

## **Pre-Feasibility Report**

For Proposed Construction of four lane TBM TUNNEL including approaches under River Brahmaputra between Gohpur on NH-52 North Bank and Numaligarh on NH-37 South Bank, Assam (Length: 34.664 km) on EPC Mode under SARDP-NE Phase-A

### Project Proponent

**“National Highways & Infrastructure Development Corporation Ltd. (NHIDCL)”**

### Prepared By



**National Highways & Infrastructure Development Corporation Ltd.**

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## 1. EXECUTIVE SUMMARY

The Salient Features of the proposed project are as provided in **Table 1**.

**Table 1: Salient Features of Project**

<b>Name &amp; Address of Company</b>	<b>National Highways &amp; Infrastructure Development Corporation Ltd. (NHIDCL)</b> Highways & Infrastructure Development Corporation 3rd Floor, PTI Building, 4, Parliament Street New Delhi-110001 Tele:011-23739027
<b>Schedule of project as per EIA Notification, 2006</b>	<b>7 (f)</b>
<b>Category of Project</b>	<b>‘A’</b>
<b>Total Project Area</b>	315.9647 Ha.
<b>Proposed Project and Configuration details</b>	The proposed alignment passes through two districts i.e Biswanath and Golaghat and 3 Talukas i.e. Khumtai, Gohpur, Bokakhat and 24 villages. The proposed alignment will pass through Alitala, Badal Pathar Borghuli, Balitika, Borphalang, Khalihai Pathar , No.2 Chakala, No.2 Rajabari, No.2 Majikuchi, Tinsukia, Bihaguri, No 1. Uppar Tinsukia, No.2 Uppar Tinsukia, Baligaon, Mazdalapa, Alami Chapori, No.2 Patharimiri Gaon, Missimi Ati, No.1 Patharimiri Gaon, Rangagora Chapori, Bongaon, Lablebi Pathar, Buralikson, and Bon Bagisa Villages The total length of proposed alignment is 34.664 km. The proposed ROW will be varying as per the proposed road design & feature in respective sections Package I, Package II & Package III viz. minimum 60m.
<b>Water Requirement of Project</b>	Total water requirement for construction of proposed project will be 2559133 KL which will be sourced from nearby water sources with prior Statutory Approvals.
<b>Power Requirement</b>	The power requirement of 2000 kVA will be sourced as per statutory provisions & DG Sets of 2000 kVA will be provided as backup during construction phase. The total power requirement during the operational phase is 21416.89 kVA.
<b>Man power</b>	1000 skilled & unskilled workers during construction phase. 50 skilled & unskilled workers during operational phase.
<b>Project Cost</b>	11204.42 Cr

## **2. INTRODUCTION OF PROJECT/BACKGROUND INFORMATION**

### **2.1 Identification of Project & Project Proponent**

National Highways and Infrastructure Development Corporation Limited (NHIDCL) is a fully owned company of the Ministry of Road Transport & Highways (MoRTH), Government of India.

The company promotes surveys, establishes, designs, builds, operates, maintains and upgrades National Highways and Strategic Roads including interconnecting roads in parts of the country which share international boundaries with neighboring countries. The regional connectivity so enhanced would promote cross border trade and commerce and help safeguard India's international borders.

In the proposed development project, National Highways and Infrastructure Development Corporation Limited (NHIDCL) has proposed to develop a connectivity between Gohpur on NH-52 (North Bank) and Numaligarh on NH-37 (South Bank) in the state of Assam under SARDP-NE Phase A. This proposed connectivity will be achieved by constructing Tunnel including approaches over River Brahmaputra.

In pursuance of the above development, NHIDCL has appointed M/s Louis Berger Consulting Pvt. Ltd, New Delhi as consultant to carry out the consultancy services for the up gradation/preparation of Feasibility Study and Detailed Project Report of the main Tunnel in Brahmaputra and its approaches.

### **2.2 Description of Nature of Project**

The proposed alignment comes under two districts i.e Biswanath and Golaghat & 3 Talukas viz. Khumtai, Gohpur, Bokakhat & passes through 24 villages. The proposed alignment will pass through 24 villages which are - Alitala, Badal Pathar Borghuli, Balitika, Borphalang, Khalihai Pathar , No.2 Chakala, No.2 Rajabari, No.2 Majikuchi, Tinsukia, Bihaguri, No 1. Uppar Tinsukia, No.2 Uppar Tinsukia, Baligaon, Mazdalapa, Alami Chapori, No.2 Patharimiri Gaon, Missimi Ati, No.1 Patharimiri Gaon, Rangagora Chapori, Bongaon, Lablebi Pathar, Buralikson, and Bon Bagisa villages. The proposed project comprises of following three components:

- Construction of 4 Lane approach road from Numaligarh side to Start of Brahmaputra River Tunnel on South Bank, Package – I, from Ch. 26+700 to Ch. 34+664 (Design Length 7.964 km) in the State of Assam under SARDP – NE on EPC mode.
- Construction of 4 Lane approach road from End of Brahmaputra River Tunnel to Gohpur side on North Bank, Package – III, from Ch. 0+000 to Ch. 11+100 (Design Length 11.100 km) in the State of Assam under SARDP – NE on EPC mode.
- Construction of Twin Tube TM Road Tunnel of 2 Lane each under River Brahmaputra, Package – II, from Ch. 11+100 to Ch. 26+700 (Design Length 15.600 km) in the State of Assam under SARDP – NE on EPC mode.

The project lies between Latitude 26°53'16.63"N to 26°39'44.06"N and Longitude 93°37'56.42"E to 93°50'55.07"E. The project alignment starts from the foothill region of Arunachal Pradesh and develops connectivity between Gohpur on NH-52 (North Bank) and Numaligarh on NH-37 (South Bank) across River Brahmaputra in the state of Assam. The schematic map of proposed alignment is given as **Figure 1**.



**Figure 1: Schematic Map of Proposed Alignment**

### 2.3 Need for the project

Un-doubtedly, infrastructure development in Assam is retarded from its normal pace due to the roads development operating for extended periods resulting in frequent traffic jams on all major roads of the state. Moreover, the mighty river Brahmaputra bifurcating the state into Northern Assam and Southern Assam adds significant lagging of connectivity, which is characterized by loss of time and resources for the transportation industries. Bridging this lack of connectivity between Northern Assam and Southern Assam is also important in strengthening the security and quick accessibility of supplies within limited resource and timeframe.

Over the last decade, the state has strengthened several segments of existing National Highways (Old NH-52 currently NH-15) in the North end and NH-37 (4-lane till Nagoan) in the Southern end having dense commercial and residential development pockets, however the connectivity (bridge) between these two highways is very sparse. The Northern Brahmaputra valley supports major cities like Biswanath, Lakhimpur, Dhemaji and other cities of Arunachal Pradesh, whereas the Southern Brahmaputra valley supports cities like Golaghat, Jorhat, Sibsagar, Dibrugarh etc. These cities although are close to each other but is geographically separated due to unavailability of connectivity bridge at appropriate interval on the river Brahmaputra stretch. Few connecting bridges over Brahmaputra river are Kalia Bhomora bridge at Tezpur, Sariaghat bridge (Central Assam), Jogighopa bridge at Goalpara (Lower Assam) and Dhola-Sadiya at Tinsukia (Upper Assam). But, these few bridges over Brahmaputra over a stretch of 500 km of Brahmaputra River are not adequate to connect the northern cities with the southern cities effectively. For example, traffic connectivity from southern cities of Assam states viz, Golaghat, Jorhat, Sibsagar, Dibrugarh have to travel all the way to Tezpur (Kalia Bhomora bridge) via NH-37 to connect with the cities of Northern Assam viz, Biswanath, Lakhimpur, Dhemaji via NH-15 which is highly time and energy intensive.



On the other hand, the existing NH-37 portion in the Southern end is a 2-lane single carriageway, which passes through the eco-sensitive zone of Kaziranga National Park and connects near Dergaon (Near Numaligarh) in Golaghat district. At present, the traffic from North to South of Brahmaputra River is using Kaliabhamora bridge (Tezpur Bridge), which is located 90 km from South and 133 km North from nodes of the proposed bridge location. Based on the current scenario, the travel time from Numaligarh to Gohpur is about 220 km, which takes about 6 hours to travel. With the proposed scheme, introduction of the proposed Tunnel with approach roads will reduce the travel distance to 34 km and travel time to half an hour.

The project is expected to serve as a very prominent route connecting Itanagar-Gohpur-Numaligarh. This road will enhance connectivity between North and South side of Brahmaputra River and will lead to rapid social and economic development of the area.

Existing traffic is crossing the Brahmaputra River on the downstream at a radial distance of approximately 90 km from the project road near Tezpur, while on the upstream the radial distance of the existing bridge from the project road is approximately 130 km near Dibrugarh. There is no crossing facility available for a length of approximately 220 km. The proposed project will divert the existing traffic using the NH-37 road adjacent to environmentally sensitive Kaziranga National Park.

Therefore, the proposed project becomes of utmost importance which connects NH-52, Gohpur (on North Side) and NH-37(on South Side).

#### **2.4 Demand & Supply Gap**

Not Applicable

#### **2.5 Import vs Indigenous Production**

Not Applicable

#### **2.6 Export Possibilities**

Not Applicable

#### **2.7 Employment Generation due to Proposed Project**

Roadway (Highway) development broadly encompasses the process of construction and maintenance, including the design, contracting, implementation, supervision, and maintenance of roadways and related structures, such as bridges and interchanges. The areas covered includes public works, private contracting of civil works, and worker-based construction techniques. For this purpose, 1000 workers shall be employed per day during construction phase & 50 personnel will be engaged during operational phase of the proposed project.

##### **➤ Direct Employment**

During the construction phase manpower will be needed to take the part in various project activities. Skilled, semi-skilled and unskilled workers, will likely to get work. In the post

construction phase, it is expected that the project will provide social benefits to local people in terms of direct employment by way of better commercial and industrial development of the area.

➤ **Indirect Employment**

The project shall also induce indirect employment generation for cleaners, guards, local vendors, operation and maintenance workers etc. Local vendors, construction material traders, electrician, plumbers etc. will be benefitted through employment generated during construction and maintenance phase.

### 3. PROJECT DESCRIPTION

#### 3.1 Type of Project

The project type is of road development wherein the proposed project is a green field 4 Lane National Highway from Gohpur to Numaligarh (Length 18.174 km, RoW – 60 M) involving Twin Tube TBM Road Tunnel of 2 Lane each under River Brahmaputra (Length 15.6), Total Length of 34.664 km under SARDP – NE on EPC mode in Biswanath & Golaghat Distircts of Assam by National Highways and Infrastructure Development Corporation Limited (NHIDCL).

#### 3.2 Project Location

The total land area required for the proposed project is 315.9647 Ha. The geographical location of the project is as mentioned in **Table 2**. The Location Map and the Google Image of the Project Site is as shown in **Figure 2** and **Figure 3** respectively.

**Table 2: Geographical Location of the project**

Sr. No.	Component	Description
1	Start Latitude/ Longitude End Latitude/ Longitude	26°53'16.63"N / 93°37'56.42"E 26°39'44.06"N / 93°50'55.07"E
2	Villages	The proposed alignment will pass through 24 villages Alitala, Badal Pathar Borghuli, Balitika, Borphalang, Khalihai Pathar , No.2 Chakala, No.2 Rajabari, No.2 Majikuchi, Tinsukia, Bihaguri, No 1. Uppar Tinsukia, No.2 Uppar Tinsukia, Baligaon, Mazdalapa, Alami Chapori, No.2 Patharimiri Gaon, Missimi Ati, No.1 Patharimiri Gaon, Rangagora Chapori, Bongaon, Lablebi Pathar, Buralikson, and Bon Bagisa villages.
3	Talukas	Khumtai, Gohpur, Bokakhat
4	Districts	Biswanath and Golaghat
5	State	Assam
6	Nearest Railway Station	Gohpur Railway Station ~ 5.2 km from Gohpur end Badulipar Railway Station ~ 3.9 km from Numaligarh end
7	Nearest Airport	Dimapur Airport ~ 86 km from Numaligarh end.

