Executive Summary

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Package V (From km. 63+530 to km. 71+520)

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E. Executive Summary (Package V)

E.1 General

- National Highways & Infrastructure Development Corporation Ltd (NHIDCL), is engaged in the development of National Highways as an executive agency for and on behalf of Government of India and as part of this endeavour, NHIDCL has decided for Improvement to 2 lane with paved shoulder of NH-40 between Shillong to Dawki section including construction of Dawki Bridge in Meghalaya for execution on EPC Mode under JICA.
- The contract for providing consultancy services for feasibility study and detailed project report has been awarded to M/s Transys Consulting Pvt. Ltd. in association with M/s Accrete Consulting Engineers (P) Ltd.
- This Final Detailed Project Report is being submitted in response to the Terms of Reference Clause 9.2, Stage 4 – Detailed Project Report. This report contains the findings of survey and investigations, design of highway, pavement, bridges, CD structures and grade separated structures, cost estimate, economic analysis etc. The consultants throughout the preparation of this report has endeavoured to ensure safety of road users and enhanced operational efficiency of the highway.
- Final Feasibility was submitted on 11th Nov. 2016. Presentation of Final feasibility report has been made on 12th Jan 2017 at NHIDCL HQ Delhi. Also, alignment of final feasibility report has been discussed with headman along with local villagers and other stake holders in a meeting chaired by honourable Deputy Commissioner East Khassi Hills District several times. The entire alignment except Pynursla bypass has been accepted by the local villagers and other stake holders. Since, the villagers/stake holders of Pynursla are not agree with the proposed bypass alignment of Pynursla due to dispute of land between two communities of the affected area, it was instructed by the State Government of Meghalaya and NHIDCL to exclude the proposed Pynursla bypass from present scope. NHIDCL vide email dated 7th July 2017 instructed to exclude Pynursla bypass from present scope and to submit the detailed project report for the balance length of the road. Accordingly, Detailed Project Report is being submitted excluding the Pynursla bypass. The entire alignment except Pynursla bypass has been approved by the state government of Meghalaya wide their letter no. PW/SW/JICA/44/2016/399 dated 17th August 2017.

E.2 Brief Description of Existing Road

E.2.1 Project Terminals

- The project road from Shillong to Dawki is a section of NH-40 and starts from existing Km. 81/740, at Rilbong intersection with NH-44 at Shillong and ends at existing km.163+000 at India/Bangladesh border near Dawki/Tamabil. Total Length of existing road is 81.260 km and length along proposed alignment is 71.190 km. The project road passes through hilly terrain in entire length. The stretch of Pynursla

bypass (8.210 Km Length) from existing km 123/800 (design km. 37+550) to 131/820 (design km. 45+760), has been excluded from the present scope.

- DPR alignment has been modified alignment in PKG-V due to various issues which are tabulated below:

Table E-1 : Modification in Alignment of Package-I (Km 0+000 to Km 11+000)

Sl. No.	Description of Changes	Original DPR Chainage		Revised Chainage		Remarks/ Reference
		From	To	From	To	
					nil	

- Major built-up areas along the project road are Shillong, Ritmawniew, Mylliem, Laitlyngkot, Pynursla, and Dawki. The Project road passes through two districts namely East Khasi hills and West Jaintia Hills. Most of the stretch of the road lies in East Khasi hills district which is 78.260 km and rest 3 km length lies in West Jaintia Hills district. Following table gives details of alignment in different districts.

Table E-2 : Length distribution of Project road Package V in different districts

District	Existing Chainage			Proposed Chainage		
	From	To	Length (km)	From	To	Length (km)
East Khasi hills	151+330	160+000	8.670	63+530	69+420	5.980
West Jaintia Hills	160+000	163+000	3.000	69+420	71+520	2.100

- These two districts are affluent in mineral deposits and contain large resources of lime stone suitable for cement and chemical industries. This road is of strategic importance as it connects with Bangladesh and also may become gateway to Meghalaya/North-Eastern states as it will be the shortest route from Kolkata to Guwahati and other north-eastern states via Dhaka-Sylhet-Tamabil-Dawki-Shillong. The project aims to improve the road network by widening and improvement of the targeted section and thereby contributing to the accelerated economic growth and poverty reduction in the region.

