will be properly designed and built so that no water pollution takes place in adjacent canals			
C30	Potable Water	The Contractor will construct and maintain all labour accommodation in such a fashion that uncontaminated water is available for drinking, cooking and washing. The Contractor will also provide potable water facilities within the precincts of every workplace in an accessible place, as per standards set by the building and other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996. Testing of water will be done as per parameters prescribed in IS 10500:1991.	Along the Roads, construction Camps/construction site	Contractor	Environmental Expert of AE and PIU
C31	Sanitation and Sewage System	The contractor will ensure that - the sewage system for the camp are designed, built and operated in such a fashion that no health hazards occurs and no pollution to the air, ground water or adjacent water courses take place separate toilets/bathrooms, wherever required, screened from those from men (marked in vernacular) are to be provided for women Adequate water supply is to be provided in all toilets and urinals	Along the Roads, construction Camps/Construction Sites	Contractor	Environmental Expert of AE and PIU
C32	Waste Disposal	The contractor will provide garbage bins in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as per the Comprehensive Solid Waste Management Plan approved by the Environmental Expert of AE. Unless otherwise arranged by local sanitary authority, arrangements for disposal of night soils (human excreta) suitably approved by the local medical health or municipal authorities or as directed by Environmental Expert of AE will have to be provided by the contractor.	Along the Roads, construction Camps	Contractor	Environmental Expert of AE and PIU
C33	Consultation	The Environmental Expert of AE will contact the responsible people with the enhancement drawing of the site for which enhancement has been proposed and take their consent	Along the Roads	Contractor	Environmental Expert of AE and PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		before the start of work. Accesses to Different Schools along the road will be developed to the satisfaction of 'PIU'.			
C34	Clean-up Operations, Restoration and Rehabilitation	Contractor will prepare site restoration plans, which will be approved by the Environmental Expert of AE. The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. The contractor will clear all temporary structures; dispose all garbage, night soils and POL waste as per Comprehensive Waste Management Plan and as approved by AE. All disposal pits or trenches will be filled in and effectively sealed off. Residual topsoil, if any will be distributed in pre identified approved areas or in places suggested by the Environmental Expert of AE areas in a layer of thickness of 75 mm-l50 mm. All construction zones including river-beds, culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, at the contractor's expense, to the entire satisfaction to the Environmental Expert of AE and PIU will certify in this regard.	Along the Roads, construction Camps	Contractor	Environmental Expert of AE and PIU
OPERATION STAGE					
Activities to be carried Out by PIU					
O1	Monitoring Operation Performance	The PIU will monitor the operational performance of the various mitigation/ enhancement measures carried out as a part of the project. The indicators selected for monitoring include the survival rate of trees; utility of enhancement provision, status of rehabilitation of borrow areas and disposal sites.	Along the Road	PIU	PIU
O2	Maintenance of Drainage	PIU will ensure that all drains (side drains, median drain and all cross drainages) are periodically cleared especially before monsoon season to facilitate the quick passage of rainwater and avoid flooding. PIU will ensure that all the sediment and oil and grease traps set up at the water bodies are cleared once in every three months.	Along the Road	PIU	PIU
O3	Pollution	The periodic monitoring of the ambient	Along the	PIU through	PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
	Monitoring	air quality, noise level, water quality, soil pollution/contamination in the selected locations as suggested in pollution monitoring plan. PIU will either appoint PCB or its approved pollution-monitoring agency for the purpose	Road	Pollution Monitoring Agency	
O4	Air Pollution	Ambient air concentrations of various pollutants shall be monitored as envisaged in the pollution-monitoring plan. Bottlenecks should be avoided for smooth flow of traffic. Plantation of pollutant adsorbing trees, such as Spider Plant, Bamboo Palm, etc. Regular maintenance of the road will be done to ensure good surface condition	Along the Road	PIU through Pollution Monitoring Agency	PIU
O5	Noise Pollution	Noise pollution will be monitored as per monitoring plan at sensitive locations. Noise control programs are to be enforced strictly. According to monitoring results, use of sound barriers / trees will be considered where warranted Signs for sensitive zones (health centers / educational institutions etc.) will be put up where horn should not be blown or traffic speed need to be regulated Pressure Horn must be banned in the project road	Along the Road	PIU through Pollution Monitoring Agency	PIU
O6	Water Pollution	Water Quality will be monitored as per monitoring plan	Along the Road	PIU through Pollution Monitoring Agency	PIU
O8	Soil Erosion and Monitoring of Borrow Areas	Visual monitoring and inspection of soil erosion at borrow areas, quarries (if closed and rehabilitated), embankment > 2m. and other places expected to be affected, will be carried out once in every three months as suggested in monitoring plan.In case soils erosion is found, suitable measures should be taken to control the soil erosion.	Along the Road	PIU	PIU
O9	Road Safety and Traffic	**Road Safety will be monitored during operation especially at location where traffic-calming measures have been proposed.** **The spills at the accident sites will be cleared immediately and disposed off properly in accordance with Emergency Response Plan** **Traffic management plan will be developed, especially along congested locations and near sensitive locations**	Along the Road	PIU	PIU

Sl.	Environmental and Social Issue	Management Measures	Location	Responsibility	
				Planning and Execution	Supervision/ Monitoring
		Traffic control measures including speed limits will be enforced strictly. **Engagement with local community / Awareness Training**			

Nonconformity to Environmental Management Plan (EMP)

The Contractor will implement necessary mitigation measures for which responsibility is assigned to him as stipulated in the EMP. Any lapse in implementing the same will attract the damage clause as detailed below:

- Any complaints of public, within the scope of the Contractor, formally registered with the PIU and communicated to the Contractor, which is not properly addressed within the time period intimated by the PIU shall be treated as a major lapse.
- Non-conformity to any of the mitigation measures like unsafe conditions, non-collection of excavated material (during laying of drainage pipes) regularly and other unattended Environment, Health & Safety (EHS) issues, as stipulated in the EMP Report (other than stated above) shall be considered as a minor lapse.
- On observing any lapses, PIU shall issue a notice to the Contractor, to rectify the same.
- Any minor lapse for which notice was issued and not rectified, first and second reminders shall be given after ten days from the original notice date and first reminder date respectively. Any minor lapse, which is not rectified, shall be treated as a major lapse from the date of issuing the second reminder.
- If a major lapse is not rectified upon receiving the notice PIU shall invoke reduction, in the subsequent interim payment certificate.
- For major lapses, 10% of the interim payment certificate will be withheld, subject to a maximum limit of about 0.5% of the contract value.
- If the lapse is not rectified within one month after withholding the payment, the amount withheld shall be forfeited immediately.

Environmental Monitoring

Environmental monitoring describes the processes and activities that need to take place to characterize and monitor the quality of the environment. Environmental monitoring is used in the preparation of environmental impact assessments, as well as in many circumstances in which human activities carry a risk of harmful effects on the natural environment. All monitoring strategies and program have reasons and justifications which are often designed to establish the current status of an environment or to establish trends in environmental parameters. In all cases the results of monitoring will be reviewed, analyzed statistically and published. The design of a monitoring program must therefore have regard to the final use of the data before monitoring starts.

Monitoring Plans for Environment Condition

For each of the environmental components, the monitoring plan specifies the parameters to be monitored; location of the monitoring sites; frequency and duration of monitoring. The monitoring plan also specifies the applicable standards, implementation and supervising responsibilities. The monitoring plan for the various environmental condition indicators of the project in construction and operation stages is presented in **Table88**
Monitoring plan does not include the requirement of arising out of Regulation Provision such as obtaining NOC/ consent for plant site operation.

Table 51:Environment Monitoring Plan

nt al	ct St	Monitoring	Institutional Responsibility

		Parameters	Special Guidance	Standards	Location	Frequency	Implementation	Supervision
Air	**Construction Stage**	PM10, PM 2.5, SO_x, NOx, CO	Respirable Dust Sampler to be located 50 m from the plant in the downwind direction. Use method specified by CPCB for analysis	Air (P&CP) Act,1981 and its amendment	Hot mix Plant / Batching Plant. Stretch of the road where construction is in progress at the site. (Total 03 locations)	Three times in a year for two years (Excluding Rainy season)	Contractor through NABL approved monitoring agency	Environment Expert-AE/IE/PIU
	Operational Stage	PM10, PM 2.5, SO_x, NOx, CO	Respirable Dust Sampler to be located 50m from the plant in the downwind direction. Use method specified by CPCB for analysis	Air (P&CP) Act,1981 and its amendment	As directed by the PIU (03 Project locations)	Three times in a year for two years (Excluding Rainy season)	P I U through NABL approved monitoring agency	P I U
Water Quality	**Construction Stage**	Parameters as per IS: 10500 and standards of surface water	Grab sample collected from source and analyze as per Standard Methods for Examination of Water quality	Water quality standards by CPCB	01 drinking water sample-Labour Camp and 02 surface water samples in project stretch.	Three times in a year for two years (Excluding Rainy season)	Contractor through NABL approved monitoring agency	Environment Expert-AE/IE/PIU
Water Quality	**Operation Stage**	Parameters as per IS: 10500 and standards of surface water	Grab sample collected from source and analyze as per Standard Methods for Examination of Water quality	Water quality standards by CPCB	As directed by the PIU (03 Project locations)	Three times in a year for two years (Excluding Rainy season)	P I U through NABL approved monitoring agency	P I U

Environmental Component	Project Stage	Monitoring					Institutional Responsibility	
		Parameters	Special Guidance	Standards	Location	Frequency	Implementation	Supervision
Noise Levels	Construction Stage	Noise levels on dB (A) scale	As per CPCB	Noise standards by CPCB	Hot mix Plant / Batching Plant. Stretch of the road where construction is in progress at the site. (Total 03 locations)	Three times in a year for two years.	Contractor through NABL approved monitoring agency	Environment Expert-AE/IE/PIU
	Operation Stage	Noise levels on dB (A) scale	As per CPCB	Noise standards by CPCB	As directed by the PIU (Total 03 locations)	Three times in a year for two years.	PIU through NABL approved monitoring agency	PIU
Soil Erosion	Construction Stage	Turbidity in Storm Water Silt load in ponds, water courses	----	As per Standard (ICAR)	01 location construction camp and 02 major construction locations. (Total 03 locations)	Three times in a year for two years	Contractor through NABL approved monitoring agency	Environment Expert-AE/IE/PIU
	Operational Stage	Turbidity in Storm Water Silt load in ponds, water courses	----	As per Standard (ICAR)	As directed by the PIU (Total 03 locations)	Three times in a year for two years.	PIU through NABL approved monitoring agency	PIU

Environmental Monitoring Budget:

The environmental monitoring cost is estimated on the basis of the length and existing environmental scenario of the proposed project. Environmental monitoring cost of 9, 00,000/- is estimated for the construction and Operation stages. The details have been presented in Table 53

