

**SCHEDULE - B**  
**(See Clause 2.1)**  
**DEVELOPMENT OF PROJECT HIGHWAY**

**1. Development of the Project Highway**

Development of the Project Highway shall include detailed design, including plan & profile within available proposed ROW and construction of the Project Highway as described in Schedule-B and Schedule-C. The alignment plans of the Project Highway are given in Annex-III of Schedule A which is minimum requirement and are for guidance only. The proposed plan & profile, locations of different structures/drain/service & slip road/RE walls, chainages of different structures/drain/service & slip road/RE walls, length of different structures/drain/service & slip road/RE walls etc. of the project highway as indicated in the Schedule A, Schedule B, Schedule C and their Annexures, shall be treated as an approximate assessment and as minimum requirement. Based on site/design requirement, the Concessionaire shall finalize Detailed Design Report including plan & profile of the project highway and submit the same to Authority & its Engineer for acceptance, before the start of the execution of project.

Based on accepted DPR including Plan & profile prepared by the Concessionaire, the detailed work program with Network Method (PERT/CPM) shall be prepared along with commensurate deployment of all resources and get approved from Engineer before start of civil work. Any required changes in scope of work given in Schedule B and Schedule C, including any variation in standard, shall be finalized by both the parties before start of actual civil work. Requirement specifically mentioned in Schedule B & C shall prevail over general requirements given in Manual mentioned in Schedule D.

**1. Rehabilitation and Augmentation**

Rehabilitation and augmentation shall include Six Lane with Paved shoulders configuration as described in Annexure-I of this Schedule-B and in Schedule-C.

**2. Specifications and Standards**

The Project Highway shall be designed and constructed in conformity with the Specifications and Standards specified in Annexure-I of Schedule-D

**Annexure - I**  
**(Schedule - B)**  
**Description of the Project**

**1. Development of the Project Highway**

The Project Highway shall generally follow the horizontal alignment shown in the plan specified in Annexure- III of Schedule-A, unless otherwise specified by the Authority. Notwithstanding anything to the contrary contained in this Agreement or IRC: SP:87, the proposed plan & profile, locations of different structures/drains/service & slip road/ Reinforced soil (RS) walls, chainages of different structures/drains/service & slip road/RS walls, length of different structures/drains/service & slip road/ RS walls etc. of the project highway as indicated in the Schedule A, Schedule B, Schedule C and their Annexures shall be treated as minimum requirement. Based on site/design requirement, the Concessionaire/ Contractor shall finalise their Detailed Designs (Development Stage) including plan & profile of the project highway and submit the same to Authority & its Engineer for its Consent/Approval and Safety Audit by Safety Auditor, before the start of the execution of project. The designs so approved shall not be in contradiction with the scope of project. For avoidance of doubt, the provisions mentioned in schedule B & C cannot be changed, only the design of the components is to be submitted for consent/ approval.

The Concessionaire/Contractor shall deploy at its own Cost and Expenses, the Grading/Paving/Compaction Equipment fitted with System of Automated & Intelligent Machine-aided Construction (AI-MC) for finishing of all Grades including Embankment, Subgrade, GSB, WMM, DLC, PQC. The System of Automated & Intelligent Machine- aided Construction(AI-MC) used by the Concessionaire/ Contractor shall be capable of delivering accuracy as per the applicable IRC specifications. During the Construction Period, the Concessionaire / Consultant shall furnish all the Physical Progress Data (All desired type of Surface Grading Data, Compaction and Temperature Data etc.) obtained through System of Automated & Intelligent Machine-aided Construction (AI-MC)/CMS to Authority for monitoring of Construction on Daily Basis. These Digital Data and desired output shall be made available at the Location (Server/Cloud) finalised by Authority.

**1.1. Width of Carriageway**

1.1.1. Six-Laning with paved shoulders shall be undertaken. The total paved carriageway Surface shall be as per TCS for new jersey barrier median for six laning (including paved shoulder and kerb shyness/edgestrip). The earthen shoulder width shall be 2 metre on either side as per TCS.

1.1.2. Work is in built - up sections areas, the paved width shall be as per TCS.(including paved shoulder and edge strip/kerb shyness).

1.1.3. Except as otherwise provided in this Agreement, the width shall be adjusted to fit into appropriate plans and cross sections developed in accordance with TCS enclosed.

1.1.4. The entire cross-sectional elements shall be accommodated in the available/proposed ROW. If required, suitable retaining structures shall be provided to accommodate the highway cross section within the available/ proposed ROW. The details of such sections are mentioned in Schedule-B. In case of any other section not included in Schedule-B, where retaining structures are to be provided, it shall constitute a Change of Scope.

## 1.2. Width of Median

1.2.1. The width of median including kerb shyness shall be 1.61 metre for New Jersey barrier, for details of median width along the project corridor refer Typical Cross Section provided in Schedule.

1.2.2. Deleted.

1.2.3. Deleted.

1.2.4. Antiglare devices to be provided as per clause 2.10 of schedule C

## 2. Geometric Design and General Features

### 2.1. General:

Geometric design and general features of the Project Highway shall be in accordance with Section 2 of the Manual. Intermediate Sight distance (Desirable Minimum Sight Distance) shall be followed for design of all vertical curves including structures as well as highways. (

### 2.2. Design Speed:

The project road shall be designed for 100 Kmph for plain and rolling Terrain. Ramps to the viaduct shall be designed for 40 Kmph.

### 2.3. Improvement of the existing road geometrics

2.3.1. The existing road geometrics shall be improved as per the codal provisions. In the sections, where improvement of the existing road geometrics to the prescribed standards is not possible, the existing road geometrics shall be improved to the extent possible within the given right of way and appropriate road signs, pavement markings and safety measures shall be provided.

The deficient stretches are as follows.

Sr. No.	Stretch (Design Chainage) Km		Type of deficiency	Remarks
	From	To		
Nil				

2.3.2. The entire cross-sectional elements shall be accommodated in the available/proposed ROW. If required, suitable retaining structures shall be provided to accommodate the highway cross section within the available/ proposed ROW. The details of such sections are mentioned in Schedule-B. In case of any other section not included in Schedule-B, where retaining structures are to be provided, it shall constitute a Change of Scope.

2.3.3. **Realignments:** The existing road shall be improved to the standards as specified in the Manual at the following locations:

Sr.	Existing Chainage (Km)	Design Chainage (Km)	Side	Length (Km)	Remarks
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No.	From	To	From	To			
Nil							

2.3.4. **Bypasses:** The existing road shall be bypassed to the standards as specified in the Manual at the following locations:

Sr. No.	Name of bypass	Existing Chainage (Km)		Design Chainage (Km)		Length (Km)
		From	To	From	To	
Nil						

## 2.4. Right of Way

Details of the Right of Way along Project Highways and Side Roads are given in Annexure-II of Schedule-A.

## 2.5. Type of Shoulders

2.5.1. The Design Specification of paved shoulder shall conform to the requirements specified in paragraph 5.10 of the Manual.

2.5.2. Paved shoulders and strip on median side shall be of same specification and pavement composition as of main carriageway

2.5.3. The overlay on the main carriageway pavement and on the paved shoulders shall be uniform in thickness and composition.

2.5.4. In Built-up sections, footpaths and fully paved shoulder shall be provided with width 1.5m and 2.5m respectively.

2.5.5. Deleted

2.5.6. The Design Specification of earthen shoulder shall conform to the requirements specified in paragraph 5.11 IRC: SP:87-2019.

2.5.7. The earthen shoulder width shall be 1 metre on either outer sides in open country or isolated built up area and approaches to bridges/grade separated structures/ROB with free slopes. To have desirable offset for installation of W-Beam/Thrie Beam barrier along free slope stretches, placement of road signs on outer side of the crash barrier and provision of kerb and channel drain for chute drain on high embankment slope as per site requirement, additional 1.0m earthen width in all terrains shall be constructed. It shall be provided with top 150 mm on earthen shoulder with well graded naturals and morrum gravel crust stones or combination thereof, confirming to Clause 401 of MoRTH specification.

2.5.8. Deleted.

## 2.6. Lateral and Vertical Clearance at Underpasses

2.6.1. In case of VUP/ LVUP/ SVUP, the proposed structure, the finish road level in VUP/ LVUP/ SVUP shall be kept 150 mm above the ground level/service road/ cross road (whichever is higher) to ensure that these VUP/ LVUP/ SVUP don't become water accumulation points.

Sl. No.	Design Chainage (km)	Structure Type	Proposal	Span Length (m)	Vertical Clearance (m)	Total Width (m)
Nil						

2.6.2. The vertical and horizontal clearance at the underpasses shall be as per Clause 2.10.2 of the Manual

## 2.7. Lateral and vertical clearances at Overpasses

2.7.1. Lateral and vertical clearances for overpasses shall be as per paragraph 2.11 of the Manual.

2.7.2. Lateral clearance: The width of the opening at the Overpasses shall be as follows:

Sr. No.	Location Chainage (Km)	Span/opening (m)	Remarks
Nil			

## 2.8. Service roads/Slip roads/Connecting Roads:

2.8.1. **Service Road:** The height of embankment of service road shall confirm to clause 4.2.1.