E.2.2 Lane Configuration, Formation Width and Existing RoW

- Existing road is mostly 2 – lane comprising of 7.0m carriageway and 1.0 – 1.5m earthen shoulders in a length of 72.260 km from 81+740 to 154+000 and singe lane from km 154+000 onwards in a length of 7.0 km. Formation width is varying from 9.0m to 10m. At some isolated sections, carriageway is intermediate lane with 5.5 – 6.0m width in between 81+740 to 154+000. Length distribution of existing road according to lane configuration is given below:

Table E-3 : Existing Lane Configuration

Lane Configuration	Length (m)	Length Distribution (%)
Two Lane	44660	54.96%

Lane Configuration	Length (m)	Length Distribution (%)
Intermediate Lane	29600	36.43%
Single Lane	7000	8.61%
	81260	

- As per information provided by PWD (NH), Shillong, existing ROW is the available formation width of existing road since the road was built on gifted land. The formation width of existing road varies from 10 to 14m including drain/parapet. Hence, 12m has been considered as average existing ROW in entire length.

E.2.3 Terrain

- The project road passes through rolling, mountainous and steep terrain and their percentage share of total project length are 6%, 72% and 22% respectively. Section wise summary of terrain is given below:

Table E-4 : Details of Terrain along Project Road Package V

Sl. No.	Existing Chainage			Proposed Chainage			Terrain
	From	To	Length (m)	From	To	Length (m)	
1	151+330	159+500	7670	63+530	64+100	570	Mountainous
2	159+500	161+000	1500	64+100	70+200	6100	Steep
3	161+000	163+000	2000	70+200	71+520	1320	Mountainous

E.2.4 Settlements & Land use

- The existing road passes through a number of places of habitation. Major built – up areas on route are Shillong, Ritmawniew, Mylliem, Laitlyngkot, Pynursla, Wahkadait and Dawki. In the initial 15km stretch from Shillong to Mylliem (81+740 to 96+740) the road passes through continues built-up areas and after that up to Umtyngngar (101+500) it passes though isolated minor built-up areas at frequent interval. Thus, the project road can be seen as urban continuum with ribbon development in the initial 19+760 kms. The pattern of development in these sections has been predominantly linear, with nodes of commercial and related activities along the NH 40.

- In the initial stretches near Shillong, the project road passes through cantonment area with defence establishments on both sides in a length of 1.680 km from 81+740 to 83+420 and Air force area in a length of 1.570km from 89+380 to 90+950.

- After km 101+500 the alignment generally passes through open area in mountainous terrain with two major built-up areas Laitlyngkot and Pynursla at km 105+900 and 128+450 respectively.

- In summary, 61.88% length of existing road passes through barren land, 32.11% length traverses through built-up area and 6.01% of its length is Agricultural land.

- At 7 locations - 3rd Mile, Ritmawniew, Mylliem, Laitlyngkot, Pynursla, Mawshun, Dawki existing road passes through congested built-up areas and has sharp

geometry and reverse "S" curves with low degree of curvature with curves having the design speed of 20 to 30 km/hr which is not in conformity with the current IRC standards. The available wall to wall distance is varying between 10 to 12m. To widen the existing road with National Highway standards would require acquisition of dense built-up areas at these locations. Hence, 7 nos. of bypasses have been proposed to minimise resettlement. These bypasses will be required in the longer term to accommodate increase in traffic demand in the future.

E.2.5 Pavement:

- The existing pavement along the project road is of flexible type with thin bituminous surfacing. The existing pavement consist of SDBC/DBM on base course of water bound Macadam (WBM) and moorum /gravely soil as sub base course on varying type of sub grade. The average crust thickness consists of 100mm of bituminous layer, 200mm of WBM, 150mm of GSB/Soling. Total thickness of existing pavement is 450mm

- The pavement condition of the project road in the initial sections from km. 81+740 to km. 98+000 is good, whereas for the section from km. 98+000 to km.154+000 pavement condition is fair to poor. In this section the road has developed cracks, potholes etc. for most of the stretches. For the remaining section from km. 154+000 to km 163+000 pavement is in poor condition. At many locations in this stretch, bituminous layer is worn out and the road now functions as gravel road. Due to the proposed re-grading of the project road to improve geometrics, existing pavement crust cannot be used and has to be re-built from sub-grade level.

- Test results of existing subgrade soils indicate that the soil used in the subgrade construction primarily belong to the SM, SC SW-SM category indicating that they are mostly in organic Gravely Sand, Sandy Silt, and Silty Sand type of non-plasticity. The in-situ field dry density at the existing pavement of subgrade varies in the range of 1.60 to 1.84 gms/cc, the laboratory MDD varies in the range of 1.62 to 1.72 gm/cc and the corresponding laboratory CBR values vary in the range 8 to 16%.

E.2.6 Culverts

- There are total 426 nos. of existing culverts along the project corridor, out of which 96 are Slab and 330 are Pipe culverts. The condition of these culverts is ruined and damaged. Protection works like return walls, wing walls, Floor protection works etc. are not observed at existing culverts. Some culverts are abandoned due to realignment and bypasses. All culverts need reconstruction due to improvement in horizontal geometry, vertical regrading and poor condition of the culverts.