Table 52: Environmental Monitoring Cost

Cost of Environment / Migration Plan Description	Unit	Quantity	Unit Rate	Cost
Air quality monitoring at 3 locations for 3 seasons for 2 consecutive years. (Construction Stage)	No.	18	9000	162,000
Air quality monitoring at 3 locations for 3 seasons for 2 consecutive years. (Operation Stage)	No.	18	9000	162,000
Water quality monitoring at 3 locations for 3 seasons for 2 consecutive years. (Construction Stage)	No.	18	7000	126,000
Water quality monitoring at 3 locations for 3 seasons for 2 consecutive years. (Operation Stage)	No.	18	7000	126,000
Noise quality monitoring at 3 locations for 3 seasons for 2 consecutive years. (Construction Stage)	No.	18	3000	54,000
Noise quality monitoring at 3 locations for 3 seasons for 2 consecutive years. (Operation Stage)	No.	18	3000	54,000
Soil quality monitoring at 3 locations for 3 seasons for 2 consecutive years. (Construction Stage)	No.	18	6000	108000
Soil quality monitoring at 3 locations for 3 seasons for 2 consecutive years. (Operation Stage)	No.	18	6000	108000
Total				**900000**

Table 53:Environment Management Plan Implementation Budget

Sl.	Environmental Components	Particulars	Unit	Rate In (Rs.)	Approx. Quantity	Total Cost In (Rs.)
		Mitigation / Enhancement Cost				
2		Construction Stage				
2.1	Air	Dust Management with sprinkling of water, covers for vehicles transporting construction material	35 Km	Cost included in Total Civil Cost		
2.2	Water	Provision of Taps	No.	Included in utility shifting and replacement cost.		
	Water Bodies	Enhancement of Road side Ponds	No.	Retaining wall has been proposed to protect this water bodies. Cost of retaining wall is included in total Civil Cost.		
		Oil trap at parking/servicing of construction vehicles (at	No.	Ref: Project Cost Estimate		

Sl.	Environmental Components	Particulars	Unit	Rate In (Rs.)	Approx. Quantity	Total Cost In (Rs.)
		three location every 14km)-				
2.3	Environmental Enhancements	Enhancement of traffic sign outside of most sensitive locations mentioned in EMP, by planting of traffic sign and planting of 1 row of trees at a distance of 3m c/c and as per directions of the Engineer	No.	At this location proper traffic sign has been proposed. The cost of traffic sign is included in total civil cost.		
2.4	Flora	tree within toe line due to widening of highway is 166 trees which will be transplanted.	Nos.	The cost of trees transplantation is included in total civil cost.		
	Provision of Mobile Toilets at Work Site	Supply and commissioning of mobile toilets on wheel (5 units each Toilet and Bathroom) with proper water supply and drainage system, electric supply and safe access at work site locations	Nos.	1	250000	250000
		Maintenance: Daily cleaning twice a day by engaging one permanent helper	Monthly	24	18000	432000
		Painting at every six months	Six Monthly	4	25000	100000
	Noise barrier	Provide the Noise barrier at sensitive areas like schools and hospitals. The noise barriers of hollow brick wall/reinforced concrete panels with height of 3.5m. The design of the noise barrier shall be approved by theengineer in charge**.**		Cost of noise barrier is included in Total Civil Cost.		
2.5	Silt Runoff Control	Slope stabilization, turfing, silt fencing etc		For slope stabilization turfing has been proposed on high embankment. Cost of slope stabilization is included in Total Civil Cost.		
2.6	Slope/ embankment protection measures	Stone pitching, Gabion, Retaining wall, Turfing at toe line, etc		For Slope/ embankment protection Retaining wall, Turfing has been proposed. Cost of Slope/ embankment is included in Total Civil Cost.		
2.7	Relocation of sensitive receptor	Relocation of religious structure, educational properties and health care center		Cost of relocation is included in Total Civil Cost.		
		Total Mitigation / Enhancement Cost				782000
3		**Operation Stage**				
3.1	Soil	Mitigation measure for soil		included in Total Civil Cost		

Sl.	Environmental Components	Particulars	Unit	Rate In (Rs.)	Approx. Quantity	Total Cost In (Rs.)
	erosion	erosion				
3.2	Contamination from spills due to traffic and accidents	Clearing of spills at accident site			Average cost	700,000
3.3	Flora	Maintenance of planted trees	Already included in construction phase			
3.4	Safety	Traffic management and Traffic control	Part of project construction cost.			
		Total Mitigation / Enhancement Cost				700,000

Table 54:Summary of Environmental Management Budget

Sl.	Environmental Components	Cost (Rs.)
1	**Construction Phase**	
1.1	Total Mitigation / Enhancement Cost	782000
1.2	Environmental Monitoring Cost	450000
Total Cost in Construction phase		**1232000**
2	**Operation Phase**	
2.1	Total Mitigation / Enhancement Cost	7,00,000
2.2	Environmental Monitoring Cost	450000
Total Cost in Operation Phase		**11,50,000**
3	**Miscellaneous Cost**	
3.1	Environmental Awareness and Training	1,20,000
3.2	Administrative Charges including logistics	4,00,000
Total Cost in Miscellaneous		**5,20,000**
TOTAL BUDGETED COST (1+2+3)		**29,02,000**

An environmental management budget at of INR**29,02,000**has been estimated for implementation of the environmental management plan. This budget includes cost of environmental monitoring and associated trainings.

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CHAPTERXIII: CONCLUSION AND RECOMMENDATIONS

The environmental and the social impact assessment have been conducted as per the approach/ methodology for conducting ESIA study for all the eight project corridors. All the potential impacts were identified in relation to pre-construction, construction, and operation phases. Social impact assessment study has done within the proposed corridor. The proposed project interventions shall not attract Environmental Clearance (EC) from the SEIAA.

Focus Group Discussions (FGD's) were conducted to assess the perception of the people about the proposed project. The stakeholders selected included shop keepers, residents along the road, owners/ workers of local commercial establishments etc. The outcome of the consultations depicts the requirement for the road safety measures; road furniture's (including street lights, additional bus bays, signages, speed breaker etc.).The project is not huge and can be easily completed with the local labour force. There might movement of labour from the neighbouring districts within the state.

In view of the environmental Impact assessment, there will be temporary negative impacts, arising mainly from construction dust and noise, hauling of construction material, waste and equipment on the project corridors (traffic, dust, safety etc.), mining of construction material, occupation health and safety aspects, disturbance to the residents, businesses, safety risk to workers, public and nearby buildings due to road excavation works, access impediment to houses and business, disposal of large quantities of construction waste, etc. These are all general impacts that are likely to arise during the road construction works in the settlement areas, and there are well developed methods of mitigation that are suggested in the ESMP. Mitigation will be assured by a program of environmental monitoring conducted during construction and operation to ensure that all measures are implemented, and to determine whether the environment is protected as intended. This will include observations on- and off-site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported by the contractor to the CSC/PIU.

The prepared ESMP will assist the Contractor, CSC, and the PIU in mitigating the environmental and social impacts, and guide them in the environmentally sound execution of the proposed project. A copy of the updated ESMP shall be kept on-site during the construction period at all times. The ESMP shall be included in the bidding document along with appropriate contractual clauses for safeguarding the environment during the project construction and operation (maintenance period). As per the World Bank policy requirements, the prepared safeguard documents shall be disclosed in the World Bank website.

Annexure 1: Environmental Screening Checklist

Name of the sub-project	Nongstoin Maweit Road
Size of the project (approx. area in sq. mt/hac or length in mt/km, as relevant)	35 km
Location of the proposed sub-project	Maghalaya, India
Name of the of the district, block	West Khasi Hills
Name of the settlement/ area, where the bridge is located	This road passes through towns/ Villages viz. Nongpyndeng, Mawlait, Nongthraw, Wahlyndoh, Nongsbah, Mawdom, Miangshiang, Nongpathar, Maweit and Nonglyer.
Latitude and longitude	start point- Lat 25°31'40.25"N and long 91°15'24.66"E End Point- Lat 25°25'54.51"N and long 91° 4'20.11"E
New construction/ repair/ rehabilitation/ expansion (if there is an existing bridge, please share picture of old bridge. Also, the approach roads.)	Expansion of the project road
If expansion, then is there any need of new land	No
If yes, please share detail: • **Total requirement** • **Private land** • **Govt. land** • **Forest land**	
What is the High Flood Level in the sub-project area?	

S. No.	Environmental & Social Features	Presence within 500 mts from activity sites (Yes/No) If yes, mention distance in km)	Type of Impact (+ or -)	Significance of Impact (High (H), Medium (M), Low (L))	Likelihood of Impact (Likely, Unlikely)	Description of Impact
Physical Environment						
	Springs	No				
	Standing water bodies (ponds, lakes, etc.)	Yes	_	Low (L)	Likely	
	Flowing water bodies (rivers, rivulets, streams, canals, etc.)	Yes	_	Low (L)	Likely	Increase in turbidity
	Ground water sources (open wells, bore wells, etc.)	No				
	Meandering River	No				
	Erosion prone stretches	Yes	_	Medium (M)	Likely	Problem of soil erosion is expected in some locations. particularly soil erosion due to a lack of drainage facilities.
	Areas with high slope (higher than 15 percent)	Yes	_	Medium (M)	Likely	high slope in almost entire project area which will face problem of soil erosion.
	Landforms (hills, valleys)	Yes	_	Medium (M)	Likely	Project road mostly passing through the hill area will require new hill cutting and steep slopes.
	Coal Mine	No				
Biological Environment						
	National Park / Wildlife Sanctuary	Consider both end of the bridges and within 10km radius as per law				No National Park / Wildlife Sanctuary are locating along the project road
	Reserved Forests	Consider both end of the bridges and within 10km radius as per law				No reserved forest are locating along the project road
	Community Forest/ Fisheries	Local consultation Fish breeding Around the area – unique amphibian species (relevant dept.)				No
	Large Trees / Woodland	Visual checks – if found, please click photograph	_	Medium (M)	Likely	Tree cutting cause soil erosion