#### 3.3 Size & Magnitude of Operation

The total stretch of proposed National Highway is 34.664 km starting from Gohpur in Biswanath District and ends at Numaligarh in Golaghat District. The proposed alignment will have 4 lane roads.

##### 3.3.1 Land Requirement

A total of 315.9647 Ha. land is proposed to be acquired out of which 108.0869 Ha. is private land and 207.8778 Ha. is Government land. Total number of land parcels proposed to be

Pre-Feasibility Report - Proposed Construction of four lane TBM TUNNEL including approaches under River Brahmaputra between Gohpur on NH-52 North Bank and Numaligarh on NH-37 South Bank, Assam (Length: 34.664 km) on EPC Mode under SARDP-NE Phase-A

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acquired is 899 as per survey and 100% PAHs has been covered as of Nov, 2020. The details of land to be acquired are given in following Table.

**Table 3: District Wise Land Involvement**

<b>Sr. No.</b>	<b>District</b>	<b>Area in ( Ha)</b>	<b>Private land in (Ha)</b>	<b>Govt Land in (Ha)</b>	<b>Number of Land Parcel</b>
1	Golaghat	150.9419	68.7054	82.2363	432
2	Biswanath	165.0228	39.3815	125.6415	467
<b>Total</b>		<b>315.9647</b>	<b>108.0869</b>	<b>207.8778</b>	<b>899</b>

### **3.3.2 Project Cost**

The estimated overall cost for the proposed project inclusive of civil & engineering aspect is Rs. 11204.42 Crores.

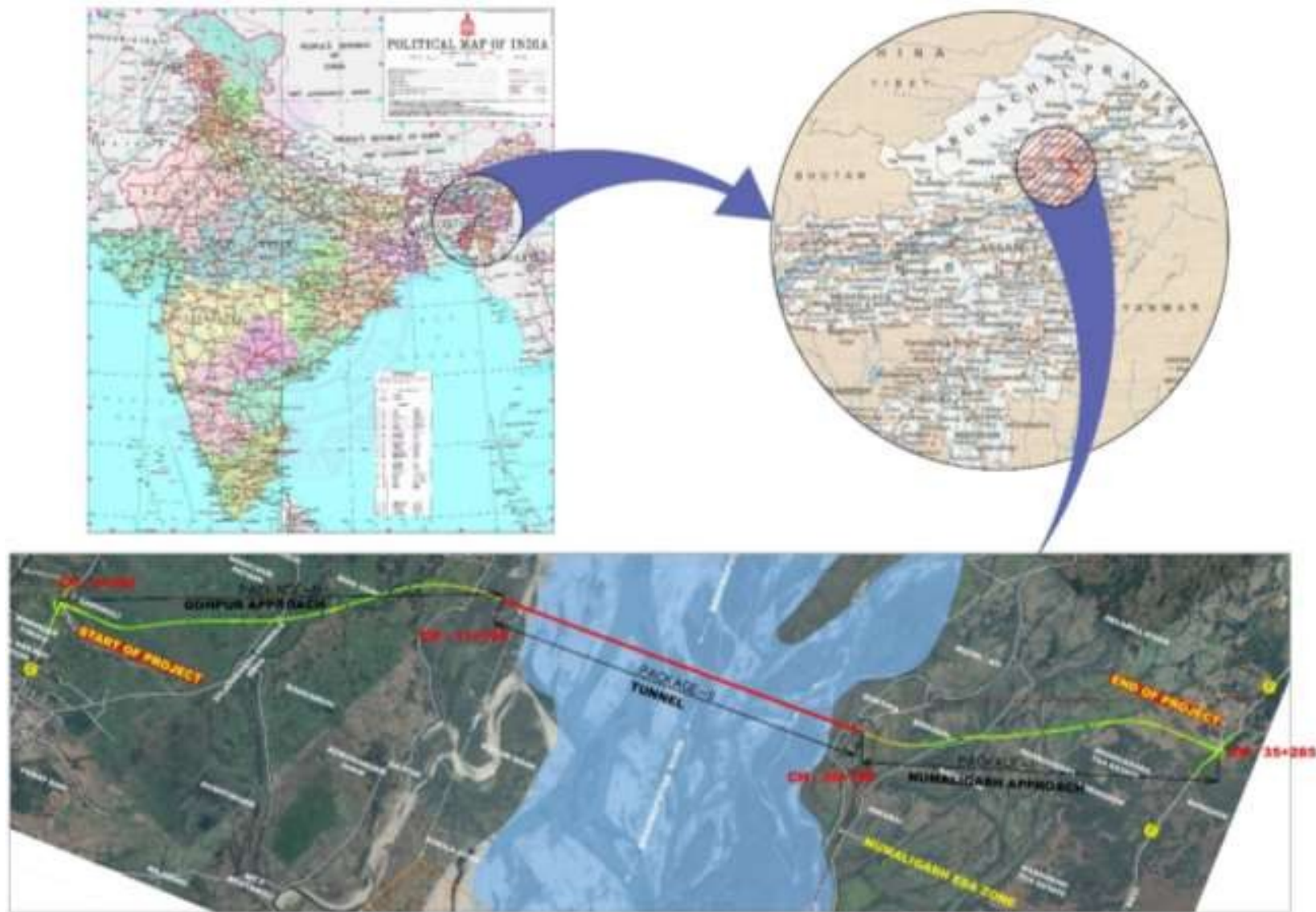


Figure 2: Location Map of Proposed Alignment

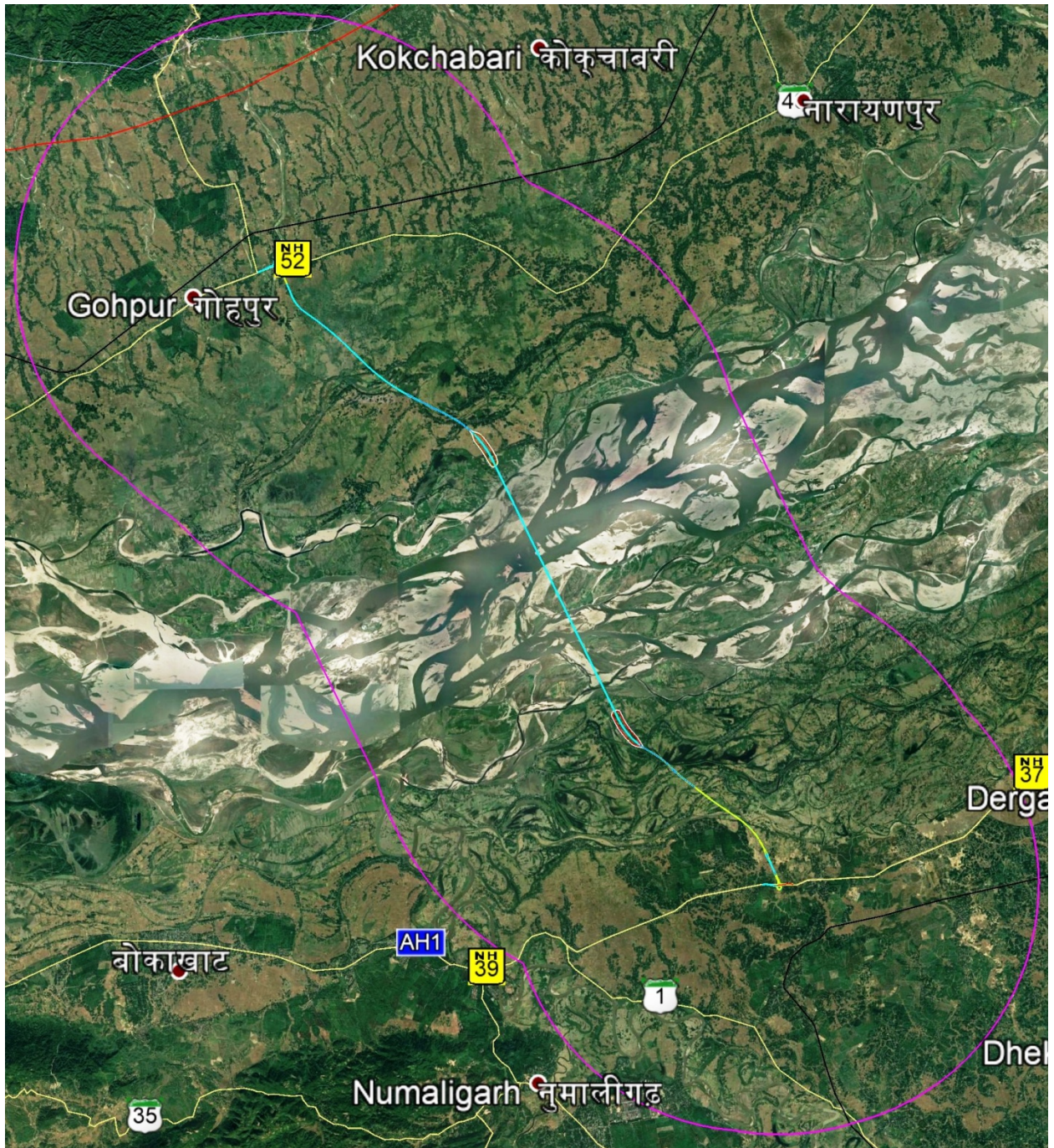


Figure 3: Google Image of the Project Site and 10 km Study Area

### 3.4 Project Description with Process Details

#### 3.4.1 Connectivity to existing National Highway Network

The proposed 4 lanes road connects with NH 52 on the northern side of River Brahmaputra in Gohpur and terminates at NH 37, on the southern side of River Brahmaputra in Numaligarh. The entire length of road is passing through plain terrain. The land use by the side of the project stretch includes mainly agriculture activities and sparsely distributed residential use.

### 3.4.2 Project Road

The project is in the state of Assam and is expected to serve as a very prominent route connecting Itanagar – Gohpur – Numaligarh. This road will enhance the connectivity between North and South side of Brahmaputra River and will lead to the rapid special and economic development of the area.

Existing traffic is crossing the Brahmaputra river on the downstream side at a radial distance of approximately 90 km from the project road near Tezpur while on the upstream side the radial distance of the existing bridge from the project road is approximately 130 km near Dibrugarh. There is no crossing facility available for a length of approximately 220 km. The proposed road will divert the existing traffic using the NH37 road adjacent to environmentally sensitive Kaziranga Forest. Therefore, the project road becomes more important. The project road connects NH52 on the Gohpur side (North side) and NH 37 on the Numaligarh side (South side).

The start and end point coordinates are given in **Table 4**.

**Table 4: Start & End Point Coordinates of Proposed Alignment**

Sr. No.	Description	Northing	Easting
1	Start of Project Road with junction at NH 52	563670.9526	2974572.1531
2	End of Project Road with junction at NH 37	584477.9299	2949240.9155

The project road starts with a junction with NH 52 on the Gohpur side and traverses' southwards through agricultural fields above the ground till chainage 11+100 crossing various streams and village roads, where bridges and vehicular underpasses are proposed. This section of the project road traverses over ground on varying embankment.

From chainage 11+100 till chainage 13+400 Artificial Island is proposed, for a width of 210m on each side of the project road. The artificial island acts as a bund to protect the ingress of water within this section of the project road as the project road is starting to go below the ground and Brahmaputra River through Tunnel. The top level of the island is proposed above the HFL+ Free Board level. The entire area of the artificial island is proposed to be backfilled with the material excavated during the construction of the Tunnel. The driving pit for lowering the Tunnel Boring Machine (TBM) also lies within the island. The project road will be in open cut section between chainage 11+640 to chainage 11+990. From chainage 11+990 to chainage 13+260 the project road is proposed to be as a cut and cover tunnel section. Beyond this chainage the project road is proposed to be as a TB tunnel section. The top of the tunnel is proposed to be approximately 40.0m below the bed of the River Brahmaputra. It is proposed to be a twin tube tunnel which will be connected through a cross passages at every 300 m as per the requirements of the codes. The project road traverses as a TBM tunnel below the Brahmaputra River till chainage 24+687, where the receiving pit is proposed to retrieve the TBM, on the other side of the river Brahmaputra. From chainage 24+687 to chainage 26+020 the project road section is proposed to be in cut and cover tunnel section. The section of the project road from chainage 26+020 till chainage 26+400 will in open cut section.