E.2.7 Bridges

- In this section of NH-40, there are 9 bridges consisting of one major bridge and 8 minor bridges. All minor bridges are RCC with 2-lane configuration and are in good condition. Most of the bridges have RCC T-girder with RCC slab type superstructure

resting on open foundation at all locations. The width of these bridges is varying from 8.4m to 12.5m.

- One major bridge over Piyang River near Dawki at km 160+350 is a single lane suspension bridge of 103m span with sharp curves on both sides of the bridge. The height of the existing bridge is approx. 35m from river bed. Condition of the bridge is fairly good. This is a single lane bridge and only one direction traffic is allowed. Max load limit of this bridge is 8t.

E.3 Traffic

- At present the corridor is primarily used by cars, which is the traffic to tourist places and villages located along and near by the corridor. Traffic is more in the initial 20km length and as we move towards Dawki the traffic levels reduces from preceding section. It is observed that the truck traffic towards the end of project road is low, which is due single lane weak bridge over Dawki River. At present, goods are being transported to Dawki/Tamabil with LCV. Once the project road in improved most of the LCV traffic would convert into trucks.
- The project road is characterized by different level of traffic at individual sections. Considering the location major built-up areas, important connecting roads and present traffic volume, the project is divided into six homogeneous sections. Detail of these sections are given in Table E-5.
- Considerable volume of traffic is flowing on the project road especially in the initial sections from start point to junction with NH44E (section 1 and 2). These sections carry local traffic of upper Shillong area, traffic to/from Nongstoin, Cherrapunji and Dawki. Most of the traffic gets diverted towards Nongstoin at the end of section 2. The traffic in section 3 is 7992 PCU, which is traffic to/from Cherrapunji, Dawki and the traffic to villages and small towns located in this section. Traffic in section 4 and 5 is 4517 and 3240 PCU. At the end of section 5 near Dawki, NH40 from Jowai joins the project road and the traffic between Dawki and Tamabil is 4335 PCU.
- It is observed that approx. 500 nos. of trucks carrying stone boulders to Bangladesh are plying in section 6, which are coming mainly from Jowai side. Once the road is improved, new quarries may come up in and around the project corridor, which would contribute to increase in traffic. Hence, an induced traffic of 10% has been considered from year 2020 in the section 4, 5, and 6.
- The following table gives details of present and projected traffic at different sections.

Table E-5 : Projected Traffic in PCU (AADT)

Section		Exisitng Chainage		Length (m)	Traffic (PCU)							
		From	To		2016	2020	2025	2030	2035	2040	2045	2050
1	Railbong Point to 3rd Mile	81+740	84+000	2260	17072	23107	32780	45249	60959	80190	105513	138863
2	3rd Mile to Junction with NH44E	84+000	90+300	6300	12909	17594	25113	34814	47029	61957	81639	107593
3	Junction with NH44 to Junction with SH5 (Cherrapunji Road)	90+300	101+730	11430	5928	7992	11285	15516	20849	27388	35988	47300
4	Junction with SH5 (Cherrapunji Road) to Pynursala	101+730	131+000	29270	3021	4517	6314	8629	11550	15141	19854	26041
5	Pynursla to Dawki	131+000	162+000	31000	1825	3240	4389	5855	7712	10021	13026	16938
6	Dawki to Tambil	162+000	163+000	1000	2788	4335	5677	7387	9561	12301	15831	20379

E.4 Improvement Proposals

E.4.1 Alignment and Geometry

- The existing alignment has sharp geometry with curves having the design speed of 20 to 30 km/hr which is not in conformity with the current IRC codes. Gradients are also steep at some locations. The road thus requires frequent realignment and geometric improvements to bring it into the conformance with IRC. Also bypasses/major re-alignments are required at 8 locations to avoid congestion and roadside friction, further to cater to increasing traffic and to minimise land acquisition in built up areas and also to improve the geometry. The proposed locations of proposed Bypasses/re-alignments were critically examined/studied for alternative improvements. The most economical with minimum disturbance has been considered. The Main feature of the proposed route is presented in table below.
- Major geometric improvements are required in a length of 32.730 km and bypasses/re-alignments in a length of 26.700 km. Hence total length of geometric improvements/ bypasses/re-alignments is 59.430 km. Locations of these improvements are given below.