S. No.	Environmental & Social Features	Presence within 500 mts from activity sites (Yes/No) If yes, mention distance in km)	Type of Impact (+ or -)	Significance of Impact (High (H), Medium (M), Low (L))	Likelihood of Impact (Likely, Unlikely)	Description of Impact
	Sacred Groves	Discuss with community if found, please click photograph				No sacred groves are founding along the project road
	Presence of endangered species / habitat areas	Consider both end of the bridges and within 10km radius as per law				No
	Migratory routes	Please refer to ESMF and check if any intercepts with the project area				No
	Ecologically sensitive areas	Consider both end of the bridges and within 10km radius as per law				No
Human Environment						
	Settlements/Habitations	Yes	+	Medium (M)	Likely	10 settlements, improve the connectivity
	Sensitive Receptors (schools, hospitals, markets etc.)	Yes	–	Low	Likely	Increase of noise and air pollution.
	Drinking water sources	No				
	Underground utility lines like electricity lines, pipelines for gas, etc	No				
	Physical cultural resources – Protected monuments, historical/ heritage sites etc.	No				
	Physical cultural resources – Religious structures, other sites significant to community	No				
	Agricultural land/ Other activities					
	Defence Installations / Airports	No				
	Heavy polluting Industry	No				
	Water or Waste water Treatment Plant	No				
Social Safeguard Issues						
	Any loss / reduction of access to traditional dependent communities (to areas where they earn for their					

S. No.	Environmental & Social Features	Presence within 500 mts from activity sites (Yes/No) If yes, mention distance in km)	Type of Impact (+ or -)	Significance of Impact (High (H), Medium (M), Low (L))	Likelihood of Impact (Likely, Unlikely)	Description of Impact
	primary or substantial livelihood).					
	Adverse impacts to women, gender issues including economic and safety concerns	Community consultation				
	Presence of Indigenous / vulnerable communities	Community consultation				
	Land acquisition of private land leading to loss of shelter and livelihood					
	Whether land acquired / donated is more than 10% of the total holding					
	Land acquisition resulting to loss of income; livelihood; sources of livelihood; loss of access to common property resources and / or private residential and/or property resources.					
	Possible conflicts with and/or disruption to local community					
	Significant issues raised by the stakeholders during consultation	MoM of the community consultation				

Annexure 2: Social Screening Checklist

Urban Roads (Town roads) and Non-urban roads under MITP (World Bank) initiative. Public Works Department (Roads), Government of Meghalaya

Social Screening Format

General Information:

Name of Project: **Nongstoin Maweit Road** Urban/ Rural Area: **Rural**

Tehsil: **Nongstoin** District: **West Khasi Hills**

1. Does the project activity require additional land area? **No**

2. If response in above question is yes, then fill information against sl. no. 3, 4& 5 (as applicable), otherwise skip to sl. no. 6

Details	Unit	Quantity	Classification/ Category of land	Present Usage of land
3. Private land required	Acres			
a. No. of land owners affected	Number			
b. Persons whose livelihood is primarily dependent on land likely to be acquired/required	Number			
c. BPL Families (among a+b)	Number			
d. Total Vulnerable Families (including BPL) (among a+b)	Number			
4. Government Land	Acres			
a. Non-Titleholders – Encroachers Families	Number			
b. Non-Titleholders – Squatters Families	Number			
c. Various other users of this Govt. Land; Families	Number			
d. People losing livelihoods/ access due to loss of Govt. Lands project; Families	Number			
5. Tribal Families affected	Number			

6. Residential structures/buildings affected due to project activities:

Details	Unit	Quantity
a. Total Affected Families	Number	Nil
b. Title Holders	Number	Not Applicable
c. Non-Titleholders – Encroachers	Number	Not Applicable
d. Non-Titleholders – Squatters	Number	Not Applicable
e. BPL Families losing Dwellings	Number	Not Applicable
f. Total vulnerable families (including BPL)	Number	Not Applicable
g. Total Tribal Families	Number	Not Applicable

7. Commercial units (permanently) affected due to project activities:

Details	Unit	Quantity
a. Total Affected Families	Number	Nil
b. Title Holders	Number	Nil
c. Non-Titleholders – Encroachers	Number	Nil
d. Non-Titleholders – Squatters	Number	Nil
f. BPL Families losing Commercial Properties	Number	Nil
g. Total vulnerable families (including BPL)	Number	Nil
h. Total Tribal Families	Number	Nil
i. Vendors affected	Number	Nil
j. Petty shop keepers & Kiosk affected	Number	Nil

8. Common Property Resources (permanently) Affected: (Please give each type by number)

Description	Unit	Quantity
Religious structure (specify)	Number	Nil
Well	Number	Nil
Waiting Shed/Rain Shelter	Number	Nil
Schools/Educational/ Cultural Structures	Number	Nil
Government/ Community Structures	Number	Nil

9. Residential and/or Commercial units affected during construction activities:

Details	Unit	Quantity
a. Total Affected Residential/Commercial Families	Number	Nil
b. Title Holders	Number	Nil
c. Non-Titleholders – Encroachers	Number	Nil
d. Non-Titleholders – Squatters	Number	Nil
e. Vendors affected (Non-Titleholder)	Number	Nil
f. Petty shop keepers & Kiosk affected (Non-Titleholder)	Number	Nil

10. Summary:

S No	Items	Results
1	Total no of Families (permanently) affected due to proposed project activity (Single or multiple impacts)	**Nil**
2	Total no of BPL Families (permanently) affected due to proposed project activity (Single or multiple impacts)	**Nil**
3	Total no of vulnerable Families (permanently) affected (including BPL) due to proposed project activity (Single or multiple impacts)	**Nil**
4	Total no of Tribal Families (permanently) affected (including BPL) due to proposed project activity (Single or multiple impacts)	**Nil**
5	Total number of Community Property Resources temporarily affected	**Nil**
6.	Total Number of Families temporarily affected during construction	Nil

11. Result/ Outcome of Social Screening Exercise

Output	Outcome	Triggered for the Project
If the number of affected due to scheme/ sub-project implementation is **less than equal to** 200 persons (all impacts combined together – land, structure, other assets, livelihood, etc) or there is only temporary impact during construction	Abbreviated Resettlement Action Plan (ARAP) required	**Not Applicable**
If the number of affected due to scheme/ sub-project implementation is **more than 200 persons** (all impacts combined together – land, structure, other assets, livelihood, etc)	Resettlement Action Plan (RAP) required	Not Applicable
If only govt. land, forest land, other department land is impacted and the number of affected persons is nil (all impacts combined together – land, structure, other assets, livelihood, etc)	ARAP/RAP not required	Applicable

12. Additional information to be collected about the site:

Sl. No.	Previous usage of site	Response
1	Whether the present site or part of present site ever used for any of the following purposes? Response column whichever is applicable	
	Worshipping sacred trees/ sacred grooves	No
	Burial place	No
	Grazing cattle/ goats	No
	Other small shrines	No
	Other prayers, rituals, annual or seasonal festivals/ rituals	No
	Habitation place of community Gods/ ancestors/ or any other good or bad supernatural forces	No
	Place of offering (animal sacrifice)	No
	Other purposes (e.g. sports, cattle racing, etc.)	No
	Sensitive social/ cultural/ historical folk tales or oral history of the site (which may later on influence the project)	No
	Open defecation	No
2	No specific usage/ plain ground/ agricultural	No

Annexure 3:Baseline Monitoring Result

Air Quality Monitoring

Issued to:

Test Report No.	:	**ITL/ENV/PR/AA/2201240004**
Report Issue Date	:	24/01/2022
Sample Receipt Date	:	11/01/2022
Analysis Date	:	11/01/2022 to 16/01/2022
Lab Sample No. & Date	:	**ITL/ENV/PR/AA/2201240004** & 24/01/2022
Reference No.	:	PI/CTKI21-24/WO/GEMPL/1
Date	:	00/00/0000

Nature and Description of Sample	:	Ambient Air Quality Monitoring (AAQM-2)
Type of Sample	:	Air Sample
Date of Sample Collection	:	07/01/2022 to 08/01/2022
Location / Source of Sample	:	Miangkain Latitude- 32°45'40.68" N, Longitude- 28°23'188.13" E Chainage - 26+000 Km, Distance from alignment – 050 m
Sample Quantity	:	NA
Sample Condition	:	OK
Sampling Method	:	CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin-Maweit Road**

Test Results

S No.	Parameter (s)	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM_{10}), µg/m³	IS 5182 Part 23:2006	69	100
2	Particulate Matter ($PM_{2.5}$), µg/m³	CPCB Method Volume-1, 2011	39	60
3	Sulphur dioxide (SO_2), µg/m³	IS 5182 Part 2:2001	6.1	80
4	Oxide of nitrogen (NO_2), µg/m³	IS 5182 Part 6:2006	11.1	80
5	Carbon monoxide (CO), mg/m^3	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

Issued to:

Test Report No.	:	**ITL/ENV/PR/AA/2201240003**
Report Issue Date	:	24/01/2022
Sample Receipt Date	:	11/01/2022
Analysis Date	:	11/01/2022 to 16/01/2022
Lab Sample No. & Date	:	**ITL/ENV/PR/AA/2201240003** & 24/01/2022
Reference No.	:	PI/CTKI21-24/WO/GEMPL/1
Date	:	00/00/0000

Nature and Description of Sample	:	Ambient Air Quality Monitoring (AAQM-1)
Type of Sample	:	Air Sample
Date of Sample Collection	:	07/01/2022 to 08/01/2022
Location / Source of Sample	:	Nongstoin Latitude- 32°45'40.68" N, Longitude- 28°23'188.13" E Chainage - 02+600 Km, Distance from alignment – 050 m
Sample Quantity	:	NA
Sample Condition	:	OK
Sampling Method	:	CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin-Maweit Road**

Test Results

S No.	Parameter (s)	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM_{10}), µg/m³	IS 5182 Part 23:2006	76	100
2	Particulate Matter ($PM_{2.5}$), µg/m³	CPCB Method Volume-1, 2011	42	60
3	Sulphur dioxide (SO_2), µg/m³	IS 5182 Part 2:2001	8.1	80
4	Oxide of nitrogen (NO_2), µg/m³	IS 5182 Part 6:2006	12.1	80
5	Carbon monoxide (CO), mg/m³	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

Issued to:

Test Report No.	:	**ITL/ENV/PR/AA/2201240002**
Report Issue Date	:	24/01/2022
Sample Receipt Date	:	07/01/2022
Analysis Date	:	07/01/2022 to 12/01/2022
Lab Sample No. & Date	:	**ITL/ENV/PR/AA/2201240002** & 24/01/2022
Reference No.	:	PI/CTKI21-24/WO/GEMPL/1
Date	:	00/00/0000

Nature and Description of Sample	:	Ambient Air Quality Monitoring (AAQM-2)
Type of Sample	:	Air Sample
Date of Sample Collection	:	03/01/2022 to 04/01/2022
Location / Source of Sample	:	Miangkain Latitude- 32°45'40.68" N, Longitude- 28°23'188.13" E Chainage - 26+000 Km, Distance from alignment – 050 m
Sample Quantity	:	NA
Sample Condition	:	OK
Sampling Method	:	CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin-Maweit Road**