2.8.2. The Service roads/Slip roads shall be constructed/Reconstructed at the locations and for the lengths indicated below as per TCS:

Sr. No.	Design Chainage (Km)		Length (km)		Paved Carriageway Width including shoulder & shyness (m)	Total Length(m)
	From	To	LHS	RHS		
1	365+200	365+525	LHS		7.5	325
2	365+525	365+735	LHS		8.75	210
3	365+735	366+155	LHS		8.75	420
4	366+155	366+770	LHS		8.0	615
5	366+770	366+965	LHS		8.0	195
6	366+965	367+675	LHS		8.0	710
7	367+675	368+050	LHS		8.75	375
8	368+050	368+275	LHS		7.5	225
9	365+525	365+735		RHS	11	210
10	365+735	366+155		RHS	11	420
11	366+155	366+770		RHS	11	615
12	366+770	366+965		RHS	11 to 8 (Vary)	195

13	366+965	367+675		RHS	8	710
14	367+675	368+050		RHS	8.75	375
15	368+050	368+275		RHS	7.5	225
Total Length (LHS+RHS) =						5825 m

**Note:** -. The Acceleration, deceleration lane, entry/exit lanes shall be constructed in addition to length given in above table and shall be deemed to be part of the scope and no Change of Scope shall be considered for the same.

2.8.3. The Parking bays shall be provided along service road (clause No. 2.12.2.1 IRC: SP:87-2019)

Sr. No.	Design Chainage of Parking Bay		Remarks
	LHS Service Road	RHS Service Road	
Nil			

2.8.4. **Slip Road:** The height of embankment of slip road shall confirm to clause 4.2.1. (Clause No. 4.2.1 IRC: SP:87-2019)

The Slip roads (Speed = 40 Kmph) shall be constructed at the locations and for the lengths indicated below:

Sr. No.	Design Chainage (Km)		Length (km)		Paved Carriageway Width including shyness (m)	Total Length(m)
	From	To	LHS	RHS		
Nil						

2.8.5. **Separator Between Main Carriageway and Service/Slip Road** (clause No. 2.15.1 IRC: SP:87-2019)

A separator with Crash Barrier/ pedestrian guard Rail between main carriageway and service/slip road shall be provided to prevent the pedestrians, local vehicles and animals entering the highway.

Sr. No.	Design Chainage (Km)		Length of Separator (km)		Total	Remarks
	From	To	LHS	RHS		
	365+200	365+525	325	0	325	
	365+525	365+735	210	210	420	
	368+050	368+275	225	225	450	

**Note:**

i. Above length of the service/slip roads is minimum specified. The actual length of the service/slip/connecting roads shall be determined by the Concessionaire/ Contractor in accordance with the approved plan & profile and design approved from the Independent Engineer. Any increase/ decrease-up to 5 percent length from the length-specified in this Clause of Schedule-B shall not constitute a COS. Any additional requirement at new location

shall be dealt in COS clause as per respective CA.

- ii. For avoidance of doubt, if the total length of service roads for the project to be constructed is 100 km, and the total length of service roads for the project constructed is 130 km

then the length for positive COS shall be determined as follows:

L= total length of service roads for the project as stipulated to be constructed= 100 Km

L1= total length of service roads actually executed= 130 Km

Length qualifying for COS: =  $(130 - (100 + 5\% \text{ of } 100)) = 25 \text{ Km}$

- iii. The Acceleration, deceleration lane, right turning storage lane, entry/exit lanes shall be constructed in addition to length given in above table and shall be deemed to be part of the scope and no Change of Scope shall be considered for the same.

- iv. Any structures falling within acceleration / deceleration lane /taper shall be constructed to the required width. These changes shall not be treated as change of scope.

## 2.9. Grade Separated Structures (clause No. 3.4 IRC: SP:87-2019) :

Grade separated structures shall be constructed as per paragraph 2.13 of the Manual. Proposed levels at structure locations as shown in plan & profile specified in Annexure-III of schedule A are minimum requirement and only for guidance and any increase in levels shall not constitute any change of scope. Entry/Exit arrangement from main carriageway shall be 50m before/after the start/end of approach road to grade separator i.e. start/end of valley curve (clause No. 2.12.2.2 IRC:SP:87-2019). RCC barrier shall start from start of valley curve and end after grade separator at end of valley curve.

The sub-structure shall be continued in the median portion with RCC barrier wherever superstructure has not been proposed in median portion. (Clause 7.1 (vii) IRC: SP:87-2019). Where crash barrier on the median side is not continuous along the project highway, 50m long MBCB Safety barriers on median side shall be provided on both sides approaches of the structures. MBCB provided towards median side of each of the structure with corresponding end treatment. (Clause No. 4.3.5 and 4.9, IRC 119).

Where crash barrier on the shoulder sides is not continuous along the project highway, 50m long MBCB Safety barriers on shoulder side shall be provided on both sides approaches of the bridge/ structures or till 3m embankment height whichever is more.

2.5m wide footpaths for VUP and Flyovers and 1.5m for LVUP, SVUP and Cattle Underpass shall be provided at grade intersection below structures for each direction of pedestrian movement.

The requisite particulars are given below:

### 2.9.1. Vehicle Overpass (VOP)

Sr. No.	Design Chainage (Km)	LHS Roadway Width (m)	RHS Roadway Width (m)	Super Structure Provision in Median	Square clear" Span Arrangement (m)	Minimum Vertical Clearance (m)	Skew Angle	Remarks
NIL								

### 2.9.2. Vehicle Underpasses (VUP)

Sr. No.	Design Chainage (Km)	LHS Roadway Width (m)	RHS Roadway Width (m)	Super Structure Provision in Median	Span Arrangement (m)	Minimum Vertical Clearance (m)	Skew Angle (to be specified)	Remarks
Nil								

## 2.9.3. Light Vehicle Underpasses (LVUP)

Sr. No.	Design Chainage (Km)	LHS Roadway Width (m)	RHS Roadway Width (m)	Super Structure Provision in Median	Span Arrangement (m)	Minimum Vertical Clearance (m)	Skew Angle	Remarks
Nil								

## 2.9.4. Small Vehicle Underpasses (SVUP)

Sr. No.	Design Chainage (Km)	LHS Roadway Width (m)	RHS Roadway Width (m)	Super Structure Provision in Median	Square clear” Span Arrangement (m)	Minimum Vertical Clearance (m)	Skew Angle	Remarks
Nil								

## 2.9.5. Cattle and Pedestrian underpasses

Sr. No.	Design Chainage (Km)	LHS Roadway Width (m)	RHS Roadway Width (m)	Super Structure Provision in Median	Square clear” Span Arrangement (m)	Minimum Vertical Clearance (m)	Skew Angle (to be specified)	Remark
NIL								

## 2.9.6. Boxes for passage of pedestrians

Sr. No.	Design Chainage (Km)	Width (m)	Size of opening (No. X W x H)	Skew Angle	Remarks
Nil					

## 2.9.7. Flyover/Ramp



Sr. No.	Design Chainage (Km)	LHS Roadway Width (m)	RHS Roadway Width (m)	Super Structure Provision in Median	Square clear” Span Arrangement (m)	Minimum Vertical Clearance (m)	Skew Angle	Remarks
1	367+195 to 367+525	7		-	11x30			LHS Ramp to the Viaduct
2	367+195 to 367+525		7	-	11x30			RHS Ramp to the Viaduct

The Acceleration Lane Length including taper of 250 m desirable and, deceleration lane Length including taper of 120 m desirable shall be constructed in addition to length given in above table and shall be deemed to be part of the scope and no Change of Scope shall be considered for the same.

#### 2.9.8. Viaduct

Sr No	Design Chainage (Km)	LHS Roadway Width (m)	RHS Roadway Width (m)	Super Structure Provision in Median	Span Arrangement (m)	Minimum Vertical Clearance (m)	Skew Angle (to be specified)	Remarks
1.	366+155 to 367+675	14.305	14.305	Yes	17x30+1x40+15x30+1x40+16x30	5.5	-	Refer TCS

Due to site constraint, change in span arrangement is required, then Concessionaire/ Contractor, based on site/design requirement with approval from the Independent Engineer/Authority Engineer in consultation with Authority, adjust the span length between piers. For this no change of scope will be considered.

#### 2.9.9. Tunnel

Sr. No.	Design Chainage (Km)		Tunnel configuration (Single/ Twin)	LHS	RHS	Remarks
	From	To				
						Nil

#### NOTE: -

I. At such crossing under viaduct, suitable traffic calming measures viz. road signs, markings, etc. shall be installed as per IRC:99 provisions. Further, the section of cross road below the main span of all VUPs, crossing under viaduct and the entry service road in either direction shall be provided with paver block/ cut stone pavement for a distance of 60-90 m from the junction for enforcing speed restrictions.

II. In order to avoid crisscrossing of pedestrians on divided highways especially at start

& end of approaches to the structures, New Jersey Type Concrete Crash Barriers (NJB) or Steel Railing with a height of 1.2m (to make it unclimbable) shall be provided for a minimum length of 50m so as to discourage such crisscrossing and avoid accidents. NJB may be provided where cutting of railing/ theft/ vandalism is expected, otherwise steel railing may be provided for better aesthetics and to avoid blinding effect. If pedestrian cross traffic is high at such locations, even FOBs shall be planned.

III. Since the proposed viaduct and ramps are located in coastal environment, the structure shall be designed (Concrete/reinforcement) etc. considering marine environment service conditions as per provision of manual, such that deterioration over its design service life does not impair the performance of the structure below that intended, having due regard to the service environment and the anticipated level of maintenance to achieve adequate durability. The following shall be considered:

In design:

- (i)
- (ii) Exposure condition for design and detailing of structural elements.
- (iii) Appropriate wind speed
- (iv) Foundation shall be adequately anchored in rock.

For Construction:

- (i) Permanent liner for piles (minimum thickness 10 mm)
- (ii) Use stainless steel reinforcement (in compliance of MoRTH RW/NH-34049/03/2020-S&R (B) dated 22.01.2021 and 03.09.2024)
- (iii) Using sulphate resistance cement for concreting
- (iv) The metallic bearings shall be made up of cast iron only, if use

#### 2.9.10. Interchanges (IC) (clause No. 3.4 IRC: SP:84-2019)

Sr. No	Design Chainage (km)	Name of structure	Square clear Span Arrangement (m)	Total Width (m)	Typical Cross Section	Remarks
Nil						

Note : Layout, Geometric Design and Typical Cross Sections of Interchange is included in Annexure III to schedule-B.