Table E-6 : Locations of Geometric Improvements

Sl. No	Exist. Chainage		Exist. Length (m)	Prop. Chainage		Prop Length (m)
	Start	End		Start	End	
	Total Length (m)		nil			

Table E-7 : Locations of Bypasses/Re-alignments

Sl. No	Location	Exist. Chainage		Exist. Length (m)	Prop. Chainage		Prop Length (m)	Remarks
		Start	End		Start	End		
1	Wahkadait, Dawki	151+330	162+650	11320	63+530	71+200	7670	Dawki Bridge Siting

- To develop the existing road to NH standards as per manual, major geometric improvements/re-alignments/bypasses have been proposed in a length of 59.430 km, which is 73% of existing length. In the remaining length, proposed road follows the existing road with minor geometric improvements.
- The centre line of proposed highway has almost shifted/realigned from the existing alignment as per the required curve designs. The new carriageway of proposed 2-lane road has been proposed on hill side and the centreline of the alignment is designed such that, the proposed outer/valley side shoulder edge matches with the existing shoulder edge.
- Among the most important of the proposed improvements to the existing road geometrics was the reduction in the number and severity and horizontal curves. The alignment of the project highway is designed to ease the curvature of the road to the extent possible so that, the highway is safe and design speed is uniform for substantial lengths of highway. Design speeds applicable for different sections have been adopted based on the prevailing terrain conditions of the area. 20% of length is designed for 80 kmph, 49% for 60 kmph, 23% for 50 kmph and remaining 8% length is designed for 40 kmph.
- The Gradients of the project highway were fixed to conform with the terrain and merges well with the existing contours. Generally, ruling gradients applicable to the prevailing terrain conditions are proposed. The distribution of proposed grades is as below:

<=4	>4 & <=5	>5 & <=6	>6 & <=7	>7
64%	10%	23%	4%	0%

E.4.2 Proposed Lane Configuration

- As per 2/4 lane manual and IRC:64-1990, the following lane configuration has been proposed at different sections as per the projected traffic volume.

Table E-8 : Proposed Lane Configuration

Section		Exisitng Chainage		Length (m)	Year of reaching 2-lane capacity		Recommended Lane Configuration
		From	To		LOS B	LOS C	
1	Railbong Point to 3rd Mile	81+740	84+000	2260	Already Reached	Already Reached	4 - lane
2	3rd Mile to Junction with NH44E	84+000	90+300	6300	Already Reached	2021	4 - lane
3	Junction with NH44 to Junction with SH5 (Cherrapunji Road)	90+300	101+730	11430	2027	2033	2-lane with Paved Shoulders
4	Junction with SH5 (Cherrapunji Road) to Pynursala	101+730	131+000	29270	2031	2037	
5	Pynursla to Dawki	131+000	162+000	31000	2038	2044	
6	Dawki to Tambil	162+000	163+000	1000	2034	2040	4 - lane

- For sections 1 and 2, the capacity of existing 2-lane has already exceeded at both LOS B and C. Hence, this section needs immediate 4-laning. Section 3 will reach to 2-lane capacity in the year 2027, whereas section 4 and 5 are having considerably low traffic and will reach to 2-Lane capacity in year 2031 and 2038 respectively. Hence 2-lane with paved shoulders has been proposed in these sections.

- Section 6, between Dawki and Tamabil reaches to capacity of 2-lane in the year 2034. Though, as this section is adjacent to international boundary with Bangladesh, all vehicles needs to stop at check post for various clearances, this makes the area congested with many vehicles parked alongside of road, blocking the way for vehicles coming in opposite direction. Hence, 4-lane is proposed in this section.

Existing Chainage/Location		Proposed Chainage			Lane Configuration
From	To	From	To	Length (m)	
From junction with NH 44 in Ritmawniew bypass	Up to junction with Jowai - Dawki Road in Dawki re-alignment	635300	70050	6520	2-lane with paved shoulders
From junction with NH 40 (Jowai - Dawki Road) in Dawki re-alignment	163000	70050	71520	1470	4-lane

E.4.3 Cross sectional elements

- Proposed Cross-sectional elements for the project road are as follows:

Table E-9 : Cross-Sectional Element

Two-lane road		
Paved Carriageway		1 x 7.0 m = 7.0m
Shoulders	Paved on both sides	2 x 1.50m = 3.00m
	Unpaved (Valley side)	1 x 1.00m = 1.00m
Open Drain on hill side		1 x 1.00m = 1.00m
Total Roadway Width (exclusive of parapet wall on valley side)		12.00m
Four-lane road (Built-up area)		
Paved Carriageway		2 x 7.0 m = 14.0m
Kerb shyness		4 x 0.50m = 2.00m
Median		0.610 m
Footpath on valley side		1 x 1.50 = 1.50 m
Covered Drain on hill side		1 x 1.50 = 1.50 m
Total Roadway Width (exclusive of parapet wall/railing on valley side)		19.610 m
Four-lane road (Rural area)		
Paved Carriageway		2 x 7.0 m = 14.0m
Kerb shyness		2 x 0.50m = 1.00m
Median		0.610 m
Paved Shoulder on both sides		2 x 1.50 = 3.00m
Earthen shoulder on valley side		1 x 1.00 = 1.00m
Open Drain on hill side		1 x 1.00 = 1.00m
Total Roadway Width (exclusive of parapet wall on valley side)		20.610 m