Test Results

S No.	Parameter (s)	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM_{10}), µg/m³	IS 5182 Part 23:2006	67	100
2	Particulate Matter ($PM_{2.5}$), µg/m³	CPCB Method Volume-1, 2011	38	60
3	Sulphur dioxide (SO_2), µg/m³	IS 5182 Part 2:2001	6.4	80
4	Oxide of nitrogen (NO_2), µg/m³	IS 5182 Part 6:2006	10.4	80
5	Carbon monoxide (CO), mg/m^3	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

Issued to:

Test Report No.	:	**ITL/ENV/PR/AA/2201240001**
Report Issue Date	:	24/01/2022
Sample Receipt Date	:	07/01/2022
Analysis Date	:	07/01/2022 to 12/01/2022
Lab Sample No. & Date	:	**ITL/ENV/PR/AA/2201240001** & 24/01/2022
Reference No.	:	PI/CTKI21-24/WO/GEMPL/1
Date	:	00/00/0000

Nature and Description of Sample	:	Ambient Air Quality Monitoring (AAQM-1)
Type of Sample	:	Air Sample
Date of Sample Collection	:	03/01/2022 to 04/01/2022
Location / Source of Sample	:	Nongstoin Latitude- 32°45'40.68" N, Longitude- 28°23'188.13" E Chainage - 02+600 Km, Distance from alignment – 050 m
Sample Quantity	:	NA
Sample Condition	:	OK
Sampling Method	:	CPCB Method Volume-1, 2011
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin-Maweit Road**

Test Results

S No.	Parameter (s)	Method of Test	Result	Limit As Per NAAQS Dated 18 Nov 2009
1	Particulate Matter (PM_{10}), µg/m³	IS 5182 Part 23:2006	72	100
2	Particulate Matter ($PM_{2.5}$), µg/m³	CPCB Method Volume-1, 2011	41	60
3	Sulphur dioxide (SO_2), µg/m³	IS 5182 Part 2:2001	7.4	80
4	Oxide of nitrogen (NO_2), µg/m³	IS 5182 Part 6:2006	11.2	80
5	Carbon monoxide (CO), mg/m^3	USEPA Method 13	BDL	2
6	Hydrocarbon (HC), µg/m³	CPCB Method Volume-1, 2011	BDL	-
7	Lead (Pb), µg/m³	CPCB Method Volume-1, 2011	BDL	1

* BDL – Below Detection Limit

Issued to:	*Test Report No.*	: ITL/ENV/PR/NS/2201240007-08
	Report Issue Date	: 24/01/2022
	Sample Receipt Date	: NA
	Analysis Date	: NA
	Lab Sample No. & Date	: ITL/ENV/PR/NS/2201240007-08 & 24/01/2022
	Reference No.	: PI/CTKI21-24/WO/GEMPL/1
	Date	: 00/00/0000

Nature and Description of Sample	:	Noise Level Monitoring (NM-2)
Type of Sample	:	Noise Level
Date of Sample Collection	:	Mentioned below in results table
Location / Source of Sample	:	**Miangkain** Latitude- 32°45'40.68" N, Longitude- 28°23'188.13" E Chainage:- 26+000 Km
Sample Quantity	:	NA
Sample Condition	:	NA
Sampling Method	:	NA
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya.** **Nongstoin Maweit Road**

Test Results

Time	Results as per noise monitoring date	
	03/01/2022	07/01/2022
Day 6.00	37.9	38.2
7.00	40.1	39.8
8.00	42.4	43.2
9.00	46.5	45.1
10.00	48.2	47.6
11.00	46.2	47.2
12.00	52.1	51.2
13.00	50.4	50.6
14.00	51.2	50.8
15.00	52.1	51.2
16.00	51.2	51.2
17.00	50.2	50.2
18.00	49.3	47.2
19.00	47.2	46.2
20.00	47.6	45.6
21.00	46.2	44.2
Night 22.00	43.2	42.1
23.00	40.2	39.1
24.00	42.1	39.4
1.00	41.2	38.7
2.00	39.5	39.2
3.00	38.4	38.9
4.00	38.2	38.5
5.00	38.2	38.4
Maximum	**52.1**	**51.2**
Minimum	**37.9**	**38.2**
Ld	**48.2**	**47.7**
Ln	**39.4**	**38.3**
Ldn	**48.6**	**47.9**

Issued to:	***Test Report No.***	: **ITL/ENV/PR/NS/2201240005-06**
	Report Issue Date	: 24/01/2022
	Sample Receipt Date	: NA
	Analysis Date	: NA
	Lab Sample No. & Date	: **ITL/ENV/PR/NS/2201240005-06 & 24/01/2022**
	Reference No.	: PI/CTKI21-24/WO/GEMPL/1
	Date	: 00/00/0000

Nature and Description of Sample	:	Noise Level Monitoring (NM-1)
Type of Sample	:	Noise Level
Date of Sample Collection	:	Mentioned below in results table
Location / Source of Sample	:	**Nongstoin** Latitude- 32°45'40.68" N, Longitude- 28°23'188.13" E Chainage :- 02+600 Km
Sample Quantity	:	NA
Sample Condition	:	NA
Sampling Method	:	NA
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin Maweit Road**

Test Results

Time	Results as per noise monitoring date	
	03/01/2022	07/01/2022
Day 6.00	39.4	38.4
7.00	40.1	39.1
8.00	44.2	43.2
9.00	46.2	47.2
10.00	48.2	46.5
11.00	51.2	50.1
12.00	52.1	51.2
13.00	51.2	51.4
14.00	52.3	52.1
15.00	52.1	50.1
16.00	50.1	49.1
17.00	49.2	48.4
18.00	48.2	47.5
19.00	48.9	46.1
20.00	47.2	45.7
21.00	45.2	43.4
Night 22.00	42.1	41.2
23.00	38.4	37.8
24.00	37.5	36.8
1.00	36.2	37.5
2.00	37.2	36.5
3.00	36.2	37.5
4.00	35.2	36.4
5.00	37.5	37.2
Maximum	**52.3**	**52.1**
Minimum	**35.2**	**36.4**
Ld	**48.6**	**47.7**
Ln	**36.4**	**36.5**
Ldn	**48.0**	**47.4**

Issued to:

Test Report No.	:	**ITL/ENV/PR/GW/2201240010**
Report Issue Date	:	24/01/2022
Sample Receipt Date	:	11/01/2022
Analysis Date	:	11/01/2022 to 16/01/2022
Lab Sample No. & Date	:	**ITL/ENV/PR/GW/2201240010** & 24/01/2022
Reference No.	:	PI/CTKI21-24/WO/GEMPL/1
Date	:	00/00/0000

Nature and Description of Sample	:	Ground Water
Type of Sample	:	Water Sample
Date of Sample Collection	:	08/01/2022
Location / Source of Sample	:	Nonglver Latitude- 26.694302 N, longitude- 94.413154 E Chainage - 34+050 Km, Distance from alignment - 100m
Sample Quantity	:	2.5 liter
Sample Condition	:	Sealed properly
Sampling Method	:	IS 3025 Part I, ITL/Micro/SOP/03
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin-Maweit Road**

Test Results

S. No.	Parameter(s)	Test Method	Test Result	Acceptable Limit	Permissible Limit
1	Colour, Hazen units	IS 3025 Part 4	< 1	5 Max	15 Max
2	Odour	IS 3025 Part 5	Agreeable	Agreeable	Agreeable
3	Temperature, °C	IS 3025 Part 9	19	-	-
4	pH Value at 25°C	IS 3025 Part 11	6.64	6.5 – 8.5	No Relaxation
5	Conductivity at 25°C, µS/cm	IS 3025 Part 14	284	-	-
6	Total Dissolve Solids, mg/l	IS 3025 Part 16	185	500 Max	2000 Max
7	Calcium (as Ca) mg/l	IS 3025 Part 40	16.8	75 Max	200 Max
8	Magnesium (as Mg), mg/l	IS 3025 Part 46	10.5	30 Max	100 Max
9	Sodium (as Na), mg/l	IS 3025 Part 45	20.9	-	-
10	Potassium (as K), mg/l	IS 3025 Part 45	8.4	-	-
11	Alkalinity (as HCO_3), mg/L	IS 3025 Part 23	92	-	-
12	Sulphate (as SO4), mg/l	IS 3025 Part 24	32	200 Max	400 Max
13	Chloride (as Cl) mg/l	IS 3025 Part 32	18.4	250 Max	1000 Max
14	Nitrate (as NO3), mg/l	IS 3025 Part 34	0.8	45 Max	No Relaxation
15	Boron (as B), mg/L	IS 3025 Part 57	BDL	0.5 Max	1.0 Max
16	Nitrite (as NO_2), mg/L	IS 3025 Part 34	0.05	-	-
17	Fluoride (as F), mg/L	IS 3025 Part 60	BDL	1 Max	1.5 Max
18	Dissolve Phosphate (as PO_4), mg/L	IS 3025 Part 31	BDL	-	-
19	Total Hardness (as $CaCO_3$), mg/L	IS 3025 Part 21	85	200 Max	600 Max
20	E. Coli, (MPN/100ml)	IS 1622: 1981	Absent	Shall not be detected in 100ml sample	
21	Total Coliform, (MPN/100ml)	IS 1622: 1981	Absent	Shall not be detected in 100ml sample	

Issued to:

Test Report No.	:	**ITL/ENV/PR/GW/2201240009**
Report Issue Date	:	24/01/2022
Sample Receipt Date	:	11/01/2022
Analysis Date	:	11/01/2022 to 16/01/2022
Lab Sample No. & Date	:	**ITL/ENV/PR/GW/2201240009** & 24/01/2022
Reference No.	:	PI/CTKI21-24/WO/GEMPL/1
Date	:	00/00/0000

Nature and Description of Sample	:	Ground Water
Type of Sample	:	Water Sample
Date of Sample Collection	:	08/01/2022
Location / Source of Sample	:	Nongstoin Latitude- 26.694302 N, longitude- 94.413154 E Chainage - 02+900 Km, Distance from alignment - 100m
Sample Quantity	:	2.5 liter
Sample Condition	:	Sealed properly
Sampling Method	:	IS 3025 Part I, ITL/Micro/SOP/03
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin-Maweit Road**