Artificial Island is also proposed on the southern side of the Rver Brahmaputra, which will act as a bund to protect the flood water to enter inside the construction zone created within the island to

facilitate the construction of tunnel and also during the operational phase. The top of the embankment of artificial island will be above the HFL + Free Board requirements.

The project road will be on normal embankment from chainage 26+400 till the junction point with National Highway 37 (NH 37) on the Numaligarh side, crossing many streams and village roads where bridges and vehicular underpasses are proposed. Toll Plaza is proposed along the project road on the Numaligarh side at chainage 33+350 for the collection of Toll.

### 3.4.3 Details of Right of Way

A minimum Right of Way (RoW) of 60 m is proposed for the project road in general the ROW will increase at the proposed Toll Plaza, which is proposed to be 8 Lane (3 normal lane and 1 extra wide lane each sides) expandable to 16 lanes in future and at the artificial bund/island locations where Tunnel approaches will start/end at both the sides of River Brahmaputra.

The Project Road starts from a junction with NH 52 on the Gohpur side and ends with a junction with NH 37 on the Numaligarh Side. Trumpet interchanges are proposed at both the locations for the free flow of the traffic. Total length of the Project Road (excluding interchange loops and ramps on both ends) from Junction to junction is 33.77 km.

**Table 5: Proposed Right of Way Details**

Sr. No.	Packages	Chainage (km)		Right of Way (m)	Remarks
		From	To		
1	Package III	0+890*	1+780	Varying (min. 60)	Interchange
2		1+780	11+100	60	Normal Road Section
3		11+100	11+550	60	Normal Road Section
4	Package II	11+550	12+040	varying	Artificial Island location
5		12+040	13+325	420	Artificial Island location
6		13+325	13+435	varying	Artificial Island location
7		13+435	24+500	60	Normal Road Section/Tunnel
8		24+500	24+675	varying	Artificial Island location
9		24+675	26+000	420	Artificial Island location
10		26+000	26+500	varying	Artificial Island location
11		26+500	32+970	60	Normal Road Section
12	Package I	32+970	33+730	190 (Max & Varying)	Toll Plaza
13		33+730	34+040	60	Normal Road Section
14		34+040	34+664*	Varying (min. 60)	Interchange

### 3.4.4 Road Junctions /Crossings

The proposed alignment will cross many existing earthen roads/ bitumen roads which are leading to nearby villages. The details of these roads are provided in **Table 6**.



**Table 6: Road Crossing Details**

Sl. No.	Packages	Location	Type
		From km	Cross Road
1	Package III	1+135	Village Road
2		1+222	Village Road
3		2+380	LHS-Gohapur Pathar, RHS-Village
4		6+133	LHS-Chakala No 1, RHS-Village
5		7+048	LHS-Khetriati, RHS-Dilapakhara Chakala
6		8+530	Village Road
7		11+073	Village Road
8	Package II	12+827	Existing Bund Road/ Village Road
9		14+000	Existing Bund Road/ Village Road
10		23+867	Existing Bund Road/ Village Road
11	Package I	26+970	Village Road
12		27+750	Village Road
13		28+525	Village Road
14		29+635	Village Road
15		31+525	Village Road
16		32+570	Village Road

### 3.4.5 Bypasses

Since proposed project is a new Greenfield Alignment, there is no under construction / proposed bypass.

### 3.4.6 Railway Over Bridge / Rail Crossings

The proposed alignment does not cross railway line along its entire length hence there will be no railway over bridge/rail crossings.

### 3.4.7 Typical Cross Sections

The project road is entirely a green field alignment. It is proposed to be developed as a 2x2 lane divided carriageway, with Paved and earthen shoulder on both sides. The proposed road will have a median of 4.0m excluding inner shyness. Discussions were held with the Client, NHIDCL, whether to follow the dimensions of various road elements as given in the latest IRC: SP-84-2019, or as per the old IRC code IRC:SP-84-2014. It was communicated by the Client, NHIDCL to adopt the dimensions of various road elements as per the provisions of IRC:SP-84-2014, and accordingly Typical Cross Sections were proposed for the design of project. The details of TCS are provided in DPR of the project.

Design Speed - The project road is designed for a design speed of 100 kmph as given in IRC: SP-84 2014.

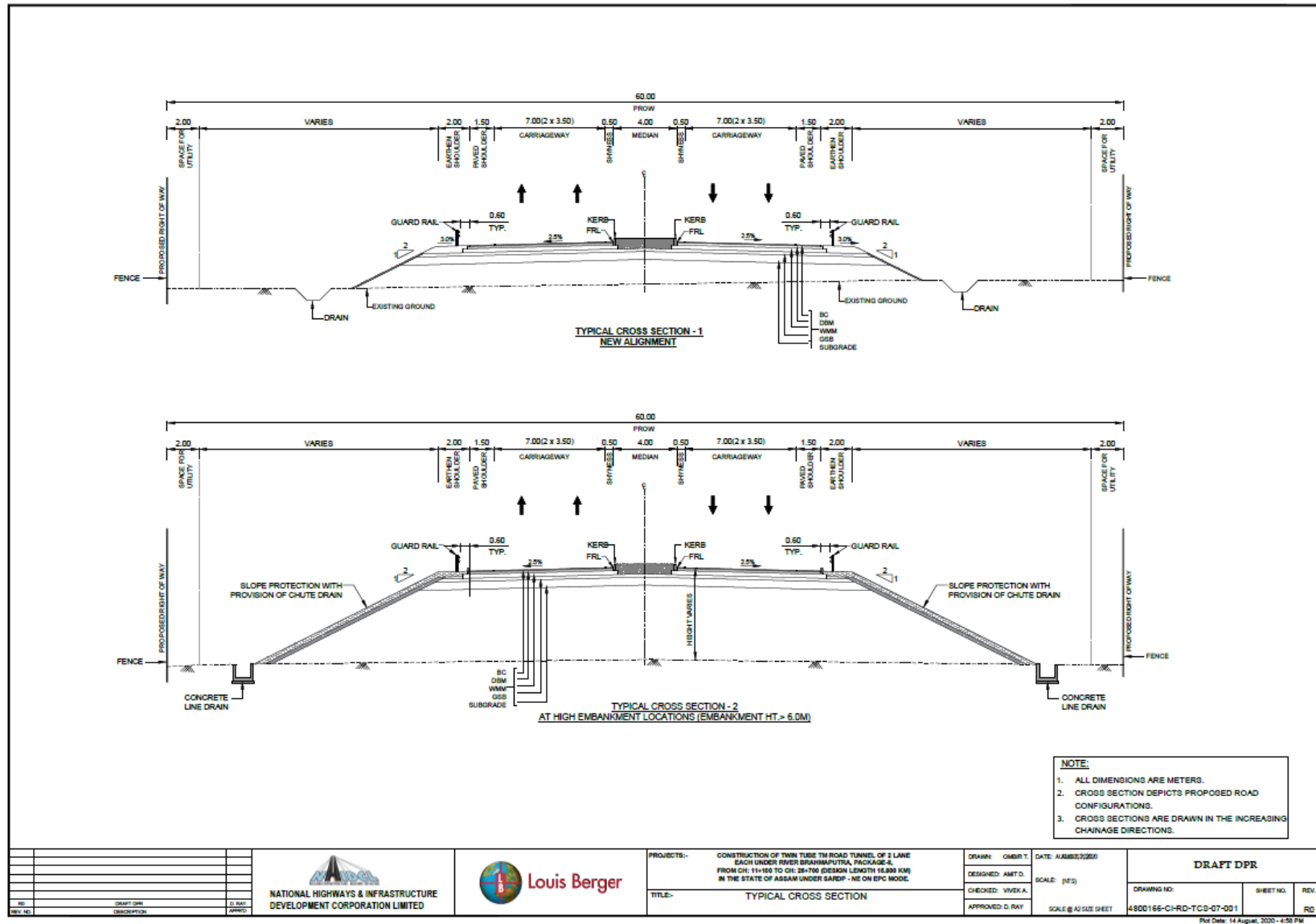


Figure 4: Typical Cross-section of Proposed Alignment & at High Embankment Locations (Embankment Ht. > 60 m)

### 3.4.8 Tunnel Design & Specifications

The project road is proposed to have a main Tunnel under the Brahmaputra River. The details of tunnel are dealt in detail in separate sections. Summary of the proposed tunnel is given below:

- 1) Tunnel Sections – Open Cut + Cut & Cover + Main Tunnel
- 2) Tunnel Configuration – Twin Tubes 2 x 2 Lanes
- 3) Length of Open Cut Section – 350m (Gohpur Approach) + 380m (Numaligarh Approach)
- 4) Length of Cut & Cover Section – 1,270m (Gohpur Approach) + 1,333m (Numaligarh Approach)
- 5) Length of Main Tunnel Section – 11,427 m
- 6) Cross Passages – @ 300m c/c
- 7) Longitudinal Gradient – 0.1% main tunnel section, up to 3% for Open Cut and Cut & Cover sections

The salient features of the tunnel are given in **Table 7**.

**Table 7: Salient Features of Tunnels**

Chainage (km)		Length (m)	Remarks
From	To		
11+100	11+642.5	542.5	Surface Roads
11+642.5	13+264.82	1622.32	Cut & Cover Tunnels
13+264.82	24+687.225	11422.405	TBM Tunnels
24+687.225	26+402.94	1715.715	Cut & Cover Tunnels
26+402.94	26+700	297.06	Surface Roads
<b>Total Length =</b>		<b>15600</b>	
Particulars		Details	
Two Lane TBM Tunnel Length (km)		11.42	
Tunnel Finished (Inner), Diameter, m		11.50	
Tunnel Segment Lining Thickness (m)		0.45	
Tunnel Excavated (Outer) Diameter		12.40	
Numbers of Tunnel Cross Passages (Pedestrians @ 300 m c/c & Motor able @ 900 m c/c)		38	
Tunnel Gradient, %		0.1 to 2%	
Tunnel Depth, m		32-56	
Soil Type		Alluvial with sand, silt and clay	
High Flood Level, m		79.143	
Segment Configuration		7+1 Key segment	
Segment Width (Transversal length) of the segment		1.5 m	
Main & tapered segment angle		49°	
Tapering of ring		± 40 mm (80 mm)	