- In accordance with 2-lane/4-lane manual, following typical cross sections have been developed for the project road. Drawings of these cross-sections are given at the end of this chapter and summary is given below:

Table E-10 : Schedule of Typical Cross Sections

Sl. No.	Cross Section Type		PKG- V
1	Type - 1	4-lane divided highway with covered drain/footpath on both sides at built-up areas	0
2	Type - 2	4-lane divided highway without paved shoulders at open areas	0
3	Type - 3	4-lane divided highway with paved shoulders at open areas	1470
4	Type - 4	2-lane with paved shoulders at open areas	6520

5	Type - 5	2-lane with paved shoulders and covered drain at built-up areas	0
6	Type - 6	At VUP/VOP Approaches with Slip road (NH - NH Crossing)	0
		Total	**7990**

From	To	Length (m)	
NH40 (Shillong - Dawki Road)			
63530	70050	6520	Type - 4
70050	71520	1470	Type - 3

E.4.4 Pavement

Type of pavement

- The current policy directives from MoRT&H stipulates that consultant shall consider rigid pavement for the Bypasses and wherever there is eccentric widening for more than 3 km length. However, consultant has considered the following while deciding on pavement type.

a. IRC: SP:48 -1998 (Hill Road Manual) Page 111 Clause 10.2.1 and page 139 Clause 10.23.1 which clearly state that rigid pavement is generally not recommended for hill roads.

b. Achieving a high level of smoothness in concrete pavements without sacrificing long-term performance for the curvilinear alignment require special adjustment at time of construction.

c. It is more difficult to construct a smooth surface for PCC pavements along horizontal curves than those on tangents because of the transitions for super elevation. Generally, roughness is more prevalent in transitions and super elevated portions of a horizontal curve than on tangents. In the transition sections, the profile pan must adjust to meet the varied cross slope requirements of the curve. As with an uneven track line, the constant adjustments of the paving machine can adversely affect the smoothness of the pavement.

d. As the horizontal curvature increases, the potential for roughness within the curve increases. When the degree of curvature exceeds 6 degrees (or the radius of curvature falls below 300 m) increased attention to the machine operation and the string line-staking interval is required and it is virtually impossible to construct the surface to the same specified tolerance desirable for a tangent section because of the significant corrective adjustments necessary by the equipment.

e. In majority of curves along the project section which occur in quick succession with very little straight tangents in between and the radii are much less than 300m. Thus, it will be very difficult and time consuming to achieve the surface finish to the desired levels.

f. Considering all the above, the consultants recommend that the pavement for project section shall be flexible, although it is against the policy directive from MORTH.

g. As per clause 4.3.1 of IRC 37-2018, flexible pavement should be designed for a minimum design period of 20 years for National Highways and State Highways subject to the condition that design traffic is less than 300 MSA

Pavement Composition for main road and slip roads:

Due to regrading of project road, it is proposed to reconstruct the pavement in entire length. The proposed composition is given below:

Design life - 20 years CBR of subgrade - 10% Design MSA - 30	**Pavement Layer**	**Thickness**
	Bituminous Concrete (BC)	40 mm
	Dense Bituminous Macadam (DBM)	65 mm
	Wet Mix Macadam (WMM)	150 mm
	Granular Sub base (GSB) Top drainage layer	150 mm
	Granular Sub base (GSB) Bottom filter layer	150 mm
	Subgrade	500 mm

E.4.5 Culverts

- Existing road is a single/two lane road, which is to be widened to 4-lanes/2-lane with paved shoulders with improved vertical and horizontal geometric. Due to the regrading of the project road all culverts need to be reconstructed. Details of proposed culverts are given in Appendix 3.5 and summary is presented below:

Table E-11 : Summary of Culverts

Culverts	Package V
PIPE	9
SLAB	2
BOX	24
Total	35

E.4.6 Bridges

- As mentioned in previous sections, there are 9 existing bridges. In addition to these, 5 additional new bridges are required along bypasses/re-alignments. Hence, the total number of bridges along the proposed alignment are 14 consisting of 2 major bridges and 12 minor bridges.
- Two existing bridges at proposed Chainage 18+630 (span 1x25m) and 69+540 (1x103m) are abandoned due to change in alignment. Two bridges at 50+420 (Span 1x25) and 54+623 (span 1x14 + 1x24 + 1x14) are 12m wide and hence proposed to be retained without any widening. Bridges at 0+275 and 7+668 are also 12m wide, these falls under 4-lane configuration. These bridges are also proposed to retain and with an additional 13.0m wide bridge besides the existing bridge. Remaining 3 bridges are 8.4m wide with 7.5m carriageway. These bridges are also retained with an additional 13.0m wide bridge besides the existing bridge.