#### 2.9.11. Details of Ramps, Cross Roads and Connecting Roads at Interchanges (IC)

Sr. No.	Carriageway Widths including Kerb Shyness	Length (m)	Description of Ramps, Crossroads and Connecting Roads	Remarks
Nil				

#### 2.10 Typical Cross Section (TCS) of the Project Highway (clause No. 2.17 IRC:SP:87-2019)

The Project Highway shall be constructed to four lane configurations. Typical cross sections required to be developed in different sections of the Project Highway are given below.

S.No	Design Chainage		Length (Mtr)	TCS No.
	From	To		

1	365+200	365+260	60	TCS-1
2	365+260	365+525	265	TCS-2
3	365+525	365+735	210	TCS-3
4	365+735	366+155	420	TCS-4
5	366+155	366+770	615	TCS-5
6	366+770	366+965	195	TCS -6A
7	366+965	367+675	710	TCS-6
8	367+675	368+050	375	TCS-7
9	368+050	368+275	225	TCS-8
		<b>Total</b>	<b>3075</b>	

**Note:**

- i. Any variations in the lengths of various TCS as specified in the Table 2.10 shall not constitute a Change of Scope. However, any authorized/ approved change in the length of the project highway, CoS clause as per respective CA.
- ii. Lengths mentioned in the above list for cross section types concerned to structures are inclusive of structure length.
- iii. RE wall shall be provided at the edge of the shoulder for full height.
- iv. Toe wall (0.6m height) or retaining wall up to full height (height as required for side slopes) above 0.6m to maintain the slope of filling wherever restriction in ROW is required leaving space for utility corridor/ drain/ service road etc. as applicable and water bodies along the proposed highway on the sections specified in Schedule-B.
- v. Chainages may be adjusted according to location of structures as per site conditions.
- vi. Carriageway width tapering shall be provided 1 in 50
- vii. A 2m wide utility corridor, along with earthen Drain/ Lined drain/Covered Drain as per TCS shall be accommodated in the ROW. Suitable Earth Retaining Structures (Toe Wall/ RE Wall & Retaining Wall with full Height shall be provided as per TCS maintain required slope of embankment as mentioned in TCS).

**3. Intersections and Grade Separated Intersections (Section 3, IRC:SP:87-2019)**

All at-grade intersections and grade separated intersections shall be as per Section 3 of the Manual. Existing at-grade intersections shall be improved to the prescribed standards.

The service road pavement composition shall be continued on cross roads of the intersections for the length specified for at-grade and grade separated intersections.

Properly designed intersections shall be provided at the locations and of types and features given in the tables below:

**3.1. At-grade intersections (clause No. 3.2 IRC:87-2019):**

**(a) Major Junctions:**

Sr. No.	Design Chainage (Km)	Junction Type	Leads to		Median Opening	Category of Cross Road	Carriageway width of cross road	Length of cross road to be developed	
			Left	Right				LHS	RHS
1	365+200	Y	Industrial Area	-	No	OR	7.5	60	

**(b) Minor Intersections:**

Sr. No.	Design Chainage (Km)	Junction Type	Leads to		Median Opening	Category of Cross Road	Carriageway width of cross road	Length of cross road to be developed	
			Left	Right				LHS	RHS
1	365+500	Y	Industrial Area	-	No	OR	7.0	60	
2	367+450	Y	Factory Exit Road	-	No	OR	7.0	140	

**Note :**

1. The Concessionaire/ Contractor shall take up 'Detailed Engineering study' to ascertain further details of all intersections and treatment of the intersections shall be designed in accordance with the latest guidelines mentioned out in section-3 of the Manual. Auxiliary lanes including storage, acceleration and deceleration lane along with physical islands to be provided.

The cross road at the junctions which are having a level difference from the main carriageway, are to be improved at the level of main carriageway for the length of 30 meter and then to be merged with the cross road at the gradient not more than 1:50.

2. For minor / major layout for left-in / left out arrangement with physical islands with hazard marking. Where there is space constraint to provide physical islands, the effect of junction kept wide opened can be avoided by ghost island with marking.

3. For U-turn, Self-Regulated U-Turn facility shall be created.

4. For s.no. 1, connecting road to be constructed (CC road).

**3.2. At-Grade Intersections below Grade Separators/ Interchanges:**

These shall be provided as given at para of this Annexure-I of the Schedule B. (clause No. 3.2.4 of IRC:SP:87- 2019)

Sr. No.	Design Chainage (Km)	Junction Type	Leads to		U-Turn provision in Viaduct Spans/Median opening	Category of Cross Road	Carriageway width of cross road (m)	Length of cross road to be developed	
			Left	Right				LHS	RHS
1	366+200	X	NMPA Colony	NMPA Admn block	Yes	OR	14 (Divided)/9 m	25	25
2	366+675	X	Truck Terminals	Panambur Brach	Yes	OR	7m / 11 m	25	25
3	367+175	Y		Cruise/ Port exist Gate	No	OR	10 m		15
4	367+285	Y	Factory Gate		Yes	Entry Road	15 m	15	
5	367+650	-		Port Main gate	Yes	Port Entry Road	15 m	A Roundabout to be developed with 10.5 m C/W width (Refer P&P)	

**Note:**

1. The Concessionaire/ Contractor shall take up 'Detailed Engineering study' to ascertain further details of all intersections and treatment of the intersections shall be designed in accordance with the latest guidelines mentioned out in section-3 of Manual.
2. Junction improvement under grade separators shall be carried out as per Manual with proper entry/exit to crossroads and slip/service roads, etc. Auxiliary lanes including storage, acceleration and deceleration lane along with physical islands to be provided.
3. Location of grade-separated structures are indicative. Exact location should be decided in consultation with Independent Engineer.
4. Intersection Layout, Entry/Exit, Right Turning Lane, U-Turns, Geometric Design & Typical Cross Sections of Interchange is included in Annexure-II of Schedule-B
5. Only Entry or Exit shall be designed at any location (provision of entry/exit by ghost island not permitted).

**4. Road Embankment and Cut Section**

Construction of road embankment/cuttings shall conform to the Specifications and Standards given in **section 4** of the Manual. Notwithstanding anything to the contrary contained in this Agreement or Manual, the proposed profile of the project highway as indicated in the Annex-III of Schedule A shall be treated as minimum requirement.

Based on site/design requirement, the Concessionaire/ Contractor shall design the alignment plans and profiles of the project highway based on site/design requirement mentioned in Schedule B with approval from the Independent Engineer/Authority Engineer within the

available.

In case of green field stretches / realignments stretches / bypasses/ full reconstruction of existing stretches (if the existing stretches have been overtopped in past during rains /floods), the bottom of subgrade shall be 1000 mm above highest flood level (HFL)/ ground water table/ Natural ground level /pond level, whichever is higher.

The side slopes shall not be steeper than 2H:1V. In case, there is a ROW constraint than, suitable soil retaining structures shall be provided.

For stability of slope upto 3 metre height the turfing can be adapted. For the slope from 3-6 metre suitable, geocell, geo-grid, geo-green etc. can be provided with suitable drainage chutes and suitable energy dissipaters as per IRC 56. For the slope more than 6 metre height, a complete slope stability analysis as per IRC:75 shall be done and the slopes shall be compulsory protected with stone pitching within stone masonry grid structure of 4x4 metre and suitable drains/chutes and energy dissipaters etc. shall be provided for effective drainage of the water.

**Utilization of Fly ash/pond ash shall be as per MOEF&CC notification dated 31<sup>st</sup> December 2021 & Ministry of Power letter no. 9/7/2011-St-Th (Vol. IV) dated 22.02.2022 as and when amended.**

It is the responsibility of the Contractor/Concessionaire to carry out due diligence of the project at bid stage regarding availability of fly ash/pond ash from the nearby TPPs keeping in mind that in case of non-availability of fly ash/pond ash from TPPs, alternate material such as soil, sand etc. shall have to be arranged on its own by the Bidder/Contractor/Concessionaire for construction of embankment and/or approaches to the structures. The Authority shall not bear the cost of fly ash/pond ash & its transportation/cost of alternate material & it's cost of transportation etc.

Use of Pond Ash and Design of Pond Ash embankment shall be specified Procurement of Pond/ Flyash shall be obligation of concessionaire and non-availability of the same shall not constitute to COS Concessionaire is also not obliged for transferring savings (if any) due to use of pond/flyash.

Where Pond Ash/Fly Ash is used for the Embankment construction, the embankment shall be designed and constructed in accordance with **section 4.4.4.i IRC: SP:87-2019.**

Mitigation measures work for slope be provided as per specifications wherever steep cutting section is involved.

The Concessionaire/Contractor shall deploy Grading, Paving and Compaction Equipment equipped with System of Automated & Intelligent Machine-aided Construction (AI-MC) for finishing of all Grades including Embankment, and Subgrade. The System of Automated & Intelligent Machine-aided Construction (AI-MC) for Motor Graders/ Paver and the same in Compactors and Dozers shall be done with help of 3D Digital Model generated from Design to ensure Quality Standards as per IRC Specifications and Productivity improvement. Further, Contractor shall ensure the Generation of measurable Digital Records that can be shared on a Digital Drive or can viewed in real time. The Hardware and Software used by the Contractor shall have Features and Specifications mentioned at Schedule D.