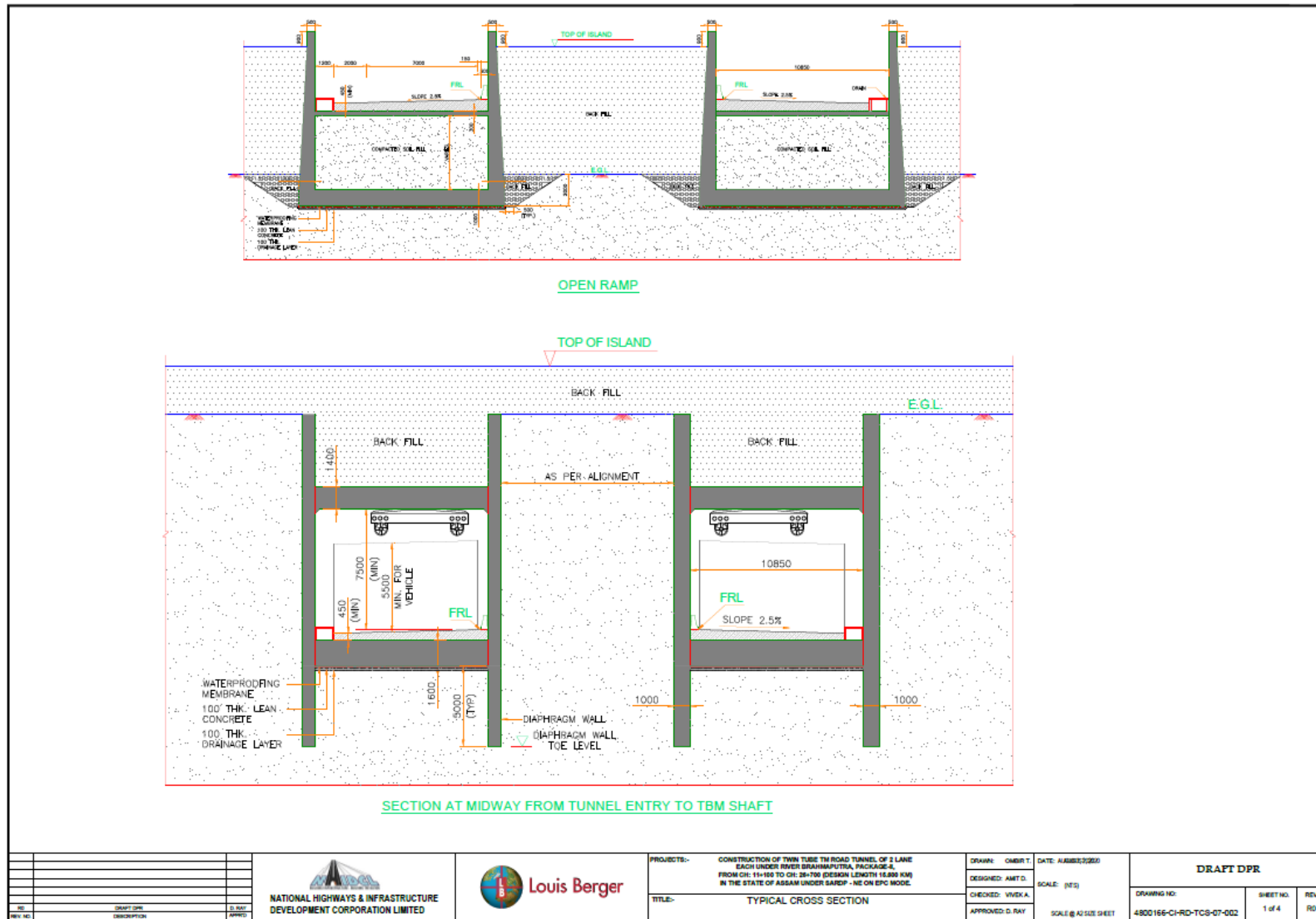


Figure 5: Section at Midway from Tunnel Entry to TBM Shaft



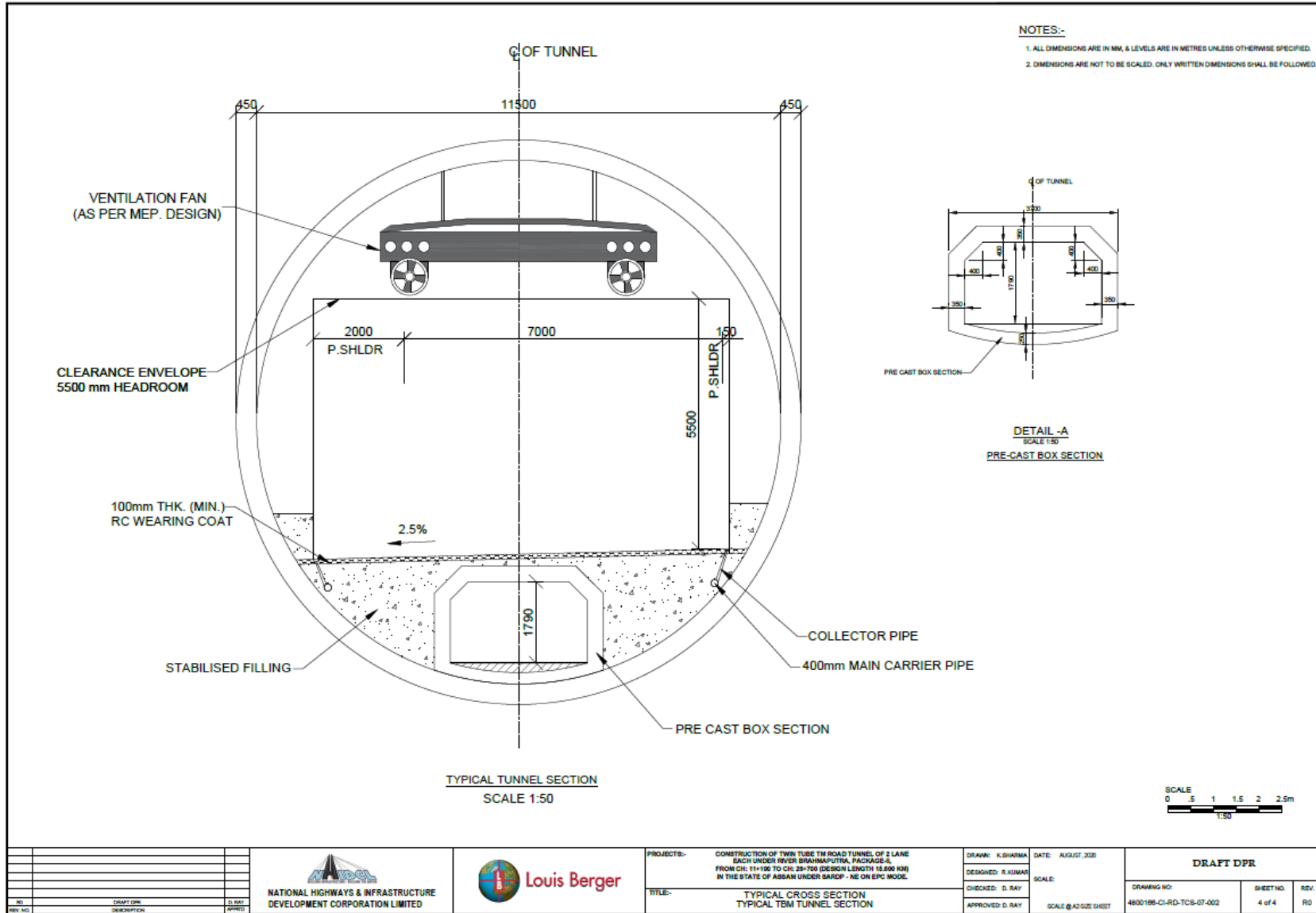


Figure 7: Typical Tunnel Section

### **3.4.9 Proposed Bridge Details**

The project road traverses from NH 52 on Gohpur side (Northern side) of River Brahmaputra to NH 37 on Numaligarh side (Southern side) while doing so the project road crosses many streams and channels. On every such crossing, bridges are proposed. Depending on the length of the crossings these bridges are further categorized as Major and Minor bridges.

Further, there are locations where the existing streams are running very close to the village roads. At all these locations, it is proposed to club major/minor bridge with the vehicular underpass. **Table 9** shows the list of bridges proposed along the project road.

**Table 9: Proposed Bridge Details**

Sr. No.	Side/ Packages	Chainage (Km.)	Type of Structure	Span Arrangement (m.)	Skew (Degree)	Width (m.)
1	<b>Gohpur Approach – Package III</b>	0+275	Minor Bridge	1x32	0	16+16+12.5
2		0+894	Interchange on NH52	2x32	0	14.5+14.5
3		1+178	Major Bridge	5x25.0	0	16.0+16.0
4		2+764	Minor Bridge	1x35	0	16.0+16.0
5		4+631	Major Bridge	3x25	45	16.0+16.0
6		6+155	Major Bridge + LVUP	1x20+3x32	0	16.0+16.0
7		7+380	Minor Bridge	1x20	0	16.0+16.0
8		7+888	Minor Bridge	1x32	11	16.0+16.0
9		8+260	Major Bridge	2x32	0	16.0+16.0
10		9+119	Major Bridge	2x32	30	16.0+16.0
11		10+400	Major Bridge	2x35	55	16.0+16.0
12		10+975	Major Bridge + LVUP	2x32+1x20	0	16.0+16.0
--	<b>Package II</b>	<b>Tunnel on River Brahmaputra</b>				
13	<b>Numaligarh Approach - Package I</b>	27+200	Major Bridge	2x35	55	16.0+16.0
14		29+514	Minor Bridge	2x25	20	16.0+16.0
15		30+788	Major Bridge	4x32	0	16.0+16.0
16		34+664	Interchange on NH37	2x35	15	16.0+16.0
17		34+885	Minor Bridge	1x32	0	16.0+16.0



### 3.4.10 Interchanges

The proposed alignment starts as a junction with NH 52, traverses southward and crosses River Brahmaputra, where tunnel is proposed. After the proposed road crosses Brahmaputra it further traverses southward and connects with NH 37 to provide free flow of the traffic on the proposed road and its junctions with NH 52 and NH 37, interchanges are proposed. **Table 10** below shows the list of Interchanges proposed on the project road.

**Table 10: Details of Proposed Interchanges**

Sr. No.	Side/ Packages	Chainage (Km)	Type of Structure	Span Arrangement (m)	Skew (Degree)	Width (m)
1	Gohpur Approach – Package III	0+894	Interchange on NH52	2 x 32	0	14.5 + 14.5
2	Numaligarh Approach – Package I	34+664	Interchange on NH37	2 x 35	15	16.0 + 16.0

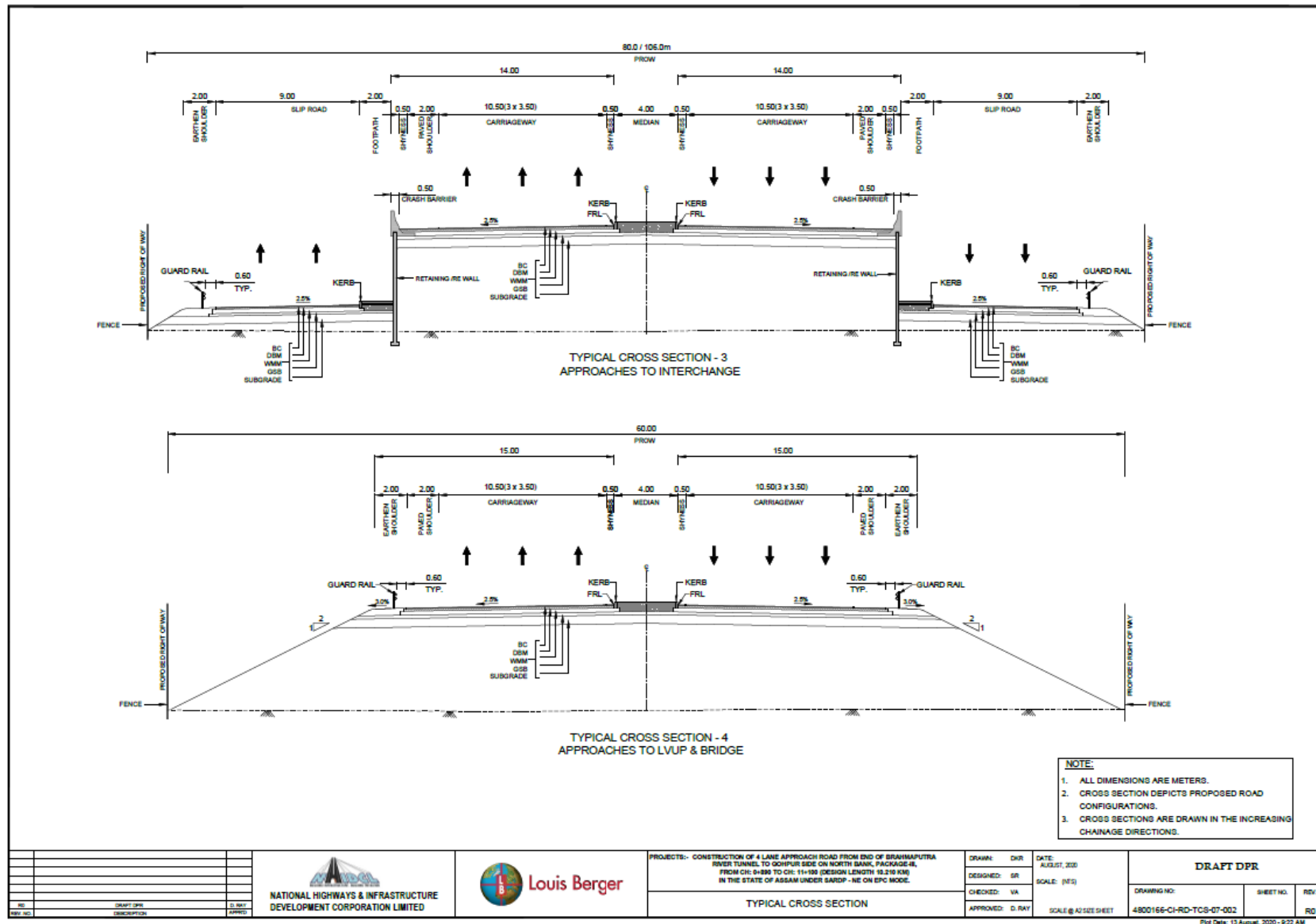


Figure 8: Typical Cross-section-Approaches to Interchange and Approaches to LVUP & Bridge