- All new/reconstructed bridges are proposed with 16m total width. For the bridges, which are in proposed 4-lane configuration, additional bridge of 13.0m width has been proposed besides the existing bridge. For the bridges, which are in proposed 2-lane+paved shoulder configuration, if the width of existing bridge is >= 12m no widening has been proposed. If the width of existing bridge < 12m, additional bridge of 13.0m width has been proposed besides the existing bridge.
- Details of proposed bridges are given in the table below:

Repair + Retain	Repair + Widening	Repair + Addl. 2-lane	New Bridges (2-lane)	Total no. of bridges
2	1	4	7	14
Note: New Minor Bridges on Pynursla bypass – 3 nos. have been excluded.				

Table E-12 : Details of Proposed bridges

Package-V												
13	Dawki Re-alignment			-	-	New 2-lane	69+100.000	1 x 25	16.0	PSC I-Girder	Open	-
14	160+350	1 x 103	4.4	Cable Suspended	Open	Abandon + New 2-lane	69+540.000	2x24 + 2x80 + 1x160	16.0	Balance Cantilever Box	Well/Open	Piyang River

E.4.7 Junctions

- There are 1 major road junctions with National Highways / State Highways / MDR and 3 minor junctions with village roads. List of Major Junctions along with proposed improvements are given below:

Table E-13 : Lists of Major Junctions

Sl. No	Proposed Chainage	Classification of cross road	Type of Junction	Road Leading to	Proposal	Packages
1	70+200	NH 40	T Junction	Jowai	At-grade	Package V

E.4.8 Grade separated structures

- There are no grade separator in this
- Following table presents the details of proposed grade separated structures.
- Following table presents the details of proposed grade separated structures.

Table E-14 : Details of Grade Separated Structures

Sl. No.	Exist. Chainage	Design Chainage	Structure Dimensions (m) No. x L x H	Width of Structure (m)	Remarks
1			nil		

E.4.9 Slip roads

- Slip roads have been provided at proposed VOP/VUPs at the following locations.

Table E-15 : Location of slip road

From	To	Width	Length (m)	Remarks
Total Length (m)			**nil**	

E.4.10 Service roads

- Service roads have been provided at BOP at the following locations.

Table E-16 : Location of service road

From	To	Width	Length (m)	Remarks
70+300	70+440	3.5	140	On LHS/Access to School/Church
70+300	70+400	3.5	100	On RHS/Access to BOP-Dawki
Total Length (m)			**240**	

E.4.11 Protection Works

- The proposed road alignment passes through hilly terrain, major stretch of the road passes through reaches with either full cutting or part cutting and filling. Due to high cut & fill natural stability of the hill slopes disturbs. Watercourses along the slopes cause erosion affecting road stability. Soil movement along slopes tend to disturb the road formation. All these have to be effectively countered to obtain a stable road, to avoid instability of the slopes and landslides in future by provision of structures/slope stability arrangements to act as retaining, restraining and protective structures.
- Various types of retaining structures/Slope stability arrangements are proposed considering the following factors.
  - Height of Cut/Fill
  - Cross slope the existing ground/hill
  - Soil properties
  - Height of hill above the finished road level

Proposed Cut Slopes

- Geologically the project area comprises of rocks from the oldest Precambrian gneissic complex to the recent alluvium formations. The type of soils encountered and the proposed side slopes of cutting adopted are given below:

Table E-17 : Proposed Cutting Slopes

From	To	Length (m)	Type of Soil/Rock				Prop. Cut Slope
63+530	63+800	270	Cs	Sandstone	Soft Rock	Tertiary Sediments	1H : 1V
63+800	71+520	7720	Ss	Sandstone	Hard Rock	Shillong Group of Rocks	1H : 2V

Breast Walls and Retaining Walls

- Breast walls of 1.5 to 3.0 height have been proposed at deep cut locations and built-up areas to restrict the width of cutting. At fill locations 2 to 14m high retaining walls are proposed.
- Length of breast wall proposed is 3660m in package-V.
- Length of retaining wall proposed is 460m in package-V.

E.4.12 Toll Plaza

- nil.

E.4.13 Rest Area

- nil.