## **5. Pavement design**

**5.1. Pavement design shall be carried out in accordance with Section 5 of the Manual and as per IRC: SP:76-2015 in case of Conventional Whitetopping.**

5.1.1 Concessionaire/Contractor shall develop 3D Digital Models and use suitable System of Automated & Intelligent Machine-aided Construction (AI-MC) for Motor Graders and Paver and the same in Compactors and Dozers to ensure Quality Standards as per IRC Specifications and Productivity improvement. Further, Contractor shall generate measurable Digital Records that can be shared on a Digital Drive or can viewed in real time. The Hardware and Software used by the Contractor shall have Features and Specifications mentioned at Schedule D.

**5.2. Type of Pavement and Design requirement the pavement shall be of Rigid type for entire length of project highway.**

**5.2.1. Design Period and Strategy:** - Rigid Pavement shall be constructed for the entire length of Project Highway including paved shoulders. Rigid pavement shall be designed for a minimum design period of 30 years. Stage construction shall not be permitted. minimum sub grade CBR of (Effective)8% and maximum subgrade CBR of (Effective) 10%.

**Recommended Pavement Design:** - Notwithstanding anything to the contrary contained in this Agreement or the Manual, the Contractor shall design the pavement for the main carriageway, approach roads, interchange ramps, loops, and associated speed change lanes considering a minimum of 13,584 commercial vehicles per day or the actual traffic, whichever is higher.

5.2.2. The pavement for service road/slip roads shall be designed for projected traffic of 30 years.

5.2.3. Deleted

5.2.4. For widening and strengthening of existing carriageway, thickness of pavement layers for new pavement shall match with the layer thicknesses of existing layers with special attention to GSB layer.

5.2.5. Due to the presence of underground utilities, the required subgrade depth cannot be achieved. The Contractor shall construct a structure to cover utility, at its own cost, no COS shall be given for the same.

5.3. In order to meet the intended functional requirement of respective pavement layers on main carriageway, the minimum thickness of respective pavement layers for main carriageway and connecting cross roads/ service roads/ slip roads/ entry/exit locations, acceleration/ deceleration lane, right turning lanes shall, however, in no case be less than as given below:

**5.3.1. Main carriageway, Paved shoulder, median side paved strip, entry/exit locations, acceleration/ deceleration lane, right turning lanes, as follows:**

**New Construction (Flexible Widening)**

**NA**

**New Construction (Rigid Widening)**

Pavement Composition	Minimum Crust Thickness(mm)
Subgrade	500
GSB	200
DLC	150
PQC	300

**5.3.2 Service Road/Slip Road (Rigid)  
New Construction/Widening (Service/Slip Road)**

Pavement Composition	Minimum Crust Thickness(mm)
Subgrade	500
GSB	200
DLC	150
PQC	280

**5.3.3** Rigid pavement is proposed for Toll Plaza Location for the minimum thickness as explained under.

NA

**5.4. Reconstruction of Stretches with New pavement (Clause No. 5.9.4 IRC: SP:87-2019)**

Sr. No.	Design Chainage		Overlay Pavement Composition	Remarks
	From	To		
NIL				

**5.5. Bituminous Mix for Overlay (Clause No. 5.9.8 IRC: SP:87-2019)**

The following stretches of the existing road shall be provided bituminous overlay as follows:

Sr. No.	Design Chainage		Overlay Pavement Composition	Side	Remarks
	From	To			
Nil					

(BHS-Both Hand Side, LHS-Left Hand Side, RHS-Right Hand Side)

**5.6 Whitetopping (MoRTH RW/NH- 35083 /09/2024-S&R (P&B) (Computer No.-241094) dated 03.10.2024)**

Conventional Whitetopping (a PQC overlay) of minimum thickness 280 mm (on the top of existing bituminous layer) as per TCS is to be provided. IRC: SP:76-2015 is to be adhere while designing the Conventional Whitetopping.



Sr. No.	Design Chainage		Side	Remarks
	From	To		
1	365+200	365+735	BHS	MCW
2	366+155	366+770	LHS	Service Road
3	366+770	366+965	LHS	Service Road
4	366+965	367+975	BHS	Service Road
5	368+050	368+275	BHS	MCW

## 6. Roadside Drainage

6.1. **Drainage system:** - Including surface and subsurface drains for the Project Highway including crossroads shall be provided as per section 6 of the Manual. Contractor shall provide a drainage plan along with its drainage profile which should be reviewed and approved by the Engineer.

RCC Drain cum footpaths shall conform to the cross- sectional features and other details as given in Annexure - II (Schedule - B) and shall be provided as under:

Details of RCC covered Drain Cum Footpath with paver block

Sr. No.	Design Chainage (Km)		Length (m)		Min bottom Width x Min Depth of Drain	Min Width of Footpath (m)	Total Length (m)	Remarks
	From	To	LHS	RHS				
1	365+200	365+525	325	-	1.5x1.0	1.5	325	
2	365+525	365+735	210	210	1.5x1.0	1.5	420	
3	365+735	366+155	420	420	1.5x1.0	1.5	840	
4	366+155	366+770	615	615	1.5x1.0	1.5	1230	
5	366+770	366+965	195	195	1.5x1.0	1.5	390	
6	366+965	367+675	710	710	1.5x1.0	1.5	1420	
7	367+675	368+050	-	375	1.5x1.0	1.5	375	
8	368+050	368+275	-	225	1.5x1.0	1.5	225	
	Sub Total on each side		2475	2750			5225	
	Total							

Top of drain shall be finished with paver blocks/ interlocking/ chequered tiles. Sides of drain should be provided with kerb stone of appropriate size along with GI grating of designed intervals of minimum 10m for entry of surface water. Width of footpath cum drain shall be slightly increased due to kerb stones. The precast cover slab on drain shall be provided as per TCS. Moreover, at locations of junctions and cross roads, the drain cover should be load

bearing.

It should be ensured that there should be adequate provision for spacing of drainage inlets for lined covered drain.

#### 6.1.1. Details of Lined Drain

Sr. No.	Design Chainage (Km)		Length (m)		Min bottom Width x Min Depth of Drain	Total Length (m)	Remarks
	From	To	LHS	RHS			
NA							

6.1.2. All the Lined/ load bearing/ Chute drains shall be Pre-cast concrete Drains

#### 6.2. Unlined Drains

Other than above mentioned locations shall be provided in the entire project length which gets terminated at all crossroad locations. In case, the definite outfall is not available, a rainwater harvesting system shall be provided at the deepest location for dispersal of water. **The size of Unlined drain should have a minimum width of 0.6m at bottom, minimum depth of 0.6m and a minimum slide slope of 2H to 1V. The Bed slope should be based on drainage profile.**

6.2.1 Between Chainage 367+675 to 368+275, there is existing Nala, which need to be channelized with boulder pitching after providing Footpath with paver block of 2 m from crash barrier. The storm water from service road may be drained through direct pipe outlets by constructing chamber at every 20.0m. Refer TCS for drainage arrangement.

**The drainage plan shall account for the water from the ROW area along with the area outside the ROW as well.**

#### 6.3. Median Drain

Median drain below viaduct structure is to be provided for structure drainage spout chainage of median drain below viaduct is given:

Sr. No.	Design Chainage (Km)		Total Length (m)	Remarks
	From	To		
1	366+155	367+675	1520	Drain shall be discontinued at junctions and openings, with appropriate water crossing arrangements provided as per the relevant specifications.

#### 6.4. Drainage arrangement

Drainage arrangement between Main Carriageway and Service/Slip Roads. Suitable drainage

arrangement for draining storm water of main carriageway shall be provided.

#### **6.5. Drainage where Embankment Height is more than 3m**

Drainage chutes shall be provided at suitable interval on embankment slopes. The drainage arrangement shall include kerb, cement concrete drainage channel at the edge roadway, Cement Concrete Chutes, CC bedding, energy dissipation basin, etc. Mountable Kerb shall be provided beyond the post of MBCB to channelize storm water into Drain.

#### **6.6. Drainage for Structures**

A suitable drainage arrangement for draining storm water from deck slab shall be provided. Water shall not fall on any surface of the structures, or remain standing or flowing over the road below structure.

#### **6.7. Drainage for Underpass and Subways Structures (Clause No. 6.8.3 IRC: SP:87-2019)**

A suitable drainage arrangement for draining storm water from Underpass and Subways shall be provided.

#### **6.8. Drainage arrangement of Retaining Structures.**

Vertical Drop-down drainage pipes with suitable cleaning provision shall be provided at suitable interval. Drainage fixtures and dropdown pipes shall be of rigid, corrosion resistant material not less than 100mm dia. The Storm water of main carriageway draining on service road is not permitted. Drainage Pipe along the Friction slab shall go Slant way and must be attached to Service Road Drain. Also, at locations where ponds/Wells are adjacent to Drain Construction Toe wall shall be constructed there for the desired length.

### **7. Design of Structures**

#### **7.1. General**

Project Highway is proposed to be constructed to Six-lane configuration. As such, superstructure of all bridges, culverts and structures is to be designed for edge movement of the vehicle considering stitching of new superstructure in future due to widening for additional lane.

**All structures except wherever expansion joints have been provided, the pavement layers WMM, DBM & BC or DLC & PQC shall be continued over the structures for smooth riding quality of the project highway.** These structures shall be designed considering the dead load of pavement (WMM, DBM, BC, DLC, PQC etc.) layers.

**All major structures will be designed preferably as continuous slab to reduce the number of expansion joints on the MJB/ ROBs/ flyover/ Interchange etc.**

For any proprietary product such as Reinforced Soil Wall, Retaining Wall, Expansion Joints, Bridge Bearing, Pre-stressing Systems, Commercial Stabiliser, Geosynthetics Products, UHPFRC elements, etc., Contractor/Concessionaire shall ensure signing of agreement between the Contractor/Concessionaire and Technology Provider before use of such material/technology/design in NH Project. The agreement shall have the provision of involvement of the Technology Provider during execution. Technology Provider shall deploy the requisite design experts/material technologist/skilled & trained construction

supervision personnel to certify material testing & material characterization for design, proof check of the design, approve construction methodology including field trial sections before actual construction, quality control and supervision & certification of the day-to-day construction/execution. The warranty for proprietary product(s) shall be submitted by Technology Provider along with all other document(s) as required by IRC: SP: 112-2017 "Manual for Quality Control in Road and Bridge works". A copy of such agreement shall be furnished to AE/IE and to RO of the Ministry / NHAI/NHIDCL for reference and record.