### 3.4.11 Culverts

The proposed alignment falls in the high rainfall area. Further, it crosses through many small streams and low-lying areas along its length. In view of these, a number of cross drainage structures in form of Box Culverts are proposed along its length. Details of the box culverts proposed along the alignment are presented in **Table 11**.

**Table 11: Details of Proposed Box Culverts**

Sr. No.	Packages	Design Chainage	Type of Culvert	Span Arrangement (m)		
				Span	Width	Height
1	Package III	1+848	Box	1	4.00	3.50
2		2+350	Box	1	4.00	3.50
3		3+300	Box	1	4.50	3.00
4		3+500	Box	1	4.00	2.00
5		3+580	Box	1	4.00	2.00
6		3+645	Box	1	4.00	2.00
7		4+335	Box	1	4.00	2.00
8		5+680	Box	1	4.00	2.00
9		7+095	Box	1	4.50	5.00
10		7+650	Box	1	4.00	3.50
11		7+770	Box	1	4.00	3.50
12		9+330	Box	1	4.00	2.00
13	Package II	9+890	Box	1	4.00	2.00
14		10+195	Box	1	4.00	2.00
15		10+740	Box	1	4.00	2.00
16	Package II	11+105	Box	1	4.00	5.00
Tunnel on River Brahmaputra						
17	Package I	27+550	Box	1	3.50	4.00
18		27+740	Box	1	3.50	4.00
19		28+455	Box	1	5.00	4.50
20		28+690	Box	1	3.50	4.00
21		29+080	Box	1	2.00	4.00
22		29+670	Box	1	5.00	4.50
23		30+130	Box	1	2.00	4.00
24		30+500	Box	1	5.00	4.00
25		31+020	Box	1	5.00	4.00
26		31+200	Box	1	3.50	4.00
27		31+500	Box	1	3.50	4.00
28		31+817	Box	1	3.00	4.50
29		32+130	Box	1	2.00	4.00
30		32+700	Box	1	3.50	4.00
31		33+025	Box	1	2.00	4.00
32		33+035	Box	1	1.55	4.00
33	33+200	Box	1	2.00	4.00	

34		33+495	Box	1	2.00	4.00
35		33+540	Box	1	2.00	4.00
36		33+950	Box	1	2.00	4.00
37		34+380	Box	1	3.50	4.00

### 3.4.12 Slip Roads

Slip lanes are provisioned at the start and end sections of the project road, which will be part of the proposed interchange and will facilitate the free flow exchange of traffic from the project road and the existing National Highways 52 and 37 on Gohpur and Numaligarh sides respectively.

**Table 12: Details of Slip Road**

Sl. No.	Packages	Location of Slip Lane (from Ch. to Ch.)	RHS/LHS/Both sides	Length (km)
1	Package III	Ch. 1+000 to Ch. 1+385	Both sides	0.385
2	Package I	Ch. 34+150 to Ch.34+500	Both sides	0.350

### 3.4.13 Service Roads

Small service roads are proposed at locations where the vehicular underpasses are proposed. These small service roads will maintain the existing crossroad connectivity.

**Table 13: Details of Service Roads**

Sl. No.	Packages	Location of Slip Lane (from Ch. to Ch.)	RHS/LHS/Both sides	Length (km)
1	Package III	Ch. 2+300 to Ch. 2+575	RHS	0.275
2		Ch. 2+300 to Ch. 2+385	LHS	0.085
3		Ch. 6+100 to Ch. 6+150	Both	0.200
4		Ch. 11+015	Both	0.200
5	Package I	Ch. 26+970	Both	0.200
6		Ch. 27+750	Both	0.200

### 3.4.14 Vehicular Underpass

The proposed alignment while traversing north to south, it crosses many village roads. At all these crossing locations, vehicular underpasses are proposed to facilitate the continuity of the traffic plying on these roads. Table 14 shows the details of vehicular underpasses proposed along the project road.

**Table 14: Details of Vehicular Underpasses**

Sr. No.	Side / Packages	Chainage	Type of Structure	Span Arrangement (m.)	Width (m.)
1	Gohpur Approach – Package III	2+380	LVUP	1 x 12	14.5 + 14.5
2		7+048	LVUP	1 x 12	14.5 + 14.5
3		8+530	LVUP	1 x 12	14.5 + 14.5
4		26+970	LVUP	1 x 12	14.5 + 14.5

5	Numaligarh Approach – Package I	27+750	LVUP	1 x 12	14.5 + 14.5
6		28+525	LVUP	1 x 12	14.5 + 14.5
7		29+635	LVUP	1 x 12	14.5 + 14.5
8		31+525	LVUP	1 x 12	14.5 + 14.5
9		32+570	LVUP	1 x 12	14.5 + 14.5

### 3.4.15 Artificial Island / Maintenance Road

Artificial Islands are proposed on both sides of the River Brahmaputra where the project road is going from over ground to underground as Tunnel. The Artificial island is designed such that the top of the island is well above the HFL and freeboard criteria required for the main Brahmaputra River, so that the water does not enter in the proposed Tunnel. The project road will go over the artificial island and then start going down below the ground level as Tunnel. The project road will be in Open cut section and cut and cover section before finally reaching as main tunnel.

The length of Artificial Island will be for a length of approx. 750m and width of 420m. The length of Artificial Island is such as to cover Open cut section, cut and cover section and the TBM driving and receiving pit. The fill material required for the construction of Artificial Island will be taken from the muck generate by the TBM machine during the progression of construction of Tunnel. Sample plan and section of Artificial Island proposed on both sides of River Brahmaputra is shown in Figure 7 to Figure10.

To maintain the Island and other facilities required for the tunnel i.e lighting, ventilation security etc, Maintenance road having a width of single lane (3.75m wide) is proposed on the periphery of the Artificial Island on both sides of the River Brahmaputra. The length of Maintenance road is approximately 3.4 km on each island proposed.

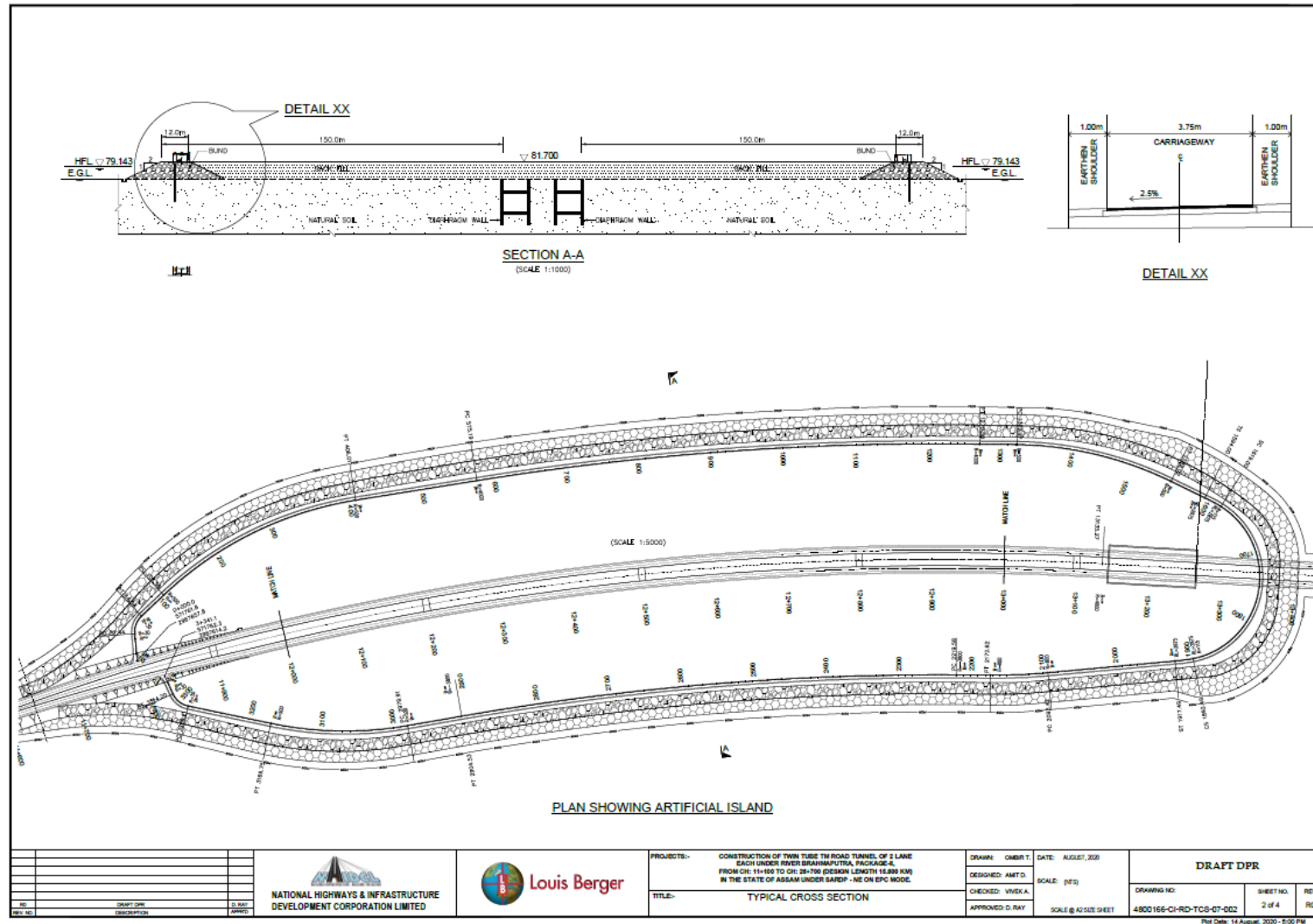


Figure 9: Plan Showing Artificial Island

### 3.4.16 Bus Bays

The project is proposed to provide direct connectivity to the north and south sides of River Brahmaputra. While traversing the project road crosses many village roads in between where vehicular underpasses are proposed. To facilitate the local people to utilize the proposed facility and connects with local/long distance public transportation, bus bays are proposed near the underpasses. Table 15 below shows the locations along the project road where these facilities are proposed.