Test Results

S. No.	Parameter(s)	Test Method	Test Result	Acceptable Limit	Permissible Limit
1	Colour, Hazen units	IS 3025 Part 4	< 1	5 Max	15 Max
2	Odour	IS 3025 Part 5	Agreeable	Agreeable	Agreeable
3	Temperature, °C	IS 3025 Part 9	18	-	-
4	pH Value at 25°C	IS 3025 Part 11	6.67	6.5 – 8.5	No Relaxation
5	Conductivity at 25°C, µS/cm	IS 3025 Part 14	357	-	-
6	Total Dissolve Solids, mg/l	IS 3025 Part 16	232	500 Max	2000 Max
7	Calcium (as Ca) mg/l	IS 3025 Part 40	22.4	75 Max	200 Max
8	Magnesium (as Mg), mg/l	IS 3025 Part 46	13.5	30 Max	100 Max
9	Sodium (as Na), mg/l	IS 3025 Part 45	24.1	-	-
10	Potassium (as K), mg/l	IS 3025 Part 45	11.2	-	-
11	Alkalinity (as HCO_3), mg/L	IS 3025 Part 23	109	-	-
12	Sulphate (as SO4), mg/l	IS 3025 Part 24	36	200 Max	400 Max
13	Chloride (as Cl) mg/l	IS 3025 Part 32	21.4	250 Max	1000 Max
14	Nitrate (as NO3), mg/l	IS 3025 Part 34	1.1	45 Max	No Relaxation
15	Boron (as B), mg/L	IS 3025 Part 57	BDL	0.5 Max	1.0 Max
16	Nitrite (as NO_2), mg/L	IS 3025 Part 34	0.06	-	-
17	Fluoride (as F), mg/L	IS 3025 Part 60	BDL	1 Max	1.5 Max
18	Dissolve Phosphate (as PO_4), mg/L	IS 3025 Part 31	BDL	-	-
19	Total Hardness (as $CaCO_3$), mg/L	IS 3025 Part 21	111	200 Max	600 Max
20	E. Coli, (MPN/100ml)	IS 1622: 1981	Absent	Shall not be detected in 100ml sample	
21	Total Coliform, (MPN/100ml)	IS 1622: 1981	Absent	Shall not be detected in 100ml sample	

Surface Water Monitoring

Issued to:

Test Report No.	:	**ITL/ENV/PR/SW/2201240012**
Report Issue Date	:	24/01/2022
Sample Receipt Date	:	11/01/2022
Analysis Date	:	11/01/2022 to 16/01/2022
Lab Sample No. & Date	:	**ITL/ENV/PR/SW/2201240012** & 24/01/2022
Reference No.	:	PI/CTKI21-24/WO/GEMPL/1
Date	:	00/00/0000

Nature and Description of Sample	:	Surface Water
Type of Sample	:	Water Sample
Date of Sample Collection	:	07/01/2022
Location / Source of Sample	:	Maweit Latitude- 26.700120 N longitude- 94.437104 E Chainage - 33+300 Km, Distance from alignment - 100m
Sample Quantity	:	2.5 Liter
Sample Condition	:	OK
Sampling Method	:	IS 3025 Part-I, ITL/Micro/SOP/03
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin-Maweit Road**

Test Results

S. No.	Parameter(s)	Test Method	Test Result	Acceptable Limit	Permissible Limit
1	Colour, Hazen units	IS 3025 Part 4	< 1	5 Max	15 Max
2	Odour	IS 3025 Part 5	Agreeable	Agreeable	Agreeable
3	pH Value at 25°C	IS 3025 Part 11	6.78	6.5 – 8.5	No Relaxation
4	Temperature, °C	IS 3025 Part 9	21.1	-	-
5	Conductivity at 25°C, µS/cm	IS 3025 Part 14	204	-	-
6	Total Dissolve Solids, mg/l	IS 3025 Part 16	133	500 Max	2000 Max
7	Total Suspended Solids, mg/l	IS 3025 Part 17	6	-	-
8	Total Solids, mg/l	IS 3025 Part 15	139	-	-
9	Calcium (as Ca), mg/l	IS 3025 Part 40	14.4	75 Max	200 Max
10	Magnesium (as Mg), mg/l	IS 3025 Part 46	6.1	30 Max	100 Max
11	Sodium (as Na), mg/l	IS 3025 Part 45	15.2	-	-
12	Potassium (as K), mg/l	IS 3025 Part 45	5.4	-	-
13	Total Alkalinity (as CaCO3), mg/l	IS 3025 Part 23	64	200 Max	600 Max
14	Sulphate (as SO4), mg/l	IS 3025 Part 24	28	200 Max	400 Max
15	Chloride (as Cl), mg/l	IS 3025 Part 32	12.4	250 Max	1000 Max
16	Nitrate (as NO3), mg/l	IS 3025 Part 34	1.5	45 Max	No Relaxation
17	Ammonia (as NH3), mg/l	IS 3025 Part 34	0.24	0.5 Max	No Relaxation
18	Iron (as Fe), mg/l	IS 3025 Part 53	0.08	0.3 Max	No Relaxation
19	Dissolve Phosphate (as PO4), mg/l	IS 3025 Part 31	0.7	-	-
20	Total Hardness (as CaCO3), mg/l	IS 3025 Part 21	61	200 Max	600 Max
21	Biochemical Oxygen Demand, mg/l	IS 3025 Part 44	02	-	-
22	Chemical Oxygen Demand, mg/l	IS 3025 Part 58	11	-	-
23	Dissolve Oxygen, mg/l	IS 3025 Part 38	6.5	-	-
24	Lead as Pb, mg/l	IS 3025 Part 47	BDL	0.01	No Relaxation
25	Nickel as Ni, mg/l	IS 3025 Part 54	BDL	0.02	No Relaxation
26	Copper as Cu, mg/l	IS 3025 Part 42	BDL	0.05	1.5
27	Zinc as Zn, mg/l	IS 3025 Part 49	0.8	5	15
28	Cadmium as Cd, mg/l	IS 3025 Part 41	BDL	0.003	No Relaxation
29	Arsenic as As, mg/l	IS 3025 Part 37	BDL	0.01	0.05
30	Total Chromium	IS 3025 Part 52	BDL	0.05	No Relaxation

Issued to:

Test Report No.	:	**ITL/ENV/PR/SW/2201240011**
Report Issue Date	:	24/01/2022
Sample Receipt Date	:	11/01/2022
Analysis Date	:	11/01/2022 to 16/01/2022
Lab Sample No. & Date	:	**ITL/ENV/PR/SW/2201240011** & 24/01/2022
Reference No.	:	PI/CTKI21-24/WO/GEMPL/1
Date	:	00/00/0000

Nature and Description of Sample	:	Surface Water
Type of Sample	:	Water Sample
Date of Sample Collection	:	07/01/2022
Location / Source of Sample	:	Nongstoin Latitude- 25.700120 N longitude- 94.437104 E Chainage - 04+450 Km, Distance from alignment - 100m
Sample Quantity	:	2.5 Liter
Sample Condition	:	OK
Sampling Method	:	IS 3025 Part-I, ITL/Micro/SOP/03
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin-Maweit Road**

Test Results

S. No.	Parameter(s)	Test Method	Test Result	Acceptable Limit	Permissible Limit
1	Colour, Hazen units	IS 3025 Part 4	< 1	5 Max	15 Max
2	Odour	IS 3025 Part 5	Agreeable	Agreeable	Agreeable
3	pH Value at 25°C	IS 3025 Part 11	7.14	6.5 – 8.5	No Relaxation
4	Temperature, °C	IS 3025 Part 9	19.2	-	-
5	Conductivity at 25°C, µS/cm	IS 3025 Part 14	240	-	-
6	Total Dissolve Solids, mg/l	IS 3025 Part 16	156	500 Max	2000 Max
7	Total Suspended Solids, mg/l	IS 3025 Part 17	4	-	-
8	Total Solids, mg/l	IS 3025 Part 15	160	-	-
9	Calcium (as Ca), mg/l	IS 3025 Part 40	15.2	75 Max	200 Max
10	Magnesium (as Mg), mg/l	IS 3025 Part 46	8.4	30 Max	100 Max
11	Sodium (as Na), mg/l	IS 3025 Part 45	16.5	-	-
12	Potassium (as K), mg/l	IS 3025 Part 45	6.4	-	-
13	Total Alkalinity (as CaCO3), mg/l	IS 3025 Part 23	71	200 Max	600 Max
14	Sulphate (as SO4), mg/l	IS 3025 Part 24	34	200 Max	400 Max
15	Chloride (as Cl), mg/l	IS 3025 Part 32	16.2	250 Max	1000 Max
16	Nitrate (as NO3), mg/l	IS 3025 Part 34	1.2	45 Max	No Relaxation
17	Ammonia (as NH3), mg/l	IS 3025 Part 34	0.28	0.5 Max	No Relaxation
18	Iron (as Fe), mg/l	IS 3025 Part 53	0.04	0.3 Max	No Relaxation
19	Dissolve Phosphate (as PO4), mg/l	IS 3025 Part 31	0.4	-	-
20	Total Hardness (as CaCO3), mg/l	IS 3025 Part 21	72.4	200 Max	600 Max
21	Biochemical Oxygen Demand, mg/l	IS 3025 Part 44	02	-	-
22	Chemical Oxygen Demand, mg/l	IS 3025 Part 58	09	-	-
23	Dissolve Oxygen, mg/l	IS 3025 Part 38	6.2	-	-
24	Lead as Pb, mg/l	IS 3025 Part 47	BDL	0.01	No Relaxation
25	Nickel as Ni, mg/l	IS 3025 Part 54	BDL	0.02	No Relaxation
26	Copper as Cu, mg/l	IS 3025 Part 42	BDL	0.05	1.5
27	Zinc as Zn, mg/l	IS 3025 Part 49	0.6	5	15
28	Cadmium as Cd, mg/l	IS 3025 Part 41	BDL	0.003	No Relaxation
29	Arsenic as As, mg/l	IS 3025 Part 37	BDL	0.01	0.05
30	Total Chromium	IS 3025 Part 52	BDL	0.05	No Relaxation

Issued to:

Test Report No.	:	**ITL/ENV/PR/SS/2201240014**
Report Issue Date	:	24/01/2022
Sample Receipt Date	:	11/01/2022
Analysis Date	:	11/01/2022 to 16/01/2022
Lab Sample No. & Date	:	**ITL/ENV/PR/SS/2201240014** & 24/01/2022
Reference No.	:	PI/CTKI21-24/WO/GEMPL/1
Date	:	00/00/0000

Nature and Description of Sample	:	Soil Sample
Type of Sample	:	Soil Sample
Date of Sample Collection	:	07/01/2022
Location / Source of Sample	:	**Miangkain** Latitude- 26.704350 N Longitude- 94.440923 E Chainage - 26+000 Km, Distance from alignment - 150m
Sample Quantity	:	5 kg
Sample Condition	:	Sealed, Ok
Sampling Method	:	ITL/SOP/Soil/01
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin-Maweit Road**