7.1.1. All bridge, Culvert and structures shall constructed in accordance with section-7 of the Manual and shall conform to the cross-sectional features and other details specified therein.

7.1.2. Clear deck width of bridges/grade separated structures (measured from inside to inside of crash barrier) shall be equal to the roadway width (carriageway width+ paved shoulder width+ earthen shoulder width+ width of median including shyness for raised median /depressed median as applicable) in their approaches. Wherever footpath is provided on bridge, RCC crash barrier should be provided between footpath and carriageway and pedestrian guard rail at outer edges of the bridge. In case of footpath on bridge, the width of earthen shoulder shall be tapered at the rate of 1:15 Circular: Efile No.RW/NH-33044/22/2020-S&R dated 4<sup>th</sup> June, 2024). The Overall width of the structure shall be as given in Para 7.3 of Annex-1 of Schedule-B. Components like bearings, expansion joints, railings, crash barriers, wearing surface, etc., which are not in sound condition, shall be replaced Minor non-structural works shall be suitably repaired.

7.1.3. The Safety Barrier and Footpath on Bridges for Service Road shall continue on approaches. The footpath shall be provided with paved surface & railing till the embankment height is more than 3m.

Details of Structures with footpaths

Sr. No.	Location at km	Skew Angle	Footpath Width (m)		Remarks
			Left	Right	
NA					

7.1.4. All bridges shall be high level bridges.

7.1.5. All structures shall be designed to carry utility services on outer side of RCC barrier/Railing as per site requirement.

7.1.6. Cross section of the new culverts and bridges at deck level for the Project Highway shall conform to the typical cross sections given in Annexure II of the Schedule-B.

## 7.2. Culverts

7.2.1. Overall width of all culverts shall be equal to the roadway width of the approaches. The overall width of culverts shall be including width of main carriageway and slip/service roads/Entry ramps/Exit Ramps/Acceleration/Deceleration lanes, etc. All culverts shall also be continued in median and in gap between main carriageway and service road.

7.2.2. **New/Reconstruction of existing RCC pipe culverts:** The existing culverts at the following locations shall be re-constructed as new culverts:

Sr.No	Design Chainage	Culvert Type	Skew Angle (Degree)	Span/ Opening (m) Nos. X Dia.	New/ Reconstruction	Culvert Crossing Type (Balancing/ Stream, etc)	Remarks
NA							

Note: - Culvert other than mentioned in Cl-7.2.2 & 7.2.3 if any in the project stretch, the contractor has to widen/reconstruct such culvert. Which shall not constitute a COS.

#### 7.2.3. Widening of existing RCC pipe culverts

All existing culverts which are to be retained shall be widened to the proposed roadway width of the Project Highway as per the typical cross section given in section 7 of the Manual. Repairs and strengthening of existing structures where required shall be carried out. Also, provision for Railing, floor protection, Parapet etc.as per relevant IRC codes and specification.

Sr. No	Design Chainage	Culvert Type	Skew Angle	Span/ Opening (m) Nos. X Dia	Repairs/ Rehabilitation proposals	Culvert Crossing Type (Balancing/ Stream, etc)	Remarks
NA							

Note: - Culvert other than mentioned in Cl-7.2.2 & 7.2.3 if any in the project stretch, the contractor has to widen/reconstruct such culvert. Which shall not constitute a COS.

#### 7.2.4. Construction of Box Culverts:

7.2.4.1 New culverts (given in table below) shall be constructed for width equal to the proposed roadway width of the Project Highway & as per typical cross-section given in schedule B. The details are given as under:

Sr. No	Design Chainage (km)	Span Arrangement (m) Nos. X Width X Depth	Skew Angle	Culvert Crossing Type	Remarks
1	365+332	1 x 2.0 x 2.0 m	0	Nala	NEW CONSTRUCTION
2	367+150	1 x 2.0 x 2.0 m	0	Nala	NEW CONSTRUCTION
3	367+415	1 x 3.5 x 2.0 m	0	Nala	RECONSTRUCTION
4	367+902	1 x 2.0 x 2.0 m	0	Nala	RECONSTRUCTION
5	367+243	1 x 5.0 x 2.0	0	Nala	RECONSTRUCTION
6	368+035	1 x 2.0 x 2.0 m	0	Nala	NEW CONSTRUCTION

Note: - Culvert other than mentioned in Cl-7.2.4 & 7.2.5 if any in the project stretch, the contractor has to widen/reconstruct such culvert. Which shall not constitute a COS.  
Due to traffic diversion limitation, pre cast box culvert to be executed.

#### 7.2.5. Widening/Retained of existing box culverts

All existing culverts which are to be retained shall be widened to the proposed roadway width of the Project Highway as per the typical cross section given in Schedule-B. Repairs and strengthening of existing structures where required shall be carried out. Also, provision for Railing, floor protection, Parapet etc.as per relevant IRC codes and specification.

Sr. No	Design Chainage	Culvert Type	Skew Angle (Deg)	Span Arrangement (m) Nos. X Width X Depth	Repairs/ Rehabilitation proposals	Culvert Crossing Type (Balancing/ Stream, etc)	Remarks
Nil							

#### 7.2.6. Box Type Structures on Cross roads:

Sr. No	Design Chainage (km)	Span Arrangement (m) Nos. X Width X Depth	Type (Box)	Length of Culvert	Remark
1	367+165	1 x 5.0 x 2.0	Box	7 m	

7.2.7. Utility ducts in form of NP-4 RCC Pipe dia 600 mm along with inspection chamber were directed for crossing of utilities anywhere as per Manual requirements.

Location for utility Ducts

Sr. No	Design Chainage (km)		Remark (No. of Utility ducts to be provided)
	From	To	
1	366+155	367+675	4 nos.

**Note:** Existing utility duct if any in the project stretch, the contractor has to widen/reconstruct such duct. Which shall not constitute a COS.

### 7.3. Bridges

#### 7.3.1. Existing bridges to be Re-constructed/widened:

- 1) Existing Major bridges proposed for reconstructed as new structures as below.
- 2) All Major and Minor Bridges to be designed for approach protection with concrete Toe wall with filter media and stone/ block pitching up to HFL of bridge +0.6 m with full height stone/ block pitching in cone filling portion of all four sides of abutments.
- 3) All river bridges & underpasses without slip roads shall be provided with steps for accessing the bottom in all four-cone filling portion for easy assessable bridges and approaches.
- 4) Existing narrow bridges proposed to be retained and widened: (Clause No. 7.3 iv IRC: SP:87-2019)
- 5) In GAD of River ridges the hydraulic aspect considered in design of GAD such as catchment area, design discharge, stream velocity & scour depth, bearing capacity of the founding strata etc. should be stipulated by the Concessionaire/ contractor.
- 6) In case of canal crossings Bridges the service road or canal bund roads should be accommodated in the proposed span with appropriate Vertical clearance of 4.5 mt and location of abutment shall be out of canal banks.

#### 7.3.1.1 Existing Major Bridges Proposed to be Re-constructed as new Structure:

Sr. No.	Design Chainage (Km)	Span Arrangement (m)	Total Proposed Length (m)	Type of Crossing	Proposed Width		Skew Angle (Deg)	Remarks
					MCW	SR		
NIL								

**7.3.1.2 Existing Minor Bridges Proposed to be Re-constructed as new Structure:**

Sr. No.	Design Chainage (Km)	Span Arrangement (m)	Total Proposed Length (m)	Type of Crossing	Proposed Width		Skew Angle (Deg)	Remarks
					MCW	SR		
NIL								

**7.3.1.3 Existing Major/Minor bridges proposed to be widened:****Major Bridge:**

Sr. No.	Design Chainage (Km)	Span Arrangement (m)	Total Proposed Length (m)	Type of Crossing	Proposed Width		Skew Angle (Deg)	Remarks
					MCW	SR		
NIL								

(BHS-Both Hand Side)

**Minor Bridge:**

Sr. No.	Design Chainage (Km)	Span Arrangement (m)	Total Proposed Length (m)	Type of Crossing	Proposed Width		Skew Angle (Deg)	Remarks
					MCW	SR		
NIL								

**7.3.2. Additional New Bridges:** New bridges at the following locations on the Project Highway shall be constructed. GADs for the new bridges are attached in the drawings folder. (Clause No. 7.3 ii IRC: SP:87-2019)

- 1) All Major and Minor Bridges to be designed for approach protection with concrete Toe wall with filter media and stone/ block pitching up to HFL of bridge +0.6 m with full height stone/ block pitching in cone filling portion of all four sides of abutments.
- 2) All river bridges & underpasses without slip roads shall be provided with steps for accessing the bottom in all four-cone filling portion for easy assessable bridges and approaches.