**Table 15: Location of Bus Bays**

Sr. No.	Packages	Chainage	Side
1	Package III	5+880	Both Sides
2		8+720	Both Sides
3	Package I	28+740	Right Side
4		29+885	Both Sides
5	Package I	31+305	Left Side
6		31+720	Right Side
7		32+415	Left Side
8		32+760	Right Side

### 3.4.17 Toll Plaza

A toll plaza is proposed along the project road in Package I, to collect the toll revenue from the traffic anticipated to ply on the proposed road. Based on the traffic data analysis and the availability of the land along the project road, 8 x 8 lane Toll Plaza is proposed along the project road. This is in line with the ministry circular to provide 4 times the number of lanes at toll plaza for the project road.

Since the project road is proposed to be 2 x 2 lane configuration, the toll plaza will have 8 x 8 lanes facility. However, the same was discussed with the Client, and it was conveyed to acquire the required land to have ultimate number of lanes i.e 8 x 8 lanes, but for the present scope only provide 4 x 4 lane facility at the Toll Plaza. Additional number of lanes will be added in the future as and when the same is required based on the traffic growth. Plan of proposed Toll Plaza is shown in Figure 8.

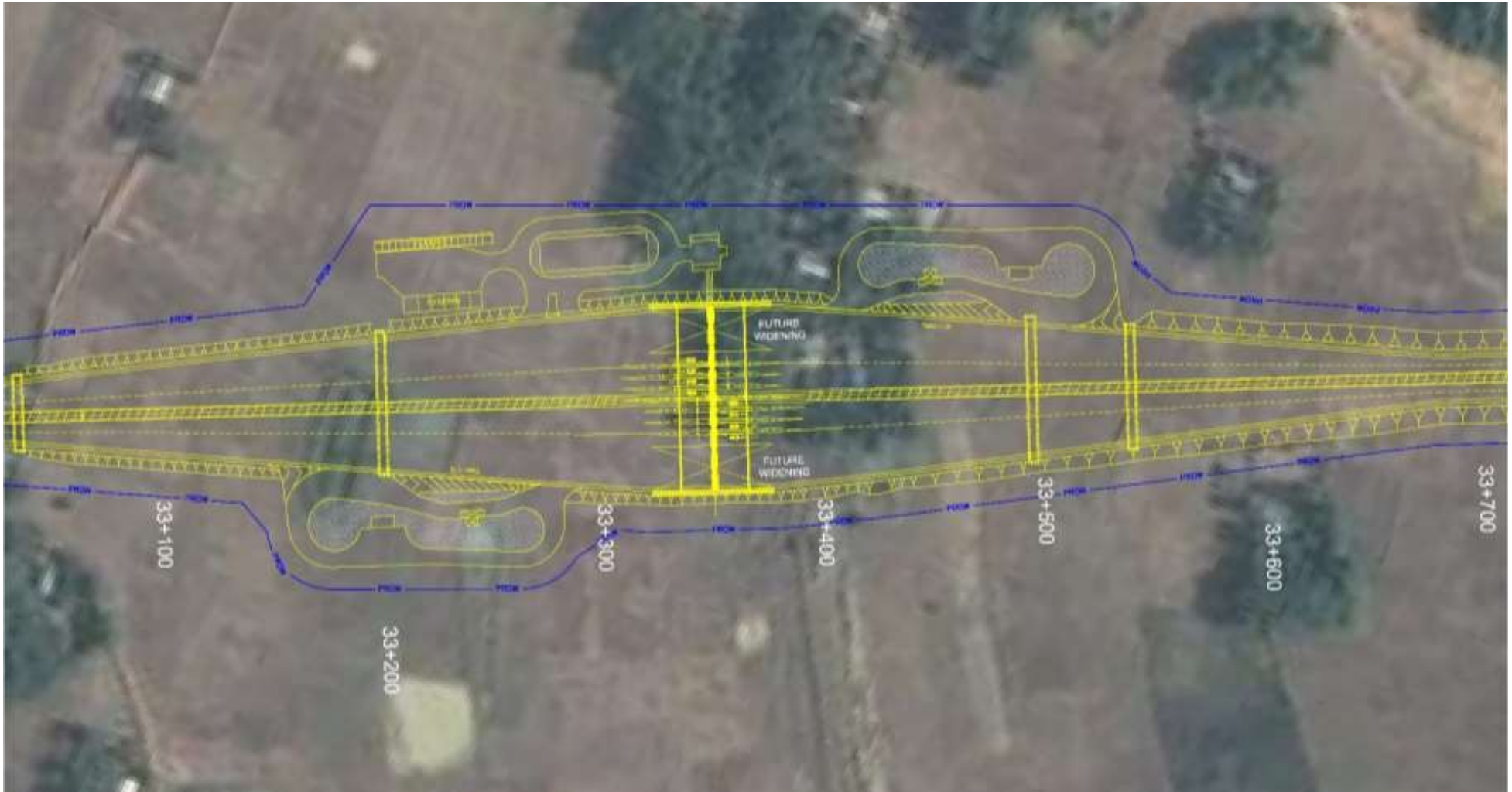


Figure 10: Schematic Alignment of Proposed Toll Plaza



### 3.4.18 Metallic Guard Rails on High Embankment Areas

Wherever the project road is on an embankment more than 3m, metal beam crash barriers are proposed for the safety of traffic.

### 3.4.19 Highway Lighting

Highway lightings are proposed along the highway at the structure locations, toll plaza and interchange locations. Highway lightings are also proposed for the entire section of the tunnel sections.

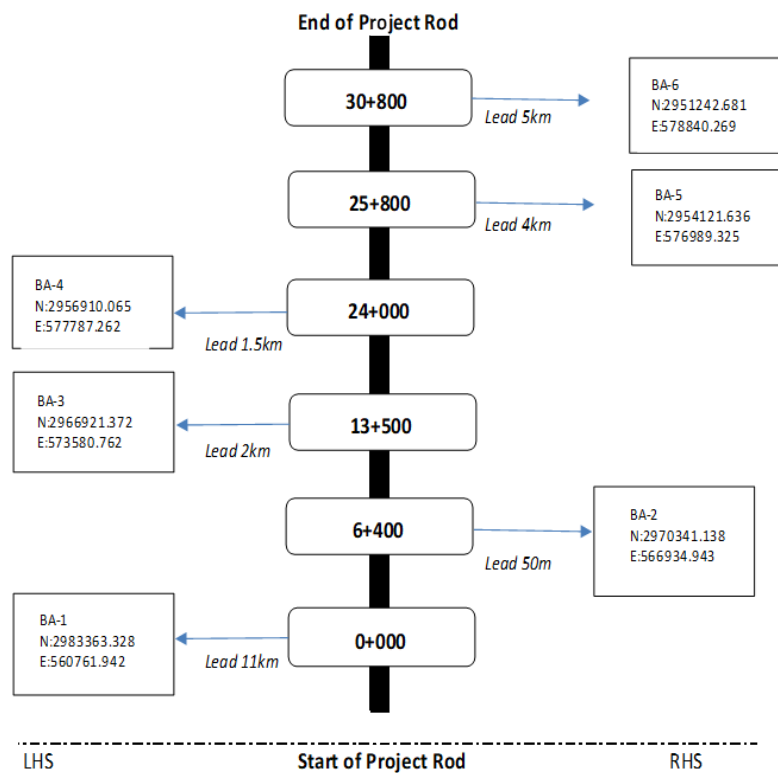
### 3.4.20 Safety Signs & Road Markings

All the necessary road safety signs including road markings have will be provided on the project road section.

## 3.5 Construction Material

### 3.5.1 Borrow Sites

A number of sources of natural soil deposits, moorum, gravel, sand, GSB and potential quarries for production of crushed rock aggregate to be used in the construction of pavement layers and highway structures had been identified. During the investigations soil borrow areas and quarries for fine and coarse aggregates were identified. Total 6 borrow areas for soil and 4 sites for sand have been identified along the project. The location of the identified borrow areas are shown in **Figure 12** and **Figure 13**.



**Figure 11: Lead Chart of Borrow areas (as per Design Chainage)**

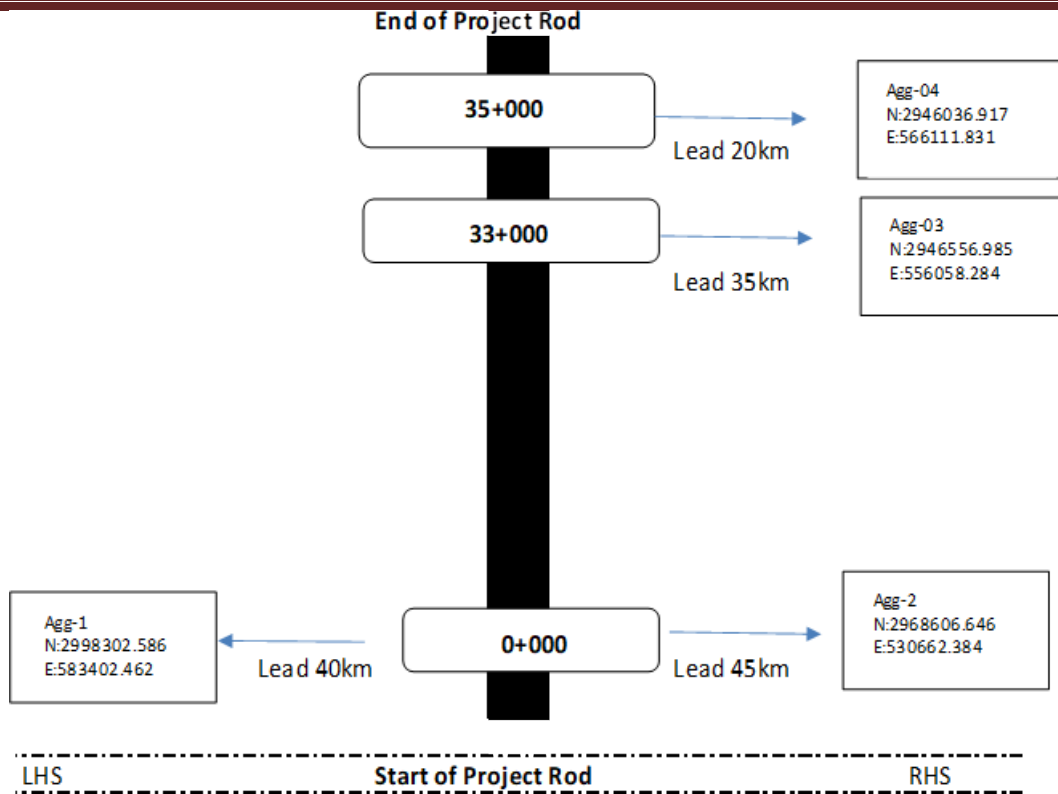


Figure 12: Lead Chart of River Sand

### 3.5.2 Raw Material Required along with Estimated Quantity

The approximate requirement of construction materials for proposed project & their source is as given in below Table.

Table 16: Construction Materials Requirement & Source

Sr. No.	Material	Quantity	Unit	Source
1	Aggregate	3056541	m <sup>3</sup>	Rangamati Gaon, Chunaigaon, Garahmurh, Borjuri Gaon
2	Soil	9477441	m <sup>3</sup>	Identified borrow areas
3	Sand	1509326	m <sup>3</sup>	Kaliani Block, Numaligarah grant Bagicha
4	Cement	466565	MT	Local market
5	Bitumen	8003	MT	Haldia Refinery
6	Steel	105946	MT	Local market

The borrow materials shall be procured by the contractor as per local laws/agreement with owner after obtaining the prior clearances from Statutory Authorities.

### 3.6 Resource Optimization, Recycle/Reused

The soil from excavation activity will be stacked and used for plantation & green belt development activity, further the fill material required for the construction of Artificial Island will be taken from the muck generate by the TBM machine during the progression of construction of Tunnel.

### **3.7 Requirement and Source of Water/Energy**

The power requirement of 2000 kVA will be sourced as per statutory provisions & DG Sets of 2000 kVA will be provided as backup during construction phase. The total power requirement during the operational phase is 21416.89 kVA.