E.4.14 Truck Lay bye

- During site reconnaissance it was observed that several truck drivers park their vehicles for getting various clearances at India-Bangladesh border. But due to lack of parking, they park their vehicles beside road. For safety and smooth flow of traffic 2 truck lay byes are proposed at the following locations:

Table E-18 : Location of Truck Lay Byes

on LHS	on RHS	Remarks
71+080		11m wide, 200m length followed by 1:10 taper
	71+180	11m wide, 160m length followed by 1:10 taper

E.4.15 Bus-bays

- There is no bus bays in this package. The locations of Bus Bays is presented in table below;

Table E-19 : Location of Bus Bays

on LHS	on RHS	Remarks
	nil	

E.4.16 Lighting

- As per clause 12.4.3 of manual, lighting has been proposed at Built-up sections, Grade separated structures, bus bays, truck lay-byes, rest area, toll plaza etc. Total length of sections proposed for lighting is 2.3 km in package-V.

E.4.17 Proposed RoW

- The ROW along the existing road is 12m, which is not sufficient for the development of project road to National Highway standards. In Hilly terrain, as per IRC: 73, minimum right-of-way (ROW) width of 24m and 20m is desirable for National Highways at open areas and built-up areas respectively. However, the proposed ROW has been worked out on the basis of actual requirement in order to accommodate the proposed 2/4-lane road along with cut/fill slopes.

E.4.18 Salient Features of the Proposed Improvements

The project road, presently 2-lane/1-lane, which shall be developed to 2-lane with paved shoulders/4-lane carriageway configuration facility with National Highway standards. Salient features of the proposed road are given below.

Table E-20 : Salient features of proposed improvements

Sl. No.	Description		Package V
1	Alignment		
	Existing Length	Km	11.670
	Proposed Length	Km	7.990
	No. of bypasses/major re-alignments	Nos	1

Sl. No.	Description		Package V
	Length of Bypasses/ Realignment/Geometric improvements	Km	7.67
2	Lane Configuration		
	2-lane with paved shoulders	Km	6.52
	4-lane	Km	1.47
3	Proposed Crust thickness		
	BC	mm	40
	DBM	mm	65
	WMM	Mm	150
	GSB top drainage layer	mm	150
	GSB bottom filter layer	mm	150
4	Bridges		
	Major bridges	Nos	1
	Minor bridges	Nos	1
5	Grade Separated Structures		
	Overpasses (VOP)	Nos	Nil
	Vehicular Underpasses (VUP)	Nos	Nil
	Small Vehicular Underpasses (SVUP)	Nos	Nil
6	Service Road/Slip Road	Km	0.24
7	Culverts		
	Pipe Culverts	Nos	9
	Slab Culverts	Nos	2
	Box culverts	Nos	24
	Total	Nos	35
8	Major junctions – at grade	Nos	1
9	Minor junctions – at grade	Nos	3
10	Toll Plaza	Nos	Nil
11	Bus Bays	Nos	Nil
12	Truck Lay Bye	Nos	2
13	Rest Area	Nos	Nil
14	RCC Covered Drain	m	990
15	PCC Open Drain	m	11530
16	RE Wall		
	Length	m	Nil
	Area	sqm	Nil
17	Retaining Wall	m	460
	Concrete Retaining wall		130
	Gabion retaining wall		330
18	Breast wall	m	2810
19	W-beam metal Crash Barrier	m	230

E.5 Environmental and Social Assessment

- The Environmental Assessment for the project corridor has been carried out based on inputs from the Environmental and Social Screening exercise. Social impact

assessment has been carried out as a part of the study to ascertain the beneficial impacts of the project on the people in general and more specifically identify the critical issues so that possible solutions can be adopted and incorporated into engineering designs so that adverse social impacts are minimized.

- The key environmental and social issues emerging out of the above exercise are as below;

E.5.1 Environmental Clearance

As per MoEF&CC EIA Notification 2006 and its subsequent amendments (2009, 2013 & 2015), Environmental Clearance from MoEF&CC is not required for the Project Highway as the length of the project road is less than 100km and additional ROW of land acquisition is less than 40 metre along existing alignments and 60 metre on re-alignment.

E.5.2 Forest Clearance

No forest land in Package IV, so no forest clearance is required

Table E-21 : Forest Area along Project Road

Sl. No.	Description	Location	Chainage		Length (m)	Total Area (Ha)
			From	To		
		nil				

E.5.3 Muck Disposal Locations

As project road is passing through hilly area, cutting of earth / rocks will be required for widening of the Road Project. The total quantity of muck expected to be generated has been estimated to be of the order of 83.06 lakh Cum. Based on the nature of the rocks and engineering properties of the soil, a part of the muck will be used as construction material and the balance will be suitably disposed.

As per the present proposal of widening, about 31.3% i.e.; 26.0 lakh cum muck shall be utilized for various project works, e.g., production of aggregates, levelling of roads by providing filling in some reaches, development of work sites, construction area facilities, construction of retaining walls, back filling behind retaining walls and in filling in valley side for widening the existing road.