Test Results

S. No.	Parameter(S)	Test Method	Unit	Test Result
1	Soil Texture	ITL/SOP/ENV/Soil/07	-	Silty Clay Soil
2	Soil Colour	ITL/SOP/ENV/Soil/08		Greyish Brown
3	pH Value at 25°C	ITL/SOP/ENV/Soil/01	-	7.88
4	Conductivity at 25°C	ITL/SOP/ENV/Soil/02	µS/cm	714
5	Moisture	ITL/SOP/ENV/Soil/03	% by mass	9.5
6	Bulk Density	ITL/SOP/ENV/Soil/04	gm/cc	1.29
7	Water Holding Capacity	ITL/SOP/ENV/Soil/05	Inches/foot	1.17
8	Nitrogen as N	ITL/SOP/ENV/Soil/09	mg/Kg	22.8
9	Phosphorus	ITL/SOP/ENV/Soil/10	mg/Kg	3.99
10	Potassium (as K)	ITL/SOP/ENV/Soil/11	mg/Kg	68.4
11	Calcium as Ca	ITL/SOP/ENV/Soil/13	mg/Kg	59
12	Nitrate as NO3	ITL/SOP/ENV/Soil/12	mg/Kg	104
13	Sulphate as SO4	ITL/SOP/ENV/Soil/14	mg/Kg	14.2
14	Chloride	ITL/SOP/ENV/Soil/15	mg/Kg	5.9
15	Organic Carbon	ITL/SOP/ENV/Soil/18	% by mass	4.9
16	Organic Matter	ITL/SOP/ENV/Soil/17	% by mass	6.2
17	Total Soluble Solids	ITL/SOP/ENV/Soil/16	mg/Kg	13.4
18	Particle size distribution			
a	Sand	ITL/SOP/ENV/Soil/06	% by mass	18.2
b	Silt	ITL/SOP/ENV/Soil/06	% by mass	39.2
c	Clay	ITL/SOP/ENV/Soil/06	% by mass	42.6

Issued to:

Test Report No.	:	**ITL/ENV/PR/SS/2201240013**
Report Issue Date	:	24/01/2022
Sample Receipt Date	:	11/01/2022
Analysis Date	:	11/01/2022 to 16/01/2022
Lab Sample No. & Date	:	**ITL/ENV/PR/SS/2201240013** & 24/01/2022
Reference No.	:	PI/CTKI21-24/WO/GEMPL/1
Date	:	00/00/0000

Nature and Description of Sample	:	Soil Sample
Type of Sample	:	Soil Sample
Date of Sample Collection	:	07/01/2022
Location / Source of Sample	:	**Nongstoin** Latitude- 26.704350 N Longitude- 94.440923 E Chainage - 02+600 Km, Distance from alignment - 150m
Sample Quantity	:	5 kg
Sample Condition	:	Sealed, Ok
Sampling Method	:	ITL/SOP/Soil/01
Name of the Sample Collecting Officer	:	By ITL Sampling Executive
Any Other Information (if any)	:	**Environmental Baseline Monitoring for Road Project at Meghalaya. Nongstoin-Maweit Road**

Test Results

S. No.	Parameter(S)	Test Method	Unit	Test Result
1	Soil Texture	ITL/SOP/ENV/Soil/07	-	Silty Clay Soil
2	Soil Colour	ITL/SOP/ENV/Soil/08		Greyish Brown
3	pH Value at 25°C	ITL/SOP/ENV/Soil/01	-	8.15
4	Conductivity at 25°C	ITL/SOP/ENV/Soil/02	µS/cm	677
5	Moisture	ITL/SOP/ENV/Soil/03	% by mass	9.1
6	Bulk Density	ITL/SOP/ENV/Soil/04	gm/cc	1.30
7	Water Holding Capacity	ITL/SOP/ENV/Soil/05	Inches/foot	1.22
8	Nitrogen as N	ITL/SOP/ENV/Soil/09	mg/Kg	25.1
9	Phosphorus	ITL/SOP/ENV/Soil/10	mg/Kg	4.21
10	Potassium (as K)	ITL/SOP/ENV/Soil/11	mg/Kg	73.1
11	Calcium as Ca	ITL/SOP/ENV/Soil/13	mg/Kg	64
12	Nitrate as NO3	ITL/SOP/ENV/Soil/12	mg/Kg	101
13	Sulphate as SO4	ITL/SOP/ENV/Soil/14	mg/Kg	13.4
14	Chloride	ITL/SOP/ENV/Soil/15	mg/Kg	5.2
15	Organic Carbon	ITL/SOP/ENV/Soil/18	% by mass	4.5
16	Organic Matter	ITL/SOP/ENV/Soil/17	% by mass	6.5
17	Total Soluble Solids	ITL/SOP/ENV/Soil/16	mg/Kg	14.2
18	Particle size distribution			
a	Sand	ITL/SOP/ENV/Soil/06	% by mass	23.4
b	Silt	ITL/SOP/ENV/Soil/06	% by mass	34.1
c	Clay	ITL/SOP/ENV/Soil/06	% by mass	42.5

Annexure 4: Air Modelling Report

Introduction

The impacts in the operation stage for air would be less severe as compared to that in construction phase. After completion of road improvement works, smoothened new pavement and widened roads reduce fugitive dust emissions. This reduced vehicular emission is due to uniform speed and less frequent acceleration and deceleration of vehicles. With reduction in the levels of CO_2, NO_x, CO and HC emissions from the operating vehicles, there will be extensive saving on fuel consumption. Air pollution can be an important concern due to increase in number of vehicles on the improved roads and poor maintenance of vehicles. To assess the likely concentrations at the critical location along the project road corridors, the prediction of the pollutant concentrations has been carried out for project using e AERMOD View^{TM} model based on Gaussian Equation. The current and projected traffic volume of **A20_2 (Balighat Tiniali to Nakachari)** road has been used for the prediction. The modeling was carried out using AERMOD developed by USEPA. The AERMOD air dispersion model is USEPAs official "Appendix A" air dispersion model for regulatory use and was developed by the AERMIC (The American Meteorological Society/EPA Regulatory Model Improvement Committee) work group (Cimorelli et al., 2004). AERMOD aims at modeling short-range (up to 50 km) dispersion from a variety of polluting sources (e.g., point, area, and volume sources) using a number of model configurations. These configurations include different sets of urban or rural dispersion coefficients as well as simple and complex topography. The model has the capacity to employ hourly sequential pre-processed meteorological data to estimate concentrations of pollutants at receptor locations at different time scales ranging from 1 h to 12 months. AERMOD is an advanced plume model that incorporates updated treatments of the boundary layer theory, understanding of turbulence and dispersion, and includes handling of terrain interactions.

Objectives of the Study

1. To estimate the emission inventory of the various sources around the project.
2. To estimate the emission inventory with the project development
3. To assess regulatory requirements
4. To recommend the prevention and mitigation measures to reduce the impacts

Tools and Methods

The major source of pollutants from the proposed project road is vehicular exhaust i.e. line source during the operational phase. Source dispersion analysis is assumed based on the AERMOD ViewTM model. This model enables analysis with respect to PM, and NOx, and gives results in easy-to-understand graphical format.

The following steps are involved in the analysis:

5. Inputs are entered into the software as per the general modeling parameters.
6. Information on the roadway network, traffic volume, and receptors are added to the software.
7. The analysis process is done by the model.

Input(s) and assumptions

Sl. no	Input Required		Availability for project
1.	Traffic Parameters	Traffic Volume	Yes
		Traffic Composition	Yes

		Type of Fuel used by each category	Yes
		Average Speed of the Vehicles	Yes
2.	Meteorological Parameters	Wind Speed, Wind Direction, Cloud Cover, Temperature, Humidity, Station Pressure, etc	IMD Weather data
3.	Emission Parameters	Expressed in grams/distance travelled	CPCB 2011
		Expressed in grams/m2/second emitted	US-EPA, AP42
		Expressed in grams/second emitted	US-EPA, AP42
4.	Road Geometry	Road Width	Actual
		Median Width	Actual
5.	Receptor	Uniform grid	Uniform grid

Model Inputs

AERMOD View™ was used for evaluating the emission scenarios for the proposed project. The inputs to the model are defined in 5 functional pathways as represented in the following sections. Each of these functional parameters includes several options that may be user-defined or set as default, the details of some of these essential elements of AERMOD View™ runs were explained in the discussions.

Control pathway inputs

8. **Default option**
9. **Calculate the concentration**
10. **Averaging period of 24hr and 1hr depending on the NAAQS and pollutant type**

Source pathway inputs

11. **Includes definition of source, its locations**
12. **Vehicle source parameter include emissions (g/m^2/s)**
13. **Construction and haul road within; area source parameter include emissions (g/m^2 /s)**

Receptors pathway inputs

14. **Cartesian grid starting at the SE corner of the ward with 400m increment over X & Y coordinates, thus forming a receptor output grid radius of 1km**
15. **Uniform grid is selected with 10x10 cell size**

Meteorology pathways inputs

16. **One hourly regional data was used as an input in the meteorology processor to generate model ready input surface & profile meteorology files.**
17. **Roughness length of 1m of measurement height, displacement height of 0.2m, Albedo of 0.2 & measurement height of 14m i.e. the height at which measurements of meteorology have been done**
18. **The minimum wind speed (0.5 m/s lower than 1m/s considered as calm by IMD), minimum mixed layer height (50m), and minimum heat flux 20 W/M2/s).**
19. **The potential temperature gradient above the mixed layer**
20. **The weather data for Thane base station provided by the Indian Meteorological Department (IMD) have been used for the present project. The data was compiled in the AERMET module of A ERMOD View™ and the results of this final analysis were used as input meteorological data**.

Output Pathway

The model ran for 1 hr average as per the pollutant type and the NAAQS standards criteria. The contour for 1st highest reading is shown for each pollutant based on construction and operational scenarios.

Model outputs were obtained for emissions of each of the pollutants in each of the 500m x 500m receptor grid spread across the gridded impact zone. A contour map is plotted for each of the study pollutants and the impact by the line source i.e. operational scenario including additional vehicle assumed to be added due to project. This map is superimposed on the road tile map of the proposed location. The maximum ground level concentration of criterion pollutants modeled by AERMOD ViewTM for the construction and operational scenarios are added to the average value of observed value of criterion pollutant from Ambient Air Quality Monitoring Report at project site to assess the impact of project on air quality.

The results of modeled maximum ground level concentrations of pollutants for both construction and operation phase were presented in the below table.