### **3.8 Quantity of Waste Generated**

Approx. 450 kg of municipal waste is expected to be generated during construction considering 1000 workers. During operation phase, the municipal solid waste generated from the amenities proposed along the alignment.

Construction wastes viz. Concrete debris, Left over Bitumen. Left over Metal, Wood & Other (Plastic material, paper etc.) are anticipated to be generated the inert solid recyclable waste will be sent to recycles & non recyclable waste management will be done as per provisions of Construction & Demolition Waste Management Rules 2016.

The hazardous waste such as Spent Oils, Used lubricants and Left over paints, Contaminated containers generated from overall project activity will be stored at designated place. The storage, handling and disposal of the same will be done as per Hazardous and Other Wastes (Management and Transboundary Movement), 2016.

## 4. SITE ANALYSIS

### 4.1 Connectivity

The proposed project in the state of Assam and is expected to serve as a very prominent route connecting Itanagar – Gohpur – Numaligarh. This road will enhance the connectivity between North and South side of Brahmaputra river and will lead to the rapid special and economic development of the area.

Existing traffic is crossing the Brahmaputra River on the downstream side at a radial distance of approximately 90 km from the project road near Tezpur while on the upstream side the radial distance of the existing bridge from the project road is approximately 130km near Dibrugarh.

There is no crossing facility available for a length of approximately 220km. The proposed 4 lanes highway will connect with NH 52 on the northern side of River Brahmaputra in Gohpur and terminate at NH 37, on the southern side of River Brahmaputra in Numaligarh. The entire length of road will be passing through plain terrain. The land use by the side of the project stretch includes mainly agriculture activities and sparsely distributed residential use.

Now since the proposed highway project is alignment is strategically planned taking into consideration the locale specific needs, none other alternative of connectivity is envisaged & considered feasible.

Further analysis of alternatives studies w.r.t project design options were conducted viz. Bridge or Tunnel for Brahmaputra as described below.

**Table 17: Analysis of Bridge & Tunnels option**

<b>Parameters</b>	<b>Tunnel Option</b>	<b>Bridge option</b>
<b>Functional</b>	Serves the operation of 2x2 Lane traffic connecting NH37 (Numaligarh) & NH52 (Gohpur)	Serves the operation of 2x2 Lane traffic connecting NH37 (Numaligarh) & NH52 (Gohpur)
<b>Overall length</b>	Total length 33.8 Km 14.85Km Tunnel (TBM and Cut & Cover) +18.95Km approaches	Total length 33.8 km 10.9Km Main bridge with viaducts+22.9 km approaches
<b>Main components</b>	14.85 Km including cut and cover section at approaches – Civil cost 6403Cr	10.9 Km of Main Bridge including viaducts & Guide Bunds– Civil cost 4175 Cr
<b>Estimated Timeline for Construction</b>	69 Months	60 Months
<b>Estimated Civil cost Tunnel/Bridge including Approaches &amp; GST</b>	11204.42 Crs	6000 Crs
<b>Environmental and Social Benefits</b>	▪ The Tunnel construction will have minimum impacts on aquatic ecology of the Brahmaputra River as all construction activities are below 30	▪ The bridge construction will have direct impact on aquatic ecology of Brahmaputra River.

	<p>mts from ground.</p> <ul style="list-style-type: none"> <li>▪ There will be no change in river flow in case there is tunnel.</li> <li>▪ There will be no impact on the movement of fisherman and ships in case there is Tunnel.</li> <li>▪ There is no change in natural aesthetic as there will be no structure over River.</li> <li>▪ There will be no contamination of river water due to accidental oil spillage as there is no movement of any vehicles over the river.</li> <li>▪ No impacts on habitats of fish, turtle, and other aquatic organisms during construction of tunnel.</li> <li>▪ There will be no contamination of river water during construction.</li> <li>▪ There will be some issues of air pollution and ventilation during construction and operation phase of the tunnel.</li> <li>▪ Strategically superior solution from Security point of view and uninterrupted movement of Defense personnel during Emergency</li> <li>▪ Reduced LA activities</li> <li>▪ No obstruction to water transport or navigational operations</li> <li>▪ Minimal Environmental Impact during Tunnel construction</li> <li>▪ No requirement of Guide bunds – reduced Land acquisition. Availability of materials for Guide Bund construction nearby Project area is a challenge – Tunnel option would minimize this crisis</li> <li>▪ Less hindrance of construction activities due to monsoon</li> </ul>	<ul style="list-style-type: none"> <li>▪ The piers and foundation construction may create hindrance for the movement of aquatic organisms.</li> <li>▪ The bridge may create height limit and hindrance for the movement of fisherman and ships.</li> <li>▪ There will be change in natural aesthetic as there will be huge structure over bridge.</li> <li>▪ There are chances of accidental oil spillage in case of bridge.</li> <li>▪ There will be some impacts on habitats of aquatic habitats.</li> <li>▪ The bridge construction may have impacts on water.</li> <li>▪ Less cost in compare to Tunnel option</li> <li>▪ Standard construction method – availability of skilled workers for similar construction</li> <li>▪ Less time for Construction – activities can go parallel whereas in Tunnel option it depends on procurement of TBM</li> <li>▪ Less operation and maintenance cost in compare to Tunnel</li> <li>▪ Visually appealing appearance</li> </ul>
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Based on the assessment carried out, it is very much clear that both the options are very close in terms of functionality and construction timeline. However, the cost for Tunnel construction is higher than the Bridge construction.

The Tunnel option has paramount benefit strategically from Environmental and Social aspects. Also, the security point of view during emergency as the operational connectivity would be maintained which may not be possible for the Bridge option.

It is therefore recommended to opt for Tunnel option underneath river bed of Brahmaputra for the proposed connectivity between Gohpur (NH52) to Numaligarh (NH37) along the approved alignment.

## **4.2 Land Form, Land Use and Land Ownership**

Reconnaissance surveys were undertaken for identification of Valued Environment Components (VECs) such as environmentally protected areas (National Parks, Wildlife Sanctuaries, Biosphere Reserves, Reserved / Protected Forest, Important Bird Areas, World heritage Sites, Archaeological Monuments etc.); surface water bodies; environmentally sensitive receptors (educational institutions, religious structures, medical facilities etc.) falling within the RoW of proposed highway. Based on the findings of reconnaissance surveys & further extensive field studies the alignment location of the proposed highway has been selected to avoid significant impact on VECs and the land form, land use & land ownership along the RoW of proposed highway is described below.

### **4.2.1 Land Form**

The entire length of proposed highway will be passing through plain terrain characterized by agricultural fields, grasslands, flood plains & river bed (tunnel passing underneath river bed).

### **4.2.2 Land Use**

The land use by the side of the proposed project alignment includes mainly agriculture, fishing activities and sparsely distributed residential use.

### **4.2.3 Land Ownership**

The proposed highway project involves Govt. & Private land, the total land requirement for the proposed project will be 315.9647 Ha. The details of land ownership are given in Table 4. Land acquisition in India is now governed by the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (RFCTLARR) and which came into force from 1 January 2014, accordingly the compensation/ rehabilitation activities will be accomplished in consonance with the regulatory framework.

### **4.2.4 Existing Land Use Pattern**

Land use pattern along the project alignment is predominantly agricultural in semi urban centers followed by Brahmaputra flood plains areas. Around 50% of the proposed project highway in Biswanath District passes through agricultural area. In addition, the highway passes through backwaters at few places.

### **4.2.5 Existing Infrastructure**

Un-doubtfully, infrastructure development in Assam is retarded from its normal pace due to the roads development operating for extended periods resulting in frequent traffic jams on all major roads of the state. Moreover, the mighty River Brahmaputra bifurcating the state into Northern Assam and Southern Assam adds significant lagging of connectivity, which is characterized by

loss of time and resources for the transportation industries. Bridging this lack of connectivity between Northern Assam and Southern Assam is also important in strengthening the security and quick accessibility of supplies within limited resource and timeframe.

The proposed project is expected to serve as a very prominent route connecting Itanagar-Gohpur-Numaligarh. This road will enhance connectivity between North and South side of Brahmaputra River and will lead to rapid social and economic development of the area.

Existing traffic is crossing the Brahmaputra river on the downstream at a radial distance of approximately 90 km from the project road near Tezpur, while on the upstream the radial distance of the existing bridge from the project road is approximately 130 km near Dibrugarh. There is no crossing facility available for a length of approximately 220 km. The proposed project will divert the existing traffic using the NH-37 road adjacent to environmentally sensitive Kaziranga National Park. With the projected increase in the city's population/ growth, strengthening and augmenting the existing transport infrastructure is the need of hour.

Majority of the alignment traverse through agricultural areas with intermittent built-up patches at village. The built-up patches comprises of small villages mainly with wooden & kucchha structures.

#### **4.2.6 Soil Classification**

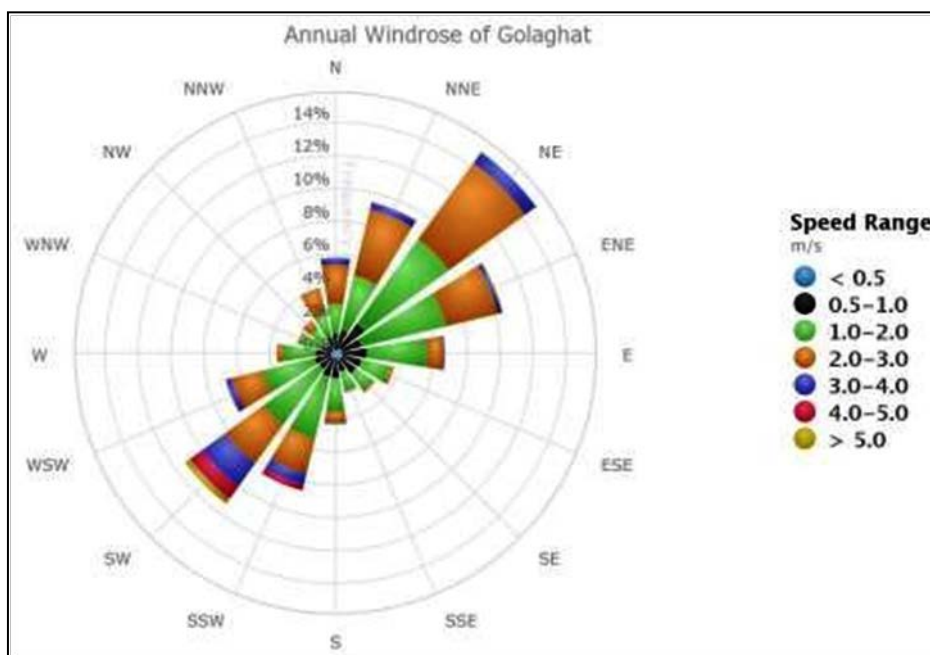
Red loamy soils, lateritic soil, new alluvial soils and older alluvial soil are found along the proposed alignment area. Red loamy soils are found in the northern end of the project site. The soil types found are Entisols (flood prone plain areas), Inceptisols (sediment deposit of river), Alfisols (foot hill region), Ultisols (reddish colour hill soil) and Histosols (water logged bodies).

### **4.3 Climatic Data from Secondary Sources**

Climate of Assam is characterized by alternate cool and warm periods with highly humidity, especially from May to November. Between March and May at the time when precipitation in Northern India is at the minimum, Assam gets some amount of rainfall from the Norwesters which keep the temperature low in the season of spring. Climate of the hills is generally salubrious while that of the plains is comparatively warm in summer but cool in winter. The project district experiences wet monsoon type of climate and heavy rainfall during southwest monsoon season followed by northeast monsoon.

#### **4.3.1 Wind**

The average wind speed in project area is 1.7 m/s with the maximum wind speed of around 6 m/s. Windrose of Golaghat shows that predominantly wind blow from the NE - about 15.08% of all wind directions. The annual windrose of the Golaghat District is given as **Figure 14**.