**New Major Bridges**

Sr. No	Design Chainage (Km)	Square clear Span Arrangement (m)	Type of Crossing	Total Proposed width (m)		Typical Cross Section of Manual	Skew Angle	Remarks
				MCW	SR			
Nil								

**New Canal Crossings as Major Bridges**

New Canal Crossings as Major Bridges								
Sr. No	Design Chainage (Km)	Square clear Span Arrangement (m)	Type of Crossing	Total Proposed width (m)		Typical Cross Section of Manual	Skew Angle	Remarks
				MCW	SR			
Nil								

**New Minor Bridges**

Sr. No	Design Chainage (Km)	Square clear Span Arrangement (m)	Type of Crossing	Total Proposed width (m)		Typical Cross Section of Manual	Skew Angle	Remarks
				MCW	SR			
Nil								

**New Minor Bridges as Canal Structures**

Sr. No	Design Chainage (Km)	Square clear Span Arrangement (m)	Type of Crossing	Total Proposed width (m)		Typical Cross Section of Manual	Skew Angle	Remarks
				MCW	SR			
Nil								

In case of canal crossings Bridges the service road or canal bund roads should be accommodated in the proposed span with appropriate Vertical clearance of 4.5 mt and location of abutment shall be out of canal banks.

7.3.3. The railings of existing bridges shall be replaced by crash barriers at the following locations: the specific. (Clause No. 7.17 iv IRC: SP:87-2019)

Sr.No	Design Chainage		Length (m)	Remarks
	From	To		
Nil				

7.3.4. The existing bridges/ RoB/ Grade Separators/ RUB retained on the project highway shall be upgraded and rehabilitation measures/proposals shall be specified as follows: (Clause No. 7.3 iv (b) IRC: SP:87-2019)

Sr. No.	Location at km	Rehabilitation Proposals	Remarks
Nil			



## 7.3.5. Structures in marine environment: -

Sr. No	Design Chainage (Km)	Total Proposed length (m)	Total Proposed width (m)	Typical Cross Section of Manual	Skew Angle
All structure are to be designed as structures in marine environment structure, Stainless steel / Epoxy coated reinforcement shall be provided as per MoRTH guidelines issued Dated 22.01.2021					

## 7.4. Rail road Bridges (ROB/RUB) (Clause No. 7.18 IRC: SP:87-2019)

7.4.1. Design, construction and detailing of ROB/RUB shall be as specified in Section 7 of the Manual.

7.4.2. Road over bridges (road over rail) shall be provided at the following locations, as per GAD drawings attached:

Sr. No.	Design Chainage (Km)	Proposed Span Arrangement (m)	Type of super-structure (i.e Bow string, simply supported composite structure etc.	Name of crossing	Total Width m)	Skew Angle	Remarks
Nil							

## 7.4.3. Note:

- 1) If the length/width of the span/ type of super-structure is changed due to any reason the COS shall not be considered.
- 2) ROB shall be designed, constructed and maintained as per the requirements of Railway authorities. The construction plan shall be prepared in consultation with the concerned railway authority.
- 3) The ROB shall be constructed and maintained by the Concessionaire/ Contractor under supervision of the Railways.
- 4) All charges payable to the Railways like D&G, Capitalized maintenance, signaling, cabling, OHE modification, any other Utility Shifting pertains to Railway Department, earthing etc. except P&E charges shall be borne by the Concessionaire/ Contractor.
- 5) NHAI GM (ROB/RUB) Letter No. 139024, dated 06.08.2019, the instrumentation for measurement of vibration shall be installed.
- 6) All bridges/structures shall be designed for severe exposure condition as per IRC:112-2020.- in addition, steel reinforcement shall be given corrosion protection by use of Fusion bonded Epoxy Coating (FBEC) or Galvanized Steel / stainless steel shall be used for reinforcement.

7.4.4. Road under bridges (road under railway line) shall be provided at the following level crossings, as per GAD drawings attached:

Sr. No.	Design Chainage	Proposed Span Arrangement (m)	Name of crossing	Total Width (m)	Skew Angle	Remarks
Nil						

## 7.5. Grade Separated Structures (Clause No. 7.19 IRC: SP:87-2019)

The grade separated structures shall be provided at the locations and of the type and length specified in paragraphs 2.9-and 3 of Annexure-I of Schedule-B.

**7.6. FoB/Skywalks (Clause No. 10 IRC: 103 and Clause No. 9.8.5 IRC: SP:87-2019)**

FoB/Skywalks shall be provided in buildup areas/ near schools.

Sr. No.	Location at km	FoB Type	Remarks
Nil			

**7.7. Pipe rack bridge**

Sr. No.	Location at km	Pipe Rack Bridge Type	Remarks
1	367+185	Overhead steel truss structure size 6m (wide) x 2.1 m (height) with vertical clearance of 5.5 m, connecting Length 120 m	Reconstruction of Existing Pipe rack bridge.

**7.8. A summary of Culverts, Bridges, Structures & Tunnel shall be presented as follows:**

Sr. No.	Name of the Structure	Total Numbers	Remarks
1	Major Bridge	00	
2	Minor Bridge	00	
3	ROB	00	-
4	VUP (Single Span)	00	-
5	VUP (Multi Span)	00	
6	LVUP	00	-
7	SVUP	00	
8	Boxes for passage of pedestrians	00	
9	Flyover/Viaduct	01	
10	Flyover /RAMPS	02	
11	Tunnel	00	
12	Cattle and Pedestrian underpasses	00	
13	FoB	00	
14	Box Culverts	06	
15	Pipe Culverts	00	
16	Road under bridge	00	
17	Animal Underpass	00	
18	Elephant Underpass	00	
19	Cross Over Structure	01	

**7.9. Span lengths for all the culvert and structures under this clause (7) are the base lengths for the Contract. Any authorized/ approved increase or decrease in the span length or/ and type/ specification of the structures will not be subject to positive change of scope.**

**7.10** NHAI reserves the right to Check/Verify Design Calculations and Drawings of all components of the Stretch of National Highway including the Structures Falling within the Scope of Work. The Concessionaire/Contractor shall be required to furnish all Data pertaining to detailed Designs, Drawings, Calculations, Design Basis Report, Input Files of Design Software used in the Project, etc. to the Authority and/or the Independent Engineer /Authority Engineer Free of Cost within a time as specified by the Authority and/or the

Independent Engineer / Authority Engineer.

Note:

1. All Major and Minor Bridges to be designed for approach protection with concrete Toe wall with filter media and stone/ block pitching up to HFL of bridge +0.6 m with full height stone/ block pitching in cone filling portion of all four sides of abutments.
2. In case of canal crossings Bridges the service road or canal bund roads should be accommodated in the proposed span with appropriate Vertical clearance of 4.5 mt and location of abutment shall be out of canal banks.
3. Any structures falling within acceleration / deceleration lane /taper shall be constructed to the required width. This increase in width of structures shall not be treated as change of scope.
4. Usage of Precast elements to be followed as per Ministry's Circular RW/NH-34049/01/2020-S&R (B) issued on 8th April 2022.
5. Construction practices for gap slab, closing /back RS walls with column type abutments shall not be permitted. Only earth retaining abutments with dirt wall i/c bracket to support the approach slab shall be provided
6. Provision of RS walls as wing walls of grade separated structures or any other structures shall be avoided. Only RCC wing walls shall be provided.
7. Placement of Geo-Composite Membrane (as a drainage layer) at the back of the facing RS walls shall be avoided. A drainage bay of minimum 600mm width at the back of facing RS walls shall be provided as per gradation mentioned in table-2 of IRC: SP:102
8. To avoid transfer of vertical load of approach slab on RCC return wall, the approach slab shall not be provided on RCC return wall. The same shall be placed on abutment's dirt wall bracket and approach fill. The crash barrier to be cast along with RCC return wall independently without and overlapping support on /with approach slab.
9. In case of RS walls approaches, the crash barrier with friction slab shall be provided as an independent unit without any monolithic/integral connection with RCC approach slab/PQC pavement. The friction slab of crash barrier shall invariably be provided below the approach slab, PQC pavement/road crust of flexible pavement.
10. If the length of structure required is more than the given value due to reasons well established and approved by the Authority, the extra length shall come under the Clause of Change of Scope.
11. For major bridges over any water body founding level of foundation cannot be raised above the founding level shown in the GAD.
12. Well/ pile cap top level cannot be lowered below the level shown in the GAD.
13. Diameter of well foundation shown in the GAD cannot be reduced further.
14. Span arrangement – to be decided as per IWAI/Irrigation Authority/Other concerned Authority guidelines considering navigational requirement.

15 The details of span are to be mentioned as per approved GAD by the IWAI/ Irrigation Authority/ Other concerned Authority. If the length/width of the span is changed due to any reason attributed to IWAI/Irrigation Authority/other concerned Authority the COS shall be considered.

16 An inspection gallery along with a caged ladder (access from the deck slab) to be provided at each pier location for facilitating regular inspection of bridge structures. An indicative General Arrangement Drawing (GAD) has been prepared and is attached at Appendix-A which may be made a part of Concession/Contract Agreement. For location where access for the deck slab is not possible from the top, the same may be provided from the bottom i.e. by providing staircase along the pier up to the top of pier cap along with an inspection platform all around the pier cap as shown in the indicative GAD. If this is not feasible, then some other kind of arrangement has to be made to provide access to the top of pier cap for inspecting bearings, underneath the box/slab structures etc.

17. Staircase (with stone masonry/concrete) in the approaches to box/slab culverts (near the end of return wall)/minor and major bridge by the side of abutments on either side of the carriageway to access the underneath of box/slab culverts/bridges. An indicative picture is shown below (for understanding purpose only):

18. Project highway is proposed to be constructed to four lane configurations with provision for widening in future. As such, superstructure of all bridges, culverts and structures is to be designed for edge movement of the vehicle considering stitching of new superstructure in future due to widening for additional lane.

## **8. Traffic Control Devices and Road Safety Works**

8.1. Traffic control devices and road safety works shall be provided in accordance with Section 9 of the IRC: SP: 84:2019/ IRC:SP: 87:2019.

### **8.2. Traffic Signs:**

Traffic signs shall be provided as per IRC 67 and MoRTH guideline dated 24th December 2024 and NHAI policy circular no 12.40/ 2025 dated 20th September 2025 and as mentioned in Schedule-C.