Description of the component	Chainage	Easting	Northing	PM10 Base	PM10 2041	Nox base	Nox 2041
Church	1+950	325015.18	2823450	0.01046	0.01536	1.15545	0.66448
Church	2+800	324340.30	2823289	0.26455	0.38855	29.2193	16.78559
School	2+900	324237.30	2823244	0.13802	0.20272	15.2442	8.75733
School	3+050	324104.80	2823208	0.12473	0.18320	13.7764	7.91412
School	3+050	324133.00	2823190	0.35469	0.52094	39.17497	22.50477
Educational Institute	**3+550**	323633.20	2823089	0.09273	0.13619	10.24182	5.88360
School	3+850	323520.80	2822841	0.03191	0.04687	3.52472	2.02484
Church	4+250	323198.60	2822682.6	0.02173	0.03192	2.40015	1.37881
School	4+250	323139.15	2822713.3	0.02377	0.03491	2.62507	1.50802
School	4+300	323116.10	2822715	0.02445	0.03591	2.70081	1.55153
Church	14+850	314655.30	2821203	0.05683	0.08347	6.27701	3.60670
Graveyard	15+150	314465.56	2820939.6	0.13103	0.19692	14.80812	9.89731
School	34+150	306245.75	2814632.1	0.12821	0.18836	14.16489	8.15349

Annexure 5: Noise Modelling Report

During operation noise generating sources will be traffic noise and road-side commercial activities at some places. Noise generated due to traffic on this road will have impact on the nearby villages. Cumulative noise levels of these traffic sources were computed using Federal Highway Administration (FHWA's) Traffic Noise Model (TNM). TNM computes incremental highway traffic noise at nearby receivers. As sources of noise, it includes noise emission levels for the following vehicle types:

1. Automobiles: all vehicles with two axles and four tyres primarily designed to carry nine or fewer people (passenger camp, vans) or cargo (vans, light trucks), generally with gross vehicle weight less than 4500 kg.
2. Medium trucks: all cargo vehicles with two axles and six tires – generally with gross vehicle weight between 4500 kg and 12000 kg.
3. Heavy trucks: All cargo vehicles with three or more axles, generally with gross vehicle weight more than 12000 kg.
4. Buses: all vehicles designed to carry more than nine passengers
5. Motorcycles: all vehicles with two or three tires and an open-air driver/passenger compartment.

The procedure for prediction of noise levels involved the following steps:

6. Identification of various receivers,
7. Determination of land uses and activities which may be affected by the noise generated
8. Assemble input parameters
9. Application of the model

- Traffic volume for the projected period is obtained from the traffic projections. The total number of vehicles passing per hour by type- light, medium and heavy along with their average speed is used for predictions. The average speeds for vehicles in our project road around build-up area are considered as 30 kmph for this model.

Table A: AADT at Thahkanar (6th Km)

Year	Growth Factors	AAD															TotalinNumbers	TotalinPCU
		Two Wheeler	Car/Jeep/ Van/Taxi/Auto	Mini/RTVs Bus	Stand.Bus	LCV	2-Axle	3-Axle	Multi-Axle	Agri.Tract. WithTrailor	Agri.Tract. Withou tTrailor	Cycle	Cycle Rickshaw	HandCart	BullockCart	HorseCart		
2021	5.0%	5	52	2	2	40	638	106	0	8	0	0	0	0	0	0	853	2390
2022	5.0%	6	55	2	2	42	670	111	0	8	0	0	0	0	0	0	895	2509
2023	5.0%	6	57	2	2	44	703	116	0	9	0	0	0	0	0	0	940	2635
2024	5.0%	6	60	2	2	46	738	122	0	9	0	0	0	0	0	0	987	2766
2025	5.0%	6	63	2	2	49	775	128	0	10	0	0	0	0	0	0	1036	2905
2026	5.0%	7	66	3	3	51	814	135	0	10	0	0	0	0	0	0	1088	3050
2027	5.0%	7	70	3	3	54	855	142	0	11	0	0	0	0	0	0	1143	3202
2028	5.0%	8	73	3	3	56	897	149	0	11	0	0	0	0	0	0	1200	3363
2029	5.0%	8	77	3	3	59	942	156	0	12	0	0	0	0	0	0	1260	3531
2030	5.0%	8	81	3	3	62	989	164	0	12	0	0	0	0	0	0	1323	3707
2031	5.0%	9	85	3	3	65	1039	172	0	13	0	0	0	0	0	0	1389	3893
2032	5.0%	9	89	3	3	68	1091	181	0	14	0	0	0	0	0	0	1458	4087
2033	5.0%	10	93	4	4	72	1145	190	0	14	0	0	0	0	0	0	1531	4291
2034	5.0%	10	98	4	4	75	1202	199	0	15	0	0	0	0	0	0	1608	4506
2035	5.0%	11	103	4	4	79	1263	209	0	16	0	0	0	0	0	0	1688	4731
2036	5.0%	11	108	4	4	83	1326	220	0	17	0	0	0	0	0	0	1773	4968
2037	5.0%	12	114	4	4	87	1392	231	0	17	0	0	0	0	0	0	1861	5216
2038	5.0%	12	119	5	5	92	1462	242	0	18	0	0	0	0	0	0	1954	5477
2039	5.0%	13	125	5	5	96	1535	254	0	19	0	0	0	0	0	0	2052	5751
2040	5.0%	13	131	5	5	10	1611	267	0	20	0	0	0	0	0	0	2155	6039

2041	5.0%	14	138	5	5	10	1692	280	0	21	0	0	0	0	0	0	2262	6340
2042	5.0%	15	145	6	6	11	1777	294	0	22	0	0	0	0	0	0	2375	6658
2043	5.0%	16	152	6	6	11	1865	309	0	23	0	0	0	0	0	0	2494	6990
2044	5.0%	16	160	6	6	12	1959	325	0	25	0	0	0	0	0	0	2619	7340

Table B:AADT at Nonglyndoh (20th Km)

Year	Growth Factors	AAD															Totalin Number s	TotalinPCU
		Two Wheeler	Car/Jeep/ Van/Taxi/A uto	Mini/RTVs Bus	Stand.Bus	LCV	2-Axle	3-Axle	Multi-Axle	Agri.Tract. WithTrailor	Agri.Tract. Withou tTrailor	Cycl e	Cycl e	HandCart	BullockCart	HorseCart		
2021	5.0%	5	42	2	2	40	637	102	0	7	0	0	0	0	0	0	838	2364
2022	5.0%	6	44	2	2	42	669	107	0	8	0	0	0	0	0	0	880	2483
2023	5.0%	6	46	2	2	44	703	112	0	8	0	0	0	0	0	0	924	2607
2024	5.0%	6	48	2	2	46	738	118	0	8	0	0	0	0	0	0	970	2737
2025	5.0%	6	51	2	2	49	775	124	0	9	0	0	0	0	0	0	1018	2874
2026	5.0%	7	53	3	3	51	813	130	0	9	0	0	0	0	0	0	1069	3018
2027	5.0%	7	56	3	3	54	854	137	0	10	0	0	0	0	0	0	1123	3168
2028	5.0%	8	59	3	3	56	897	144	0	10	0	0	0	0	0	0	1179	3327
2029	5.0%	8	62	3	3	59	942	151	0	11	0	0	0	0	0	0	1238	3493
2030	5.0%	8	65	3	3	62	989	158	0	11	0	0	0	0	0	0	1299	3668
2031	5.0%	9	68	3	3	65	1038	166	0	12	0	0	0	0	0	0	1364	3851
2032	5.0%	9	71	3	3	68	1090	174	0	13	0	0	0	0	0	0	1433	4044
2033	5.0%	10	75	4	4	72	1145	183	0	13	0	0	0	0	0	0	1504	4246
2034	5.0%	10	79	4	4	75	1202	192	0	14	0	0	0	0	0	0	1580	4458
2035	5.0%	11	82	4	4	79	1262	202	0	15	0	0	0	0	0	0	1659	4681
2036	5.0%	11	87	4	4	83	1325	212	0	15	0	0	0	0	0	0	1741	4915

2037	5.0%	12	91	4	4	87	1391	223	0	16	0	0	0	0	0	0	1829	5161
2038	5.0%	12	96	5	5	92	1461	234	0	17	0	0	0	0	0	0	1920	5419
2039	5.0%	13	10	5	5	96	1534	245	0	18	0	0	0	0	0	0	2016	5690
2040	5.0%	13	10	5	5	10	1611	258	0	19	0	0	0	0	0	0	2117	5975
2041	5.0%	14	11	5	5	10	1691	271	0	19	0	0	0	0	0	0	2223	6273
2042	5.0%	15	11	6	6	11	1776	284	0	20	0	0	0	0	0	0	2334	6587
2043	5.0%	16	12	6	6	11	1864	298	0	21	0	0	0	0	0	0	2450	6916
2044	5.0%	16	12	6	6	12	1958	313	0	23	0	0	0	0	0	0	2573	7262

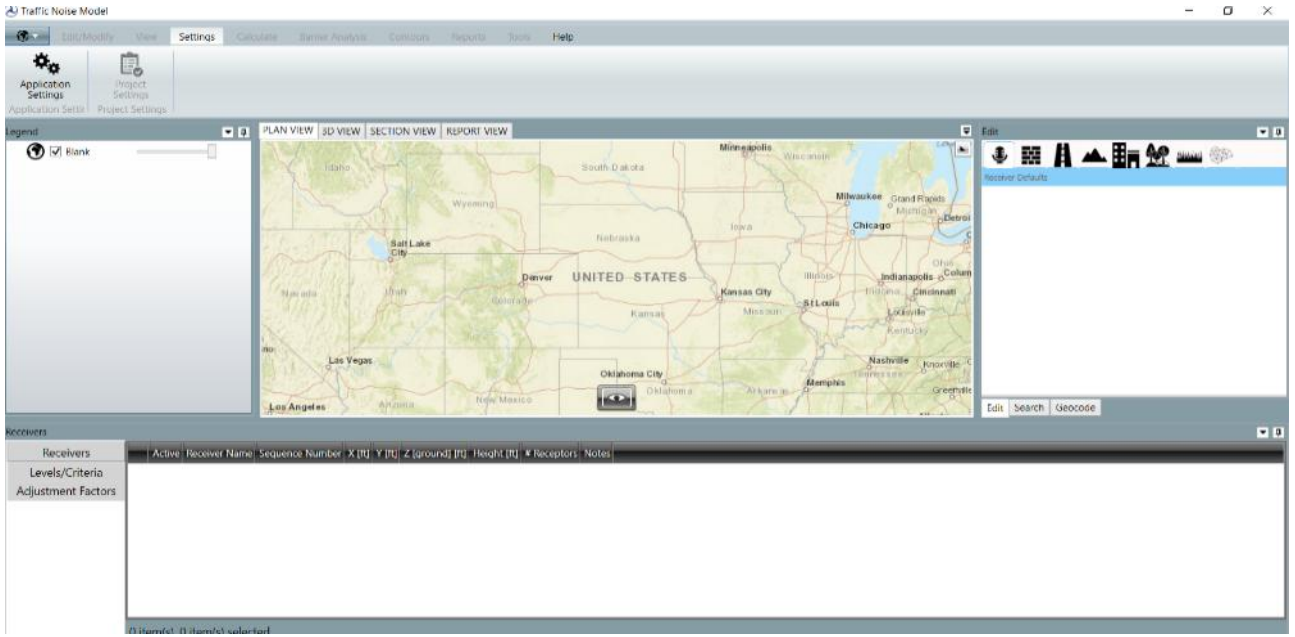

Figure 22: Layout of FHWA's Traffic Noise Model(3.0)

Output of Noise Prediction:

For Year 2021:

REPORT:	**Results: Sound Levels - Input Heights**		
TNM VERSION:	3.0.7.60002	REPORT DATE:	25 January 2022
CALCULATED WITH:	3.0.7.60002	CALCULATION DATE:	25-01-2022 14:29:40
CASE:	Nongstoin-Maweit	ORGANIZATION:	Bongs Prayukti International
ANALYSIS BY:	Anushka Chakraborty	PROJECT/CONTRACT:	Demo
DEFAULT GROUND TYPE:	HardSoil		
ATMOSPHERICS:	20°C, 50%	Average pavement type shall be used unless a state highway agency	
PAVEMENT TYPE(S) USED:	Average	substantiates the use of a different type with approval of FHWA.	