**Figure 13: Annual Windrose of Golaghat District**

### 4.3.2 Humidity

Humidity level in the project area is very high. Humidity may be so high that one will perspire and feel very uneasy, especially during the period between two bouts of rainfall. The annual humidity ranges from 65 to 85%. The maximum humidity is observed during June to October months. The relative humidity over the year in Golaghat District is given in **Table 18**.

**Table 18: Scenario of Month wise Humidity of Golaghat Distinct**

Month	Relative Humidity (%)		
	Minimum	Maximum	Average
January	49.9	93.7	77.6
February	42.0	92.9	74.4
March	43.9	97.8	72.4
April	43.2	98.4	75.1
May	60.7	97.8	83.3
June	46.6	99.3	84.2
July	65.3	99.3	87.8
August	66.5	97.1	85.9
September	61.1	96.5	84.8
October	52.4	96.2	80.8
November	55.9	97.2	81.6
December	49.4	97.2	78.4

### 4.3.3 Rainfall

The annual rainfall is 2,173 mm. The districts receive SW monsoon rainfall from the month of June which continues up to September/October. The highest rainfall areas of the district are located near the foothills of Arunachal Himalayas, i.e., in the northern part of the Brahmaputra.



The monthly average rainfall data from 2012 to 2017 is provided in Table 19, the project district of Biswanath (Sonitpur) is rainfall deficient and Golghat is observed to receive normal rainfall during the aforementioned period.

**Table 19: Scenario of Rainfall in Project Districts Biswanath and Golaghat (2012-2017)**

Month	Biswanath (mm)					
	2012	2013	2014	2015	2016	2017
January	6.3	0.0	0.1	7.9	45.7	2.2
February	3.3	12.0	29.5	5.2	14.9	66.7
March	28.6	34.8	8.7	6.4	42.1	37.8
April	254.5	122.8	16.4	221.0	228.6	196.4
May	216.0	342.9	328.4	281.4	295.8	238.5
June	571.9	248.2	270.3	482.3	158.4	490.6
July	298.2	498.5	318.6	310.3	264.9	443.4
August	253.6	276.9	193.8	442.8	161.1	304.4
September	253.9	196.9	357.2	141.7	175.9	187.6
October	163.5	77.1	9.2	42.3	81.7	109.7
November	5.8	1.2	0.0	25.9	0.1	8.9
December	1.5	1.8	0.2	57.1	2.4	0.0
	Golaghat (mm)					
January	17.8	0.0	4.9	14.2	21.8	0.0
February	10.1	10.3	31.2	14.7	1.7	49.5
March	10.6	76.7	32.8	52.8	48.4	134.0
April	213.7	62.6	43.7	258.2	279.5	165.8
May	148.0	237.8	137.5	206.6	258.3	262.8
June	273.4	137.1	148.8	193.0	262.5	224.4
July	216.8	262.7	406.3	224.7	388.1	396.9
August	254.3	327.9	253.3	205.4	156.2	227.5
September	244.4	124.6	193.4	168.1	238.7	212.3
October	60.6	143.3	21.6	88.7	39.6	149.9
November	0.1	0.0	2.6	13.8	35.7	4.1
December	1.5	6.7	2.1	28.3	3.1	0.0

#### 4.4 Social Infrastructure Available

Basic social infrastructure is available along the proposed route. The villages on the proposed route have primary health care facilities, basic education, markets, police station, transportation, roads.

## **5. PLANNING BRIEF**

### **5.1 Planning Concept**

The proposed highway project is intended to ease of traffic on NH-37 & NH-57 and with full control of access and provided with grade separators at intersection. Other planned activities include construction of intersections/junctions, culverts and drainage works, toll plazas, temporary access, diversion roads and other road construction related plants and establishments. The offsite work includes, quarrying from nearby quarry sites, worker camps, material storage yard, earth from nearby burrow area and dumping of construction spoils at dumping sites.

### **5.2 Land Use Planning**

The proposed highway project shall be a 4-lane highway. The land required for accommodating the area for RoW & other components is approx 305.458 Ha. The RoW will also cover toll plaza, emergency services, green belt and other related components.

The road landscape should be developed envisaging a holistic approach to the entire stretch. A concept should be evolved so as to maintain visual characteristics and uniformity in terms of landscape along the stretch. In the absence of uniform land availability for the plantations, different schemes may be worked out in tune with the local variations in the design. To achieve this, the entire stretch of the project corridor should be divided into homogenous landscape sections based on similarity in terms of available width, soil conditions, climate (temperature and rainfall) and topography. A study on the local flora and vegetative cover native to these sections should be carried out as part of the field surveys to enable a choice of the suitable species for particular section.

### **5.3 Assessment of Infrastructure Demand**

Physical and social infrastructures will be developed due to proposed project.

### **5.4 Amenities**

Temporary work shelters will be provided for working personals. Mobile sanitation facilities will be made available for the workers. Workers will be equipped with personnel protective equipment's like helmet, nasal masks, safety shoes etc. First aid facility will be provided for the working personals. Ambulance facility will be provided for the workers. Environmental benefit, Economic Benefit & Social Benefits will be originated through this proposed project.

## 6. PROPOSED INFRASTRUCTURE

### 6.1 Industrial Area

The proposed project will induce new establishment and construction of Commercial, Residential structure as Hotel, Dhabas, Restaurant, Petrol pumps that provide good business opportunity resulting direct and indirect generations of employment that improve the living Standard of the local communities.

### 6.2 Residential area

Not proposed

### 6.3 Greenbelt Development

The greenbelt will be developed following the guidelines of Indian Road Congress (IRC:SP:21»2009) and Green Highways (Plantation, Transplantation, Beautification & Maintenance) Policy -2015.

The road landscape should be developed envisaging a holistic approach to the entire stretch. A concept should be evolved so as to maintain visual characteristics and uniformity in terms of landscape along the stretch. In the absence of uniform land availability for the plantations, different schemes may be worked out in tune with the local variations in the design. To achieve this, the entire stretch of the project corridor should be divided into homogenous landscape sections based on similarity in terms of available width, soil conditions, climate (temperature and rainfall) and topography. A study on the local flora and vegetative cover native to these sections should be carried out as part of the field surveys to enable a choice of the suitable species for particular section.

### 6.4 Social Infrastructure

It is anticipated that toll booths, temporary camps shall come up along the alignment.

### 6.5 Connectivity

The proposed National Highway is expected to serve as a very prominent route connecting Itanagar – Gohpur – Numaligarh of approx. 34.664 km with minimum 60 m RoW. This National Highway will enhance the connectivity between North and South side of Brahmaputra River and will lead to the rapid special and economic development of the area.

The nearest connectivity details are as given below:

Sr. No.	Component	Description
1	Nearest Railway Station	Gohpur Railway Station ~ 5.2 km from Gohpur end Badulipar Railway Station ~ 3.07 km from Numaligarh end
2	Nearest Airport	Dimapur Airport ~ 86 km from Numaligarh end.

## **6.6 Sewerage System**

Mobile sanitation facilities will be provided for construction workers in construction sites which will be periodically cleaned by Night Soil Tankers as well as septic tanks followed by soak pits will be provided in worker camps.

## **6.7 Industrial Waste Management**

Not Applicable for this project

## **6.8 Solid Waste Management**

Approx. 450 kg of municipal waste is expected to be generated during construction considering 1000 workers. During operation phase, the municipal solid waste generated from the amenities proposed along the alignment.

The hazardous waste such as Spent oil, Used lubricants, Left over paints & Contaminated containers generated from overall project activity will be stored at designated place. The storage, handling and disposal of the same will be done as per Hazardous and Other Wastes (Management and Transboundary Movement), 2016.

The construction waste viz. left over metal, woods, waste cardboards & other inert materials will be sold to recyclers & non recyclable waste will be managed as per Construction & Demolition Waste Management Rules, 2006.

## **6.9 Power Requirement/ Supply/ Source**

The power requirement of 2000 kVA will be sourced as per statutory provisions & DG Sets of 2000 kVA will be provided as backup during construction phase. The total power requirement during the operational phase is 21416.89 kVA.

## 7. REHABILITATION AND RESETTLEMENT (R&R) PLAN

### 7.1 Approach Methodology for Preparation of RAP

Most of the land coming under the project area is agricultural and through somewhat inhabited area. The land required for the construction will be acquired by NHIDC before the start of construction work. Land acquisition in India is now governed by the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (RFCTLARR) and which came into force from 1<sup>st</sup> January, 2014, accordingly the compensation/rehabilitation activities will be accomplished in consonance with the regulatory framework.

The approach to conducting surveys for assessing the social impacts and preparation of RAP is based on the alignment approved by the NHIDCL. Land Acquisition Plan has been prepared as per the approved alignment and as such project impacts would be confined to proposed right of way (RoW) i.e. land width required for construction of road 60m.

Land acquisition for the project will be carried as per the provisions of “**The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 (RFCTLARR Act, 2013)**”. The Act provides compensation against the land, structures and other improvements and Resettlement and Rehabilitation (R&R) entitlements not only to land owners but also affected families whose livelihood is primarily dependent on the land acquired. Encroachers, squatters, tenants, etc. have been covered in the survey and they will be provided rehabilitation and resettlement assistance as per the entitlement matrix.

The methodology covers a review of secondary literature, laws, notifications, government circulars, policies, etc. governing land acquisition, review of Census of India data and socio-economic profile of the project area. A brief description of activities is presented below.

- The Right to Fair Compensation and Transparency in Land Acquisition & Rehabilitation and Resettlement (RFCTLARR), Act 2013.
- The National Highways Act, 1956.
- Assam Right to Fair Compensation and Transparency in Land Acquisition & Rehabilitation and Resettlement (RFCTLARR), Rules, 2015.
- Assam Right to Fair Compensation and Transparency in Land Acquisition & Rehabilitation and Resettlement (RFCTLARR), Rules, 2015.
- Panchayats (Extension to Scheduled Area) Act, 1996.
- JICA Guidelines as well as World Bank OP/BP 4.12 and OP/BP 4.10
- Census of India, 2011 (Primary Census Abstract and Village amenities directory).

## **8. PROJECT SCHEDULE AND COST ESTIMATION**

The overall cost of the Project, the civil works are expected to cost INR Total Project cost is 11204.42 crore for proposed project. The Environmental Management Plan (EMP) is proposed for the mitigation of adverse impacts and enhances the positive impacts. The tentative EMP budgetary provision has been made with a cost of INR 72.24 lacs.

It is proposed that the project will be commissioned after 48 months from grant of EC and other statutory approvals.

## 9. ANALYSIS OF PROPOSAL

The project will have multiple benefits. It will reduce the travel time substantially. In addition the improved road will provide other benefits like proposed activity improves the economic status of the village people along project area. Overall improvement will be expected in terms of;

- Development and improvement in transportation infrastructure facility will connect villages across and upstream & downstream of Brahmaputra River.
- Improved infrastructure facilities
- Better approach to Medical & Educational services and quick transportation of perishable goods like fruits , vegetables and dairy products and
- Drinking water facility
- Development of local agriculture and handicrafts
- Development of tourism and pilgrimage
- Vocational and skill development training for youth
- Opening up of opportunities for new occupations
- Improved quality of life for people and so on.
- Transporting, processing and marketing of agricultural products
- Fast and safe connectivity resulting in savings in fuel, travel time and total transportation cost to the society
- Reduction in accidents
- Reduction in pollution
- Proposed Tree Plantation along the road side, green pockets alongside of the alignment will have social benefits to the nearby people
- The proposed National Highway will have infrastructural Launch pad.
- Along with this it is also proposed to have area development, real estate development, medical facilities, food courts, police stations, public toilets, petrol pumps. This will definitely add value in the social and financial benefits in the region
- Indirect and direct employment opportunity to people from all skilled, semiskilled and unskilled streams will act as social benefits

It is assumed that the overall project will boost socio-economic development in both Biswanath & Golaghat Districts & largely in Assam State.