### **8.3. Pavement Marking:**

Pavement markings shall be completed as per IRC 35 & RT-25035/07/2023-RS (Part) (221534) dated 24<sup>th</sup> December 2024 as mentioned in Schedule-C.

### **8.4. Safety Barrier:**

The safety barriers shall be provided in accordance with Section-9 of the Clause 9.7 of the Manual and MoRTH circular no RW/NH-2923/02/2019-S&R (P&B) dated 01.01.2020. The Safety Barrier length proposed are excluding the safety barrier already proposed on Culverts, Grade Separated Structures, Interchange, Bridges, RoB and RUB as applicable cross sections respectively.

End Treatment of Steel barriers/Rope Barrier shall be specified i.e. **MELT or P-4 confirming to EN 1317-4**, TT, MBCB barrier to Concrete Barrier (**Clause No. 9.7.2 (b) IRC: SP:87- 2019**) End Treatment to Concrete barrier shall be done as specified in **Clause No. 9.7.3 (b) IRC: SP:87- 2019**

The details of the location are as below:

S.No.	Item	LHS		RHS		Total Length (m)	Remarks
		(From)	(To)	(From)	(To)		
1	W-beam Single faced metal crash barrier	Nil					
2	Thrie-beam Single faced metal crash barrier	365+200	365+735			575	B/W MCW & SR
				365+525	365+735	210	
		368+050	368+275	368+050	368+275	450	
		368+050	368+275	368+050	368+275	450	Median MCW
3	wire rope safety barrier	Nil					
4	W-beam Double faced metal crash barrier	Nil					
5	Thrie-beam Double faced metal crash barrier	NIL					
6	Concrete Single faced barriers with View cutter	365+735	366+155	365+735	366+155	840	MCW
		366+155	366+770	366+155	366+770	1230	MCW
		366+770	366+965	366+770	366+965	390	MCW
		366+965	367+675	366+965	367+675	1960	MCW
		367+675	368+050	367+675	368+050	750	MCW
		367+675	368+275			600	SR
7	Concrete Single faced barriers	367+195	367+600	367+195	367+600	810	Ramp-L
		367+195	367+600	367+195	367+600	810	Ramp-R
		366+155	367+600			1455	Left SR Median side
				366+695	367+600	1455	Right SR Median side
8	Concrete Double faced barriers	365+200	365+225	365+200	365+225	25	New Jersey Barrier in median 1.5 m to 2.0 m long pre-cast modular with interlock

S.No.	Item	LHS		RHS		Total Length (m)	Remarks
		(From)	(To)	(From)	(To)		
		365+225	368+050	365+225	368+050	2825	New Jersey Barrier in median
9	Pedestrian Guard Rail	As per TCS					
10	End Treatment for Steel Barriers	Shall be as per IRC 119-2015					

# (i) View Cutter has to be installed on the Concrete Single faced barriers mentioned at s.no. 6. View cutter will be pre-coated colored galvalume profile sheets with height of 1 mtr above the crash barrier.

(ii) At median opening under viaduct, Concrete Single faced barriers on median side is not required.

(ii) Merging of New Jersi Crash barrier with existing crash barrier near 365+200 is also be done by Contractor.

## 9. Roadside Furniture

9.1. It shall be provided as per the details mentioned in Schedule-C.

## 10. Hazardous Locations

The safety barriers shall be provided at the following hazardous location such as ponds, well, electric sub-station, Electric tower, spilt carriageway, etc.

## 11. Special Requirement:

### 11.1 RETAINING STRUCTURE AND PROTECTION WORKS

Retaining Structure and protection works shall be provided at locations as indicated below and as provided in TCS schedule in cl. 2.10 of Schedule-B.

Sr. No.	Design Chainage (Km)		Length (m)	Side	RE Wall Retaining Structure / Toe Wall	Type of Safety Barrier	Remarks
	From	To					
1	365+735	366+155	420	Both Side	RE Wall	RCC Crash Barrier	
2	367+675	368+050	375	Both Side	RE Wall	RCC Crash Barrier	
3	367+525	367+600	75	Both side	RE Wall	RCC Crash Barrier	LHS Ramp
4	367+525	367+600	75	Both side	RE Wall	RCC Crash Barrier	RHS Ramp
5	366+000	366+120	120	LHS Side	Retaning wall	RCC barrier	

## 12. Open Well within ROW

The Open well shall be identified and appropriate treatment shall be provided.

Sr. No.	Design Chainage	Well Dimension	Well Depth	Filling Material for Well	Slab on Top of Well Yes/ No	Remarks
Nil						

### 13. Shifting of Utilities

The Concessionaire/ Contractor shall undertake the work of shifting of any utility (including electric lines, water pipes, gas pipelines and telephone cables) to an appropriate location or alignment, in accordance with the provisions of Contract Agreement.

13.1. Shifting of obstructing utilities indicated in Schedule A to an appropriate location in accordance with standards and specifications of concerned Utility Owning Department is part of the scope of work of the Concessionaire. The bidders may visit the site and assess the quantum of shifting of utilities for the project before submission of their bid. Copy of utility relocation plan is enclosed. The specifications of concerned Utility Owning Department shall be applicable.

13.2. The type/ spacing/ size/ specifications of poles/ towers/ lines/cables to be used in shifting work shall be as per the guidelines of Utility Owning Department and it is to be agreed solely between the Concessionaire and the Utility Owning Department. No change of scope shall be admissible, and no cost shall be paid for using different type/ spacing/ size/ specifications in shifting work in comparison to those in the existing work or for making any overhead crossings to underground as per requirement of utility Owning department and/ or construction of project highway. The Concessionaire shall carry out joint inspection with Utility Owning Department and get the estimates from Utility Owning Department. The assistance of the Authority is limited to giving forwarding letter on the proposal of Concessionaire to Utility Owning Department whenever asked by the Contractor. The decision/ Approval of utility owning department shall be binding on the Contractor.

13.3. The dismantled material/ scrap of existing Utility to be shifted/ dismantled shall belong to the Concessionaire/ Contractor who would be free to dispose-off the dismantled material as deemed fit by them unless the Concessionaire/ Contractor is required to deposit the dismantled material to Utility Owning Department as per the norms and practice and, in that case the amount of credit for dismantled material may be availed by the Concessionaire/ Contractor as per estimate agreed between them.

13.4. The utilities shall be handed over after shifting work is completed to Utility Owning Department up to their entire satisfaction. The maintenance liability shall rest with the Utility Owning Department after handing over process is complete as far as utility shifting works are concerned.

13.5. The supervision charges at the rates / charges applicable of the utility owing department shall be paid directly by the authority to the. utility owing department as and when Concessionaire/ Contractor furnishes demand of utility owing department along with a copy of estimated cost given by the letter.

13.6. Existing lights, junction boxes, connection to individual properties along the affected section shall be disconnected and reconnected as part of utility relocation and the same shall be in the scope of the Concessionaire/ Contractor.

13.7. All the Electrical crossings less than equal to 66/132 KV shall be underground.

13.8 There are several industrial pipelines running along and across the project highway specified in Schedule-A falling in majorly on proposed service road along the approaches/below the viaduct. During execution of the works, due care must be taken to ensure the safety and protection of these pipelines. In the event of any damage, the cost of repair or restoration shall be borne by the Concessionaire/Contractor

#### 14. Tree cuttings

The felling of trees shall be carried out by the Contractor. The cost of felling upto the nos. mentioned below shall be borne by the Contractor. If any, addition will be borne by Authority. The details of are as follows:

S.No.	Type	Unit	Quantity	Location/stretches
1	Felling of Trees	Nos.	450	Including's both sides

#### 15. Work Zone Traffic Management Plans (Clause No. 7.19 IRC: SP:87-2019) Annexure-II Schedule B- Typical Cross Sections

The traffic diversion plans shall be prepared as per IRC SP 55 for smooth flow of traffic and safety. A diversion plan shall be proposed for construction of Culvert, Grade Separated Structures, Bridges, RoB/RUB, etc. and traffic management plan for widening/reconstruction of carriageway.

Sr. No.	Design Chainage (Km)		Construction Activity	Diversion	Traffic Management Plan	Barricading Type - III/IV/CC Barrier with Lighting along barrier	Deployment of Flagman In Habitation/ Schools/ Hospital, etc.	Remarks
	From	To						
	365+200	368+275	Construction of viaduct and approaches	To be assessed as per construction sequence during execution of project. For this IRC SP -55 is to be followed.  Note: It mandatory to put the barricades to prevents traffic from entering work areas including excavations or material storage sites and to provide protection and perceived safety to both traffic as well as construction workers. Permanent Type IV is to be used during the construction. The recommended dimensions of various components are given in table below and the details of Type IV barricades are shown in Figure.  The New Jersey Barriers are 1.5 m to 2.0 m long pre-cast reinforced concrete modular pieces with shaped ends that can be interlocked and connected. Where the road works are to be undertaken which where the space is limited and particularly where the speed of passing traffic				



		maybe high, near edge drop or incase of segregation of two way traffic.	
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ELEVATION OF ONE UNIT OF TEMPORARY BARRICADING

All dimensions are in millimeters.