			Noise Reduction			Barrier Cost			
			Min	Avg	Max	Area / Volume	Lineal	Total	Total/DUs
Results for:		DUs	dB	dB	dB	$	$	$	$
Receivers in the Barrier Design:	All	17	0.0	0.0	0.0	0	0	0	0
	All Impacted	4	0.0	0.0	0.0	0	0	0	0
Meeting Noise Reduction Goal:	All	0	---	---	---	0	0	0	---
	All Impacted	0	---	---	---	0	0	0	---

Receiver				Modeled Traffic Noise Levels								
				All Abatement Barriers at Zero Height					With Abatement Barriers			
				LAeq		Increase over Existing				Noise Reduction		Calc.
Name	No.	DUs	Existing LAeq	Calc.	Absolute Criterion	Calc.	Relative Criterion	Type of Impact	Calc. LAeq	Calc.	Goal	Minus Goal
			dBA	dBA	dBA	dBA	dBA		dBA	dBA	dBA	dBA
CHC 1.950-1	1	1	---	57.0	50.0	---	---	Sound Level	57.0	0.0	8.0	-8.0

CHC 2.800-2	2	1	---	45.6	50.0	---	---	None	45.6	0.0	8.0	-8.0
SCH 2.900-1	3	1	---	36.7	50.0	---	---	None	36.7	0.0	8.0	-8.0
SCH 3.050-2	4	1	---	38.4	50.0	---	---	None	38.4	0.0	8.0	-8.0
SCH 3.050-3	5	1	---	37.2	50.0	---	---	None	37.2	0.0	8.0	-8.0
INS 3.550-1	6	1	---	40.7	50.0	---	---	None	40.7	0.0	8.0	-8.0
SCH 3.850-4	7	1	---	38.5	50.0	---	---	None	38.5	0.0	8.0	-8.0
CHC 4.250-3	8	1	---	52.7	50.0	---	---	Sound Level	52.7	0.0	8.0	-8.0
SCH 4.250-5	9	1	---	44.0	50.0	---	---	None	44.0	0.0	8.0	-8.0
SCH 4.300-6	10	1	---	41.3	50.0	---	---	None	41.3	0.0	8.0	-8.0
CHC 14.850-4	11	1	---	47.1	50.0	---	---	None	47.1	0.0	8.0	-8.0
GY 15.150-1	12	1	---	58.5	50.0	---	---	Sound Level	58.5	0.0	8.0	-8.0
CHC 20.300-5	13	1	---	36.6	50.0	---	---	None	36.6	0.0	8.0	-8.0
SCH 34.050-7	14	1	---	41.7	50.0	---	---	None	41.7	0.0	8.0	-8.0
SCH 34.100-8	15	1	---	58.1	50.0	---	---	Sound Level	58.1	0.0	8.0	-8.0
SCH 34.150-9	16	1	---	43.4	50.0	---	---	None	43.4	0.0	8.0	-8.0
SCH 34.250-10	17	1	---	42.8	50.0	---	---	None	42.8	0.0	8.0	-8.0

For year 2044:

REPORT:	**Results: Sound Levels - Input Heights**		
TNM VERSION:	3.0.7.60002	REPORT DATE:	25 January 2022
CALCULATED WITH:	3.0.7.60002	CALCULATION DATE:	25-01-2022 15:51:00
CASE:	Nongstoin-Maweit	ORGANIZATION:	Bongs Prayukti International
ANALYSIS BY:	Anushka Chakraborty	PROJECT/CONTRACT:	Demo
DEFAULT GROUND TYPE:	HardSoil		
ATMOSPHERICS:	20°C, 50%	Average pavement type shall be used unless a state highway agency	
PAVEMENT TYPE(S)	Average	substantiates the use of a different type with approval of	

Results for:		DUs	Noise Reduction Min dB	Noise Reduction Avg dB	Noise Reduction Max dB	Barrier Cost Area / Volume $	Barrier Cost Lineal $	Barrier Cost Total $	Barrier Cost Total/DUs $
Receivers in the Barrier Design:	All	17	0.0	0.0	0.0	0	0	0	0
	All Impacted	6	0.0	0.0	0.0	0	0	0	0
Meeting Noise Reduction Goal:	All	0	---	---	---	0	0	0	---
	All Impacted	0	---	---	---	0	0	0	---

Receiver				Modeled Traffic Noise Levels								
				All Abatement Barriers at Zero Height					With Abatement Barriers			
				LAeq		Increase over Existing				Noise Reduction		Calc.
Name	No.	DUs	Existing LAeq dBA	Calc. dBA	Absolute Criterion dBA	Calc. dBA	Relative Criterion dBA	Type of Impact	Calc. LAeq dBA	Calc. dBA	Goal dBA	Minus Goal dBA
CHC 1.950-1	1	1	---	61.8	50.0	---	---	Sound Level	61.8	0.0	8.0	-8.0
CHC 2.800-2	2	1	---	50.4	50.0	---	---	Sound Level	50.4	0.0	8.0	-8.0
SCH 2.900-1	3	1	---	41.5	50.0	---	---	None	41.5	0.0	8.0	-8.0
SCH 3.050-2	4	1	---	43.2	50.0	---	---	None	43.2	0.0	8.0	-8.0
SCH 3.050-3	5	1	---	42.0	50.0	---	---	None	42.0	0.0	8.0	-8.0
INS 3.550-1	6	1	---	45.5	50.0	---	---	None	45.5	0.0	8.0	-8.0
SCH 3.850-4	7	1	---	43.3	50.0	---	---	None	43.3	0.0	8.0	-8.0
CHC 4.250-3	8	1	---	57.5	50.0	---	---	Sound Level	57.5	0.0	8.0	-8.0
SCH 4.250-5	9	1	---	48.8	50.0	---	---	None	48.8	0.0	8.0	-8.0
SCH 4.300-6	10	1	---	46.2	50.0	---	---	None	46.2	0.0	8.0	-8.0
CHC 14.850-4	11	1	---	51.8	50.0	---	---	Sound Level	51.8	0.0	8.0	-8.0

GY 15.150-1	12	1	---	63.3	50.0	---	---	Sound Level	63.3	0.0	8.0	-8.0
CHC 20.300-5	13	1	---	41.3	50.0	---	---	None	41.3	0.0	8.0	-8.0
SCH 34.050-7	14	1	---	46.4	50.0	---	---	None	46.4	0.0	8.0	-8.0
SCH 34.100-8	15	1	---	62.8	50.0	---	---	Sound Level	62.8	0.0	8.0	-8.0
SCH 34.150-9	16	1	---	48.1	50.0	---	---	None	48.1	0.0	8.0	-8.0
SCH 34.250-10	17	1	---	47.5	50.0	---	---	None	47.5	0.0	8.0	-8.0

Annexure 6: Select Picture Plate

Authorized Quarries that meet environmental and social standards and the necessary technical specifications will be identified by PIU in the project area.

21. Quarries must adhere to World Bank Environmental Health and Safety Guidelines
22. In case of new Quarries, they must have permission from the Department of Mining and Geology and have the necessary clearances from Pollution Control Board and Forest Department and a valid Environmental Clearance from the State Environmental Impact Assessment Authority (SEIAA);
23. Quarry should not be operating in any sites of valuable critical or natural habitat
24. Quarry should not be operating in landslide or erosion prone zones
25. Quarry should not disrupt drainage pattern or cause water pollution
26. Quarry should not be operating on the road where operations can disrupt traffic or pose safety risks
27. Where possible, quarry must include a rehabilitation plan
28. Quarry workers must have access to Personal Protective Equipment during operations
29. Quarry workers do not employ child labour
30. Contractor will finalize the quarry for procurement of construction materials after assessment of the availability of sufficient materials and other logistic arrangements In case the contractor decides to usequarries other than recommended by DPR consultant, then will beselected based on the suitability of the materials.
31. The contractor will procure necessary permission for procurement of materials from Mining Department, District Administration and State Pollution Control Board and shall submit a copy of the approval and the rehabilitation plan to the PIU and Environmental Expert of the SC.
32. Contractor will also work out haul road network and report to Environmental Expert of the PIU and SC will inspect and in turn report to PIU before approval.

Authorized sources of sand that meet environmental and social standards and the necessary technical specifications will be identified by PIU in the project area.

33. Authorized Sources of Sand that meet environmental and social standards and technical specifications identified and supply chain with contractor established
34. Sources of Sand adhere to World Bank Environmental Health and Safety Guidelines
35. Environmental safeguards: As per the Meghalaya Minor Minerals Concession Rules, 2016 (MMMCR), sand mining is treated as a quarry which requires a permit from the Divisional Forest Officer and the Principle Chief Conservator of Forest & HOFF of the Forest Department.
36. Permission will not be allowed during the month from June to August, since it is breeding season for the aquatic life.
37. Source of sand should not be from sites of critical or natural habitat, fish spawning sites, nesting sites or have the presence of known herpetofauna.
38. In case source of sand is from a river bed, the following should be ensured:
39. Sand removal rates, and processes of collection and transportation should not cause any changes to channel morphology, increased erosion, impact to aquatic or riparian habitats, decrease in flood control properties of the sand bank or pollute the river.
40. Sand removal incisions should not be from sites that could undermine the stability of support structures such as bridges
41. Sites should not lead to the creation of deep pools that could lead to an increase in vector borne disease
42. Sand mining operators have access to appropriate Personal Protective Equipment during operations
43. Mining operations should not impact other riparian livelihoods such as fishing

44. Sand mining operations should not employ child labour
45. Sand mining from any sources that could impact ecosystem structure, process or biodiversity in rivers is strictly prohibited and will be ascertained by the environment expert, PIU
46. In case identified source of sand is from a river, the following guidelines are to be followed:http://mines.bih.nic.in/Docs/Sustainable-Sand-MiningManagement-Guidelines-2016.pdf