Hence the balance quantity of muck to be disposed-off shall be about 57.06 lakh Cum.

For the disposal of muck, tentatively eight major muck disposal sites have been identified. The details of these sites are given in the following table.

Table E-22 : Muck Disposal Areas

Sl. No.	Proposed Chainage	Remarks
1	71+500	Tamabil

The dumping of muck shall be done in the scientific manner by providing appropriate protection walls with suitable foundations so that muck will not flow and washed away in to streams; Masonry work, crate work and check dam shall be provided wherever necessary in order to avoid the chances of soil erosion and to ensure flow of silt, free water. Besides these engineering measures, proper plantation shall be done at the dumping sites for reclamation of the dumping areas.

E.5.4 Social Assessment

The existing ROW (12m) is inadequate, for the development of proposed road, which would result in an acquisition of approximately 206.142 Ha. of land and displacement of around 255 households. The Entitlement Framework shall provide for adequate compensation and assistance. The cost of compensation of land and structures is 524.56 crores. The total land requirement for the project 206.142 Ha. (Excluding Pynursla Bypass) out of which 181.496 ha is private, 16.107 ha is forest, 5.216 ha is Defence land and 3.323 ha is government land. Most of the land is barren. Following table gives the summary of the land to be acquired.

Table E-23 : Area of land to be acquired

Package	Total land required for the project (in Ha)	Land already available (in Ha)	As per Section 19 Additional land to be acquired	Difference Col [5] - [4]	Land to be acquired (in Ha)									Remarks
					Private Land (in Ha)			Govt. Land (in Ha)			Defence Land (in Ha)	Forest land (in Ha)		
					To be acquired	3(A) done	3(D) done	To be acquired	3(A) done	3(D) done		Area (in Ha)	Length affected (in Km)	
[1]	[2]	[3]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]
PKG-V (km 63.53 to 71.52)	9.30	1.14	8.16	-	7.81	7.81	7.81	0.35	0.35	0.35	-	-	-	

E.6 Construction Packaging & Schedule

- Since the project involves construction of a road in hilly area with limited working period, deep cuts, special structures, and large no of retaining walls and protection works etc. it would not be possible to construct the project in reasonable time frame in single package. Hence the consultant recommends constructing the project in five construction packages. The details of the proposed construction package V is given below:

Table E-24 : Details of Construction Package V

Package	Design Chainage		Length (km)	Existing chainage		Length (km)	Remarks
	From	To		From	To		
Package - V	63+530	71+520	7.99	151330	163000	11.67	

- As per ministry circular no. RW/GHT/DPP/Genl/Misc,/(1)/2013 dated 25th Aug 2015, for widening and strengthening project time required for completion of civil works is 18 days/km and time for mobilization is 75 days. Besides this, an allowance for rainy season of about three months/year in difficult area is to be considered.

- According to the above norms, 3-years construction period is recommended for each package.

E.7 Cost Estimate

- The cost estimate has been worked out separately for each package using quantities of different items of works derived from the preliminary designs, drawings. The unit rates have been referred from Schedule of Rates (SOR) of National Highways Circle Shillong, Meghalaya for the year 2013-14.
- The unit rates in the proposal are based on PWD (Roads) Schedule of Rates (2013-14) National Highway Circle, Shillong, Meghalaya with effect from 01.06.2013 with the inflation @ 6.5% as per WPI indices to arrive item rate at current year 2019-20.
- The items which are not listed in the SOR have been analysed on the basis of the 'Standard Data Book for Analysis of Rates' published by MoRT&H. Basic rates of manpower, machinery and carriage have been referred from SOR, Meghalaya.

Table E-25 : General Abstract of Cost

		Package V
	Length of Project Road (Km)	7.99
Bill No.	**Item of works**	**Cost (Rs. Crores)**
1	Site Clearance and Dismantling	0.11
2	Earthwork	57.98
3	Granular Sub-base & Base Courses	13.17
4	Pavement Works	11.93
5	Drainage & Protection Works	
	a) Longitudinal Drains	7.68
	b) Breast wall	6.30
	c) Retaining wall & Parapet wall	1.95
	d) RE wall	0.00
	e) Slope protection work	3.99
6	Traffic Signs, Markings and Other Road Appurtenances	2.96
7	Miscellaneous	2.16
8	Toll plaza	0.00
9	Cross Drainage Works	7.62
10	Bridges and Grade Separated Structures	98.27
11	Cost of Civil Works (in Crores)	214.11
A	**Cost of Civil Works (in Crores) excluding VAT/Taxes**	**176.42**