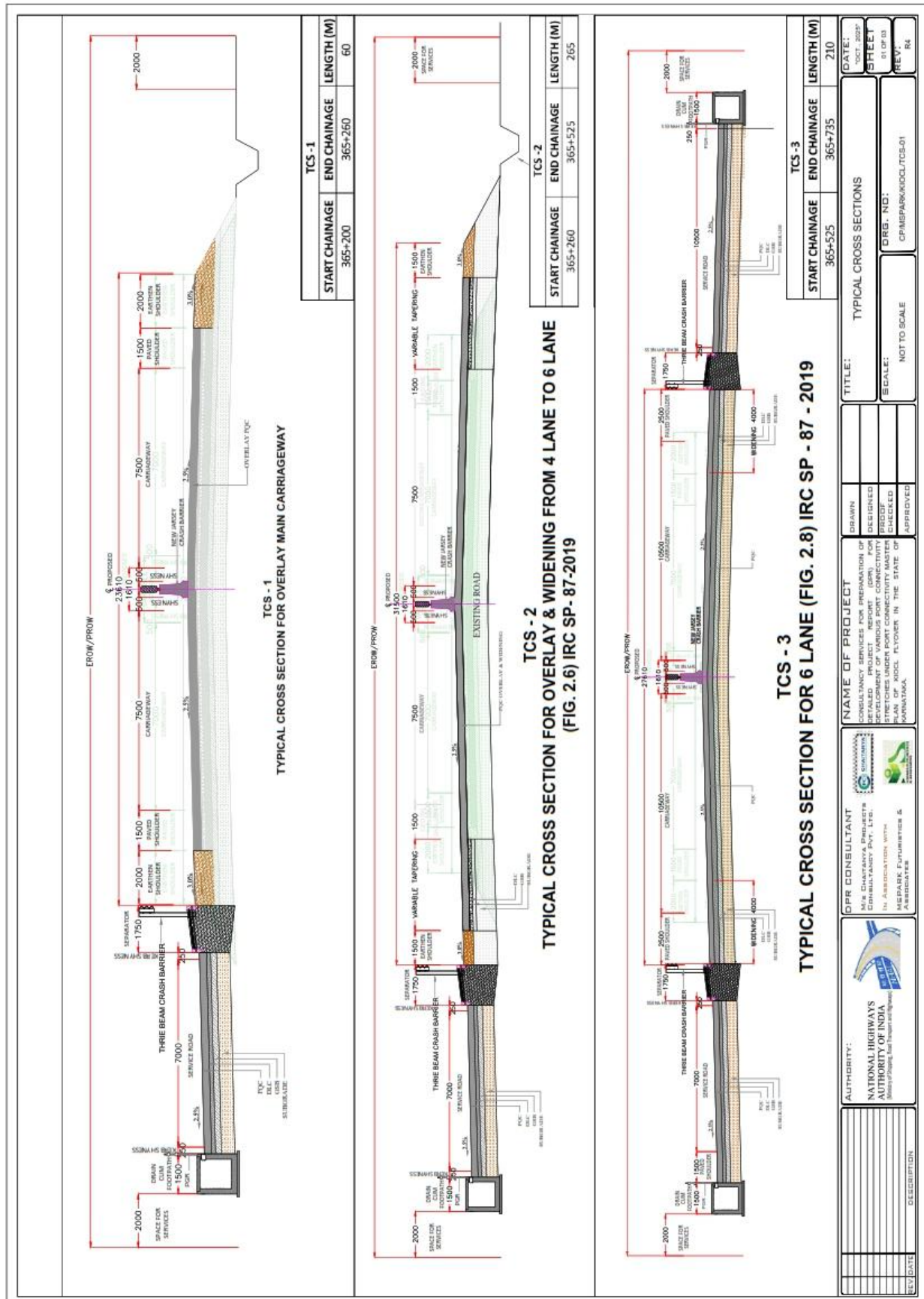
ISMC 75	= 78.50 Kg
ISA 400x400	= 12.80 Kg
CONCRETE	= 0.648
CURB M/M/S SHEET	= 26.25 Kg
SHUTTERING	= 2.16 SQM

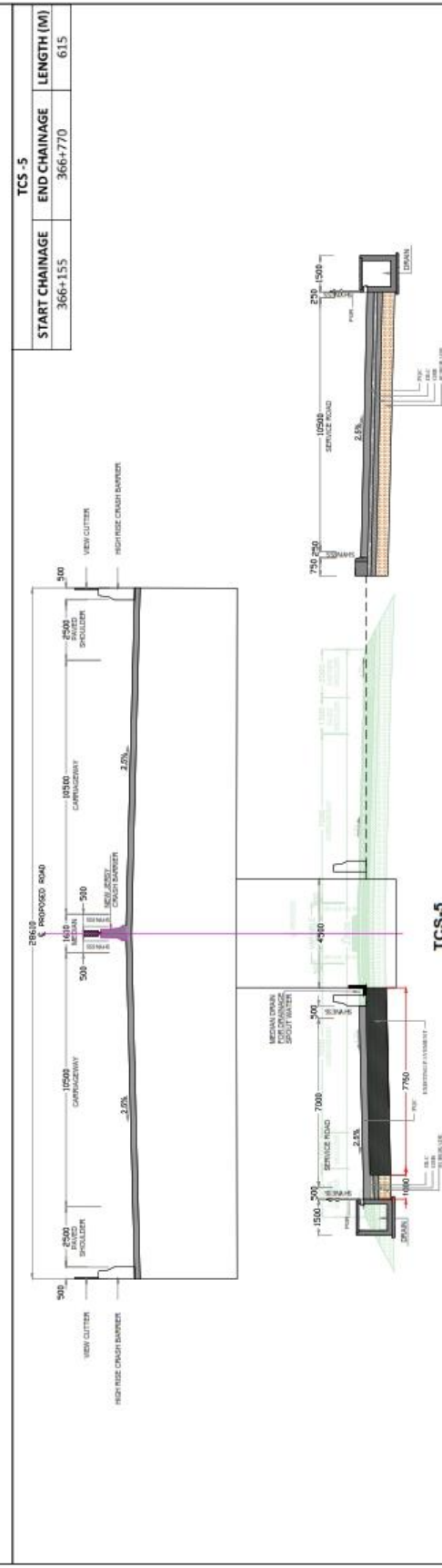
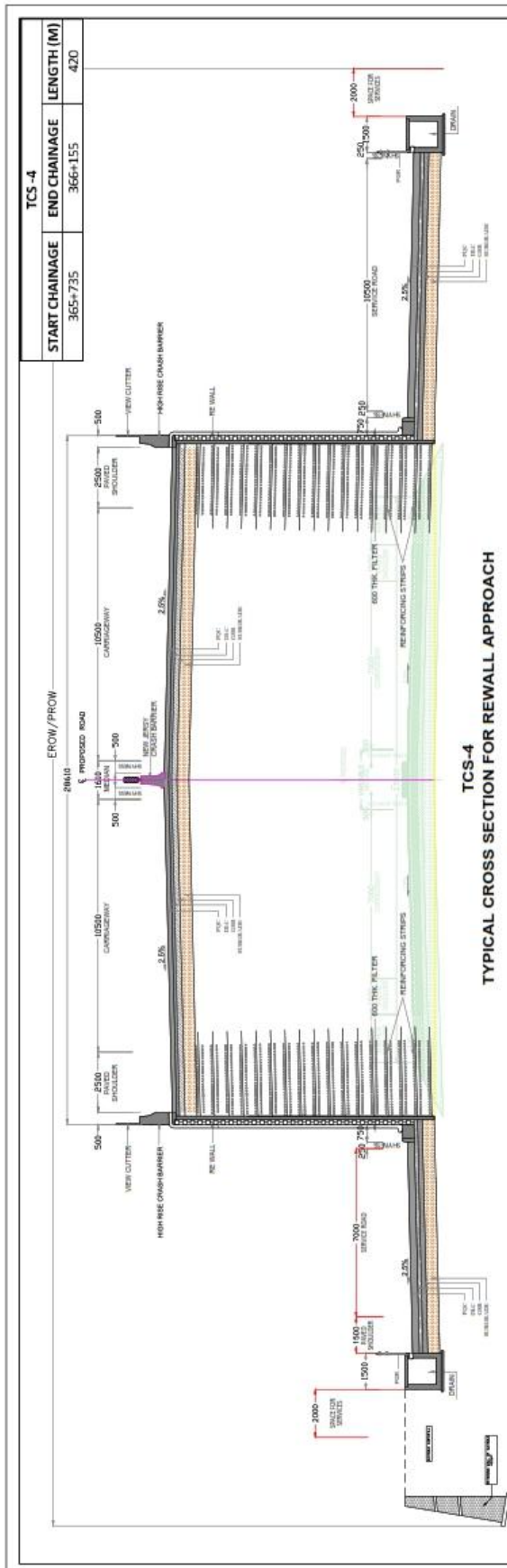
DETAILS OF FIX BARRICADING BOARDS

All dimensions are in millimeters.

Fig. 5.16 Type IV Barricade

**Annexure-II Schedule-B (TYPICAL CROSS SECTION)**





REV DATE	DESCRIPTION	 <p><b>AUTHORITY:</b> <b>NATIONAL HIGHWAYS AUTHORITY OF INDIA</b> <i>Ministry of Planning, Road Transport and Highways</i></p>		<p><b>GPR CONSULTANT</b> M/s CHARTAKA PROJECTS CONSULTANCY PVT. LTD. In Association with MEASURE FUTUREVISION &amp; PARTNERS</p>		 		<p><b>NAME OF PROJECT</b> CONSULTANCY SERVICES FOR PREPARATION OF DETAILED PROJECT REPORT (GPR) FOR DEVELOPMENT OF VARIOUS PORT CONNECTIVITY STRETCHES UNDER PORT CONNECTIVITY MASTER PLAN, KARNATAKA</p>		<p><b>DRAWN</b> DESIGNED PROOF CHECKED APPROVED</p>		<p><b>TITLE:</b> TYPICAL CROSS SECTIONS</p>		<p><b>DATE:</b> NOV. 2023 <b>SHEET</b> 02 OF 03 <b>REV</b> 04</p>	
												<p><b>ORG. NO:</b> CPMSPARK/KOOL/TCR-02</p>		<p><b>SCALE:</b> NOT TO SCALE</p